

# NHD-7.0-800480WF-CTXI#-T

## TFT (Thin-Film-Transistor) Color Liquid Crystal Display Module

|         |                       |
|---------|-----------------------|
| NHD-    | Newhaven Display      |
| 7.0-    | 7.0" Diagonal         |
| 800480- | 800xRGBx480 pixels    |
| WF-     | Model                 |
| C-      | Built-in Controller   |
| T-      | White LED backlight   |
| X-      | TFT                   |
| I-      | 6:00 view, Wide Temp  |
| #-      | <b>RoHS Compliant</b> |
| T-      | Touch Panel           |

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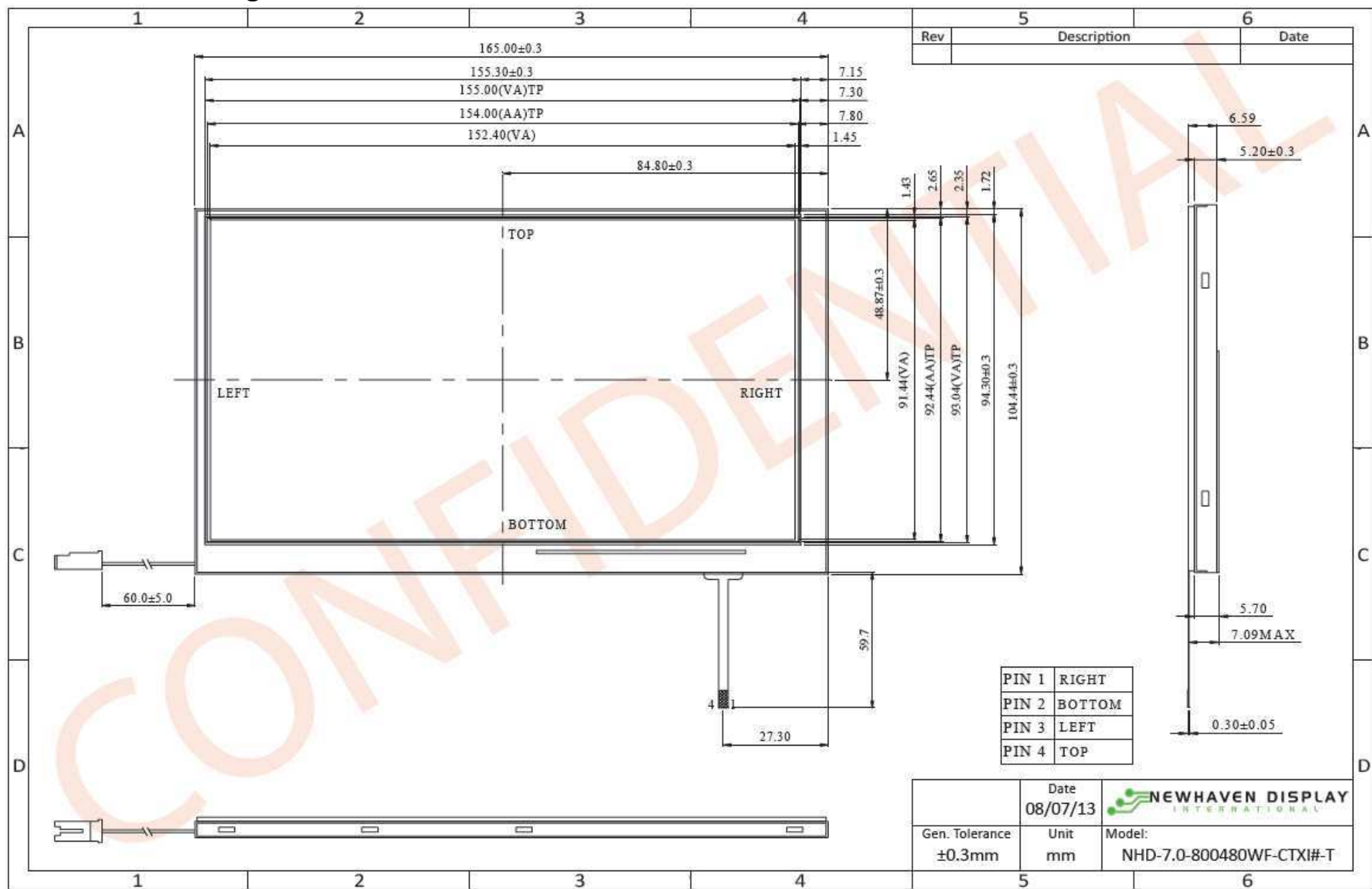
## Document Revision History

| Revision | Date      | Description                                                                                 | Changed by |
|----------|-----------|---------------------------------------------------------------------------------------------|------------|
| 0        | 8/31/2010 | Initial Release                                                                             | MC         |
| 1        | 10/5/2010 | Mechanical Drawing updated                                                                  | BE         |
| 2        | 2/8/2011  | Initialization code added                                                                   | AK         |
| 3        | 2/23/2011 | Grammar/symbols updated                                                                     | BE         |
| 4        | 10/7/2011 | Backlight and Touch Panel pin descriptions added                                            | AK         |
| 5        | 1/6/2012  | Pixel data format updated                                                                   | AK         |
| 6        | 8/7/2013  | Updated Functions and Features, Mechanical Drawing, Electrical and Optical Characteristics. | JN         |

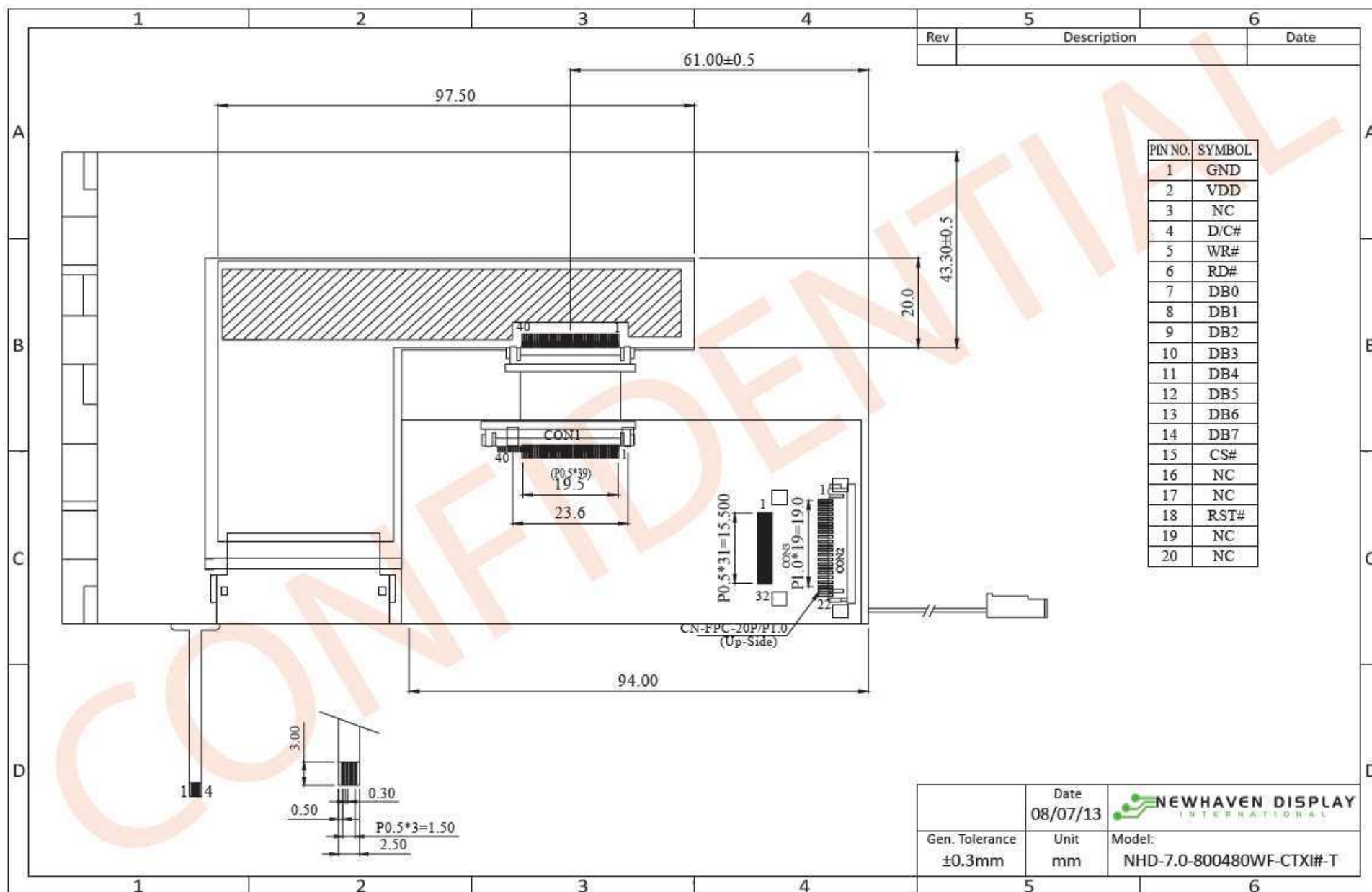
## Functions and Features

- 800xRGBx480 resolution
- LED backlight
- 8-bit MCU interface
- 262,144 colors
- SSD1963 8-bit controller

Mechanical Drawing



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## CON2 LCD Pin Description

| Pin No. | Symbol  | Connection   | Function Description                                                         |
|---------|---------|--------------|------------------------------------------------------------------------------|
| 1       | GND     | Power Supply | Ground                                                                       |
| 2       | VDD     | Power Supply | Power supply for logic (+3.3V)                                               |
| 3       | NC      | -            | No Connect                                                                   |
| 4       | D/C#    | MPU          | Register Select signal: 1=Data, 0=Command                                    |
| 5       | WR#     | MPU          | Active LOW Write signal (8080 mode)<br>Read/Write signal (6800 mode)         |
| 6       | RD#     | MPU          | Active LOW Read signal (8080 mode)<br>Edge trigger Enable signal (6800 mode) |
| 7-14    | DB0~DB7 | MPU          | 8-bit bi-directional data bus                                                |
| 15      | CS#     | MPU          | Active LOW Chip Select signal                                                |
| 16      | NC      | -            | No Connect                                                                   |
| 17      | NC      | -            | No Connect                                                                   |
| 18      | RST#    | MPU          | Active LOW Reset signal                                                      |
| 19      | NC      | -            | No Connect                                                                   |
| 20      | NC      | -            | No Connect                                                                   |

**LCD connector:** 1.0mm pitch,20-Conductor FFC, top contact

**Recommended connection:** 1.0mm pitch, 20-conductor FFC cable

## CON1 TFT Pin-Out (before controller board):

| Pin No. | Symbol | Connection   | Function Description           |
|---------|--------|--------------|--------------------------------|
| 1       | GND    | Power Supply | Power Ground                   |
| 2       | GND    | Power Supply | Power Ground                   |
| 3       | NC     | -            | No connect                     |
| 4-7     | VDD    | Power Supply | Power Supply (+3.3V)           |
| 8       | NC     | -            | No connect                     |
| 9       | DE     | MPU          | Data Enable                    |
| 10-12   | GND    | Power Supply | Power Ground                   |
| 13-15   | B5-B3  | MPU          | Blue B5 (MSB) to B3            |
| 16      | GND    | Power Supply | Power Ground                   |
| 17-19   | B2-B0  | MPU          | Blue B2 – B0(LSB)              |
| 20      | GND    | Power Supply | Power Ground                   |
| 21-23   | G5-G3  | MPU          | Green B5 (MSB) to B3           |
| 24      | GND    | Power Supply | Power Ground                   |
| 25-27   | G2-G0  | MPU          | Green B2 – B0(LSB)             |
| 28      | GND    | Power Supply | Power Ground                   |
| 29-31   | R5-R3  | MPU          | Red B5 (MSB) to B3             |
| 32      | GND    | Power Supply | Power Ground                   |
| 33-35   | R2-R0  | MPU          | Red B2 – B0(LSB)               |
| 36-37   | GND    | Power Supply | Power Ground                   |
| 38      | DCLK   | MPU          | Clock (Falling edge triggered) |
| 39-40   | GND    | Power Supply | Power Ground                   |

**LCD connector:** 0.5mm pitch,40-Conductor FFC, Bottom contact

**Recommended connection:** 0.5mm pitch, 40-conductor FFC cable

## Backlight Pin-Out:

| Pin No. | Symbol | Connection   | Function Description |
|---------|--------|--------------|----------------------|
| 1       | VDD    | Power Supply | Power Supply (+9.9V) |
| 2       | GND    | Power Supply | Power Ground         |

**Backlight connector:** JST p/n: BHSR-02VS-1

**Recommended mating connector:** JST p/n: SM 02B-BHSS-1

## Touch Panel Pin-Out:

| Pin No. | Symbol | Connection  | Function Description |
|---------|--------|-------------|----------------------|
| 1       | X-     | Touch Panel | Touch Panel – RIGHT  |
| 2       | Y-     | Touch Panel | Touch Panel – BOTTOM |
| 3       | X+     | Touch Panel | Touch Panel – LEFT   |
| 4       | Y+     | Touch Panel | Touch Panel – TOP    |

## Touch Panel Characteristics

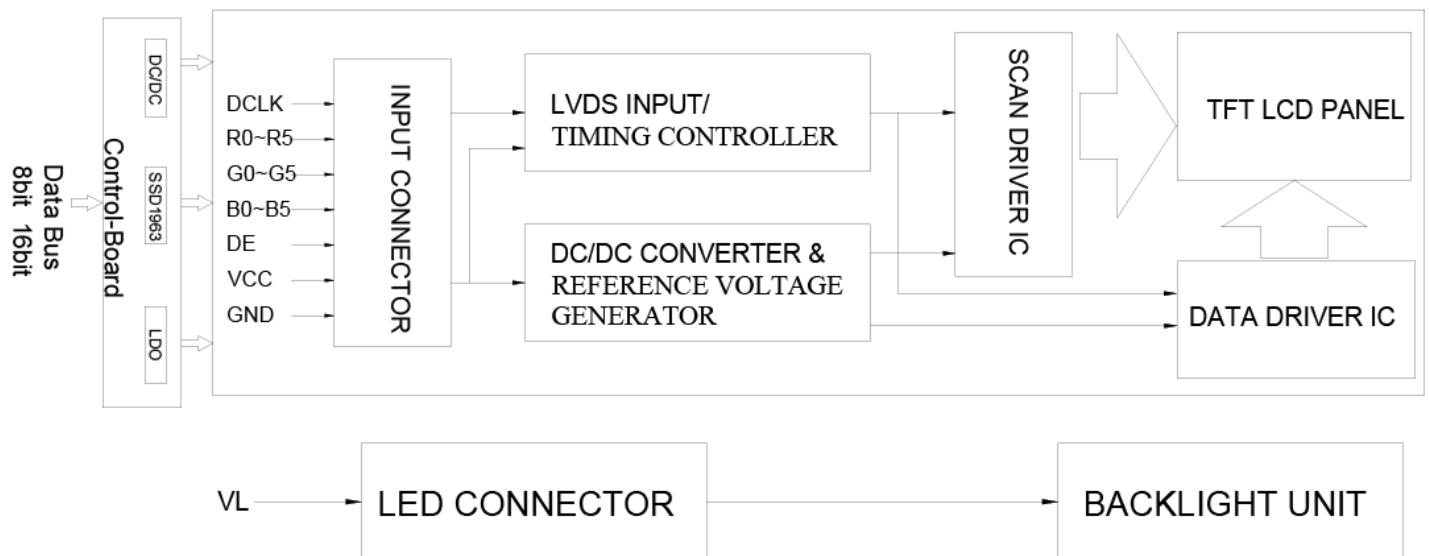
| Item                        | Min.      | Typ. | Max. | Unit       |
|-----------------------------|-----------|------|------|------------|
| Linearity                   | -         | -    | 1.5  | %          |
| Circuit Resistance – X-Axis | 450       | 800  | 1300 | $\Omega$   |
| Circuit Resistance – Y-Axis | 100       | 350  | 800  | $\Omega$   |
| Insulation Resistance       | 10        | -    | -    | M $\Omega$ |
| Operating Voltage           | -         | -    | 5    | V          |
| Chattering                  | -         | -    | 10   | ms         |
| Transmittance               | 82        | -    | -    | %          |
| Activation Force            | 50        | -    | 200  | g          |
| Pen Writing Durability      | 100,000   | -    | -    | Characters |
| Pitting Durability          | 1,000,000 | -    | -    | Touches    |
| Surface Hardness            | 3         | -    | -    | H          |
| Haze                        | -         | 7    | -    | %          |

## 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 25°C         | -       | 200    | 260      | mA   |
| "H" Level input             | Vih    |                       | 0.8V*DD | -      | VDD+ 0.5 | V    |
| "L" Level input             | Vil    |                       | -       | -      | 0.2*VDD  | V    |
|                             |        |                       |         |        |          |      |
| Backlight Supply Voltage    | VLED   |                       | -       | 9.9    | -        | V    |
| Backlight Supply Current    | ILED   | VLED=9.9V             | 140     | 160    | 180      | mA   |
| Backlight Lifetime          | -      | Until half-brightness | 10,000  | 20,000 | -        | Hrs. |

## Optical Characteristics

| Item                   | Symbol | Condition | Min. | Typ. | Max. | Unit              |
|------------------------|--------|-----------|------|------|------|-------------------|
| Viewing Angle – Top    |        | Cr ≥10    | -    | 50   | -    | °                 |
| Viewing Angle – Bottom |        |           | -    | 70   | -    | °                 |
| Viewing Angle – Left   |        |           | -    | 70   | -    | °                 |
| Viewing Angle – Right  |        |           | -    | 70   | -    | °                 |
| Contrast Ratio         | Cr     | -         | 250  | 400  | -    | -                 |
| Luminance              | YL     | -         | 300  | 350  | -    | cd/m <sup>2</sup> |
| Response Time (rise)   | Tr     | -         | -    | 5    | 10   | ms                |
| Response Time (fall)   | Tf     | -         | -    | 11   | 16   | ms                |



## Controller Information

Built-in SSD1963 controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/SSD1963.pdf](http://www.newhavendisplay.com/app_notes/SSD1963.pdf)

## Parallel Interface:

The SSD1963 controller supports both 8080 mode and 6800 mode.  
See the SSD1963 datasheet for detailed timing diagrams.

## Command Instructions:

See the SSD1963 datasheet for the Instruction Table and Command Descriptions.

## Pixel Data Format:

| Interface | Cycle           | D[7] | D[6] | D[5] | D[4] | D[3] | D[2] | D[1] | D[0] |
|-----------|-----------------|------|------|------|------|------|------|------|------|
| 8 bits    | 1 <sup>st</sup> | R7   | R6   | R5   | R4   | R3   | R2   | R1   | R0   |
|           | 2 <sup>nd</sup> | G7   | G6   | G5   | G4   | G3   | G2   | G1   | G0   |
|           | 3 <sup>rd</sup> | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |

## Example Initialization Code

```
/******  
* Function Name : UILCD_Init  
* Description  : Initializes LCD.  
* Input       : None  
* Output      : None  
* Return      : None  
*****/  
  
void TFT_7_Init(void)  
{  
    GPIO_ResetBits(GPIOC, CS1);  
    GPIO_SetBits(GPIOC, nRD);  
    GPIO_ResetBits(GPIOC, nWR);  
    GPIO_WriteBit(GPIOC, RES, Bit_RESET);  
    TFT_delay(5);  
    GPIO_WriteBit(GPIOC, RES, Bit_SET);  
    TFT_delay(100);  
    TFT_7_Write_Command(0x01); //Software Reset  
    TFT_7_Write_Command(0x01);  
    TFT_7_Write_Command(0x01);  
    TFT_delay(10);  
    TFT_7_Command_Write(0xe0,0x01); //START PLL  
    TFT_7_Command_Write(0xe0,0x03); //LOCK PLL  
    TFT_7_Write_Command(0xb0); //SET LCD MODE SET TFT 18Bits MODE  
    GPIO_SetBits(GPIOC, RS);  
    TFT_7_Write_Data(0x08); //SET TFT MODE & hsync+Vsync+DEN MODE  
    TFT_7_Write_Data(0x80); //SET TFT MODE & hsync+Vsync+DEN MODE  
    TFT_7_Write_Data(0x03); //SET horizontal size=800-1 HightByte  
    TFT_7_Write_Data(0x1f); //SET horizontal size=800-1 LowByte  
    TFT_7_Write_Data(0x01); //SET vertical size=480-1 HightByte  
    TFT_7_Write_Data(0xdf); //SET vertical size=480-1 LowByte  
    TFT_7_Write_Data(0x00); //SET even/odd line RGB seq.=RGB  
    TFT_7_Command_Write(0xf0,0x00); //SET pixel data I/F format=8bit  
    TFT_7_Command_Write(0x36,0x09); //SET address mode=flip vertical, BGR  
    TFT_7_Command_Write(0x3a,0x60); //SET R G B format = 6 6 6  
    TFT_7_Write_Command(0xe2); //SET PLL freq=113.33MHz  
    GPIO_SetBits(GPIOC, RS);  
    TFT_7_Write_Data(0x22);  
    TFT_7_Write_Data(0x03);  
    TFT_7_Write_Data(0x04);  
    TFT_7_Write_Command(0xe6); //SET PCLK freq=33.26MHz  
    GPIO_SetBits(GPIOC, RS);  
    TFT_7_Write_Data(0x02);  
    TFT_7_Write_Data(0xff);  
    TFT_7_Write_Data(0xff);  
    TFT_7_Write_Command(0xb4); //SET HBP,  
    GPIO_SetBits(GPIOC, RS);  
    TFT_7_Write_Data(0x03); //SET HSYNC Total  
    TFT_7_Write_Data(0xef);  
    TFT_7_Write_Data(0x00); //SET HBP  
    TFT_7_Write_Data(0xa3);  
    TFT_7_Write_Data(0x07); //SET VBP  
    TFT_7_Write_Data(0x00); //SET Hsync pulse start position  
    TFT_7_Write_Data(0x00);
```

```

TFT_7_Write_Data(0x00);           //SET Hsync pulse subpixel start position
TFT_7_Write_Command(0xb6);        //SET VBP,
GPIO_SetBits(GPIOC, RS);
TFT_7_Write_Data(0x01);           //SET Vsync total = 496
TFT_7_Write_Data(0xef);
TFT_7_Write_Data(0x00);           //SET VBP=4
TFT_7_Write_Data(0x04);
TFT_7_Write_Data(0x01);           //SET Vsync pulse 2=1+1
TFT_7_Write_Data(0x00);           //SET Vsync pulse start position
TFT_7_Write_Data(0x00);
TFT_7_Write_Command(0x2a);        //SET column address
GPIO_SetBits(GPIOC, RS);
TFT_7_Write_Data(0x00);           //SET start column address=0
TFT_7_Write_Data(0x00);
TFT_7_Write_Data(0x03);           //SET end column address=799
TFT_7_Write_Data(0x1f);
TFT_7_Write_Command(0x2b);        //SET page address
GPIO_SetBits(GPIOC, RS);
TFT_7_Write_Data(0x00);           //SET start page address=0
TFT_7_Write_Data(0x00);
TFT_7_Write_Data(0x01);           //SET end page address=479
TFT_7_Write_Data(0xdf);
/*TFT_7_Write_Command(0x33);      //SET scroll area
GPIO_SetBits(GPIOC, RS);
TFT_7_Write_Data(0x00);           //SET top fixed area=0
TFT_7_Write_Data(0x00);
TFT_7_Write_Data(0x01);           //SET vertical scrolling area=479
TFT_7_Write_Data(0xdf);
TFT_7_Write_Data(0x00);           //SET bottom fixed area=0
TFT_7_Write_Data(0x00);
TFT_7_Write_Command(0x28);        //SET display off */
}

```

```

void TFT_7_Write_Command(unsigned char command)
{
    GPIO_Write(GPIOB, command);
    GPIO_ResetBits(GPIOC, RS);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_SetBits(GPIOC, nWR);
}

```

```

void TFT_7_Write_Data(unsigned char data1)
{
    GPIO_SetBits(GPIOC, RS);
    GPIO_Write(GPIOB, data1);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_SetBits(GPIOC, nWR);
}

```

```

void TFT_7_Command_Write(unsigned char REG,unsigned char VALUE)
{
    TFT_7_Write_Command(REG);
    TFT_7_Write_Data(VALUE);
}

```

```

void TFT_7_SendData(unsigned long color)

```

```

{
GPIO_SetBits(GPIOC, RS);
GPIO_Write(GPIOB, (color>>16));
GPIO_ResetBits(GPIOC, nWR);
GPIO_SetBits(GPIOC, nWR);
GPIO_Write(GPIOB, (color>>8));
GPIO_ResetBits(GPIOC, nWR);
GPIO_SetBits(GPIOC, nWR);
GPIO_Write(GPIOB, (color));
GPIO_ResetBits(GPIOC, nWR);
GPIO_SetBits(GPIOC, nWR);
}

void TFT_7_WindowSet(unsigned int s_x,unsigned int e_x,unsigned int s_y,unsigned int e_y)
{
TFT_7_Write_Command(0x2a);           //SET page address
TFT_7_Write_Data((s_x)>>8);           //SET start page address=0
TFT_7_Write_Data(s_x);
TFT_7_Write_Data((e_x)>>8);           //SET end page address=639
TFT_7_Write_Data(e_x);

TFT_7_Write_Command(0x2b);           //SET column address
TFT_7_Write_Data((s_y)>>8);           //SET start column address=0
TFT_7_Write_Data(s_y);
TFT_7_Write_Data((e_y)>>8);           //SET end column address=479
TFT_7_Write_Data(e_y);
}

```

## 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 , 240hrs                                                                      | 2    |
| Low Temperature storage               | Endurance test applying the low storage temperature for a long time.                                                            | -30°C , 240hrs                                                                      | 1,2  |
| High Temperature Operation            | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.                    | +70°C 240hrs                                                                        | 2    |
| Low Temperature Operation             | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.                     | -20°C , 240hrs                                                                      | 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 , 240hrs                                                             | 1,2  |
| Thermal Shock resistance              | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.                  | -30°C,30min -> 25°C,5min -> 80°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)