# NHD-7.0-800480WF-CTXI#

## 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 |
| #- | **RoHS Compliant** |


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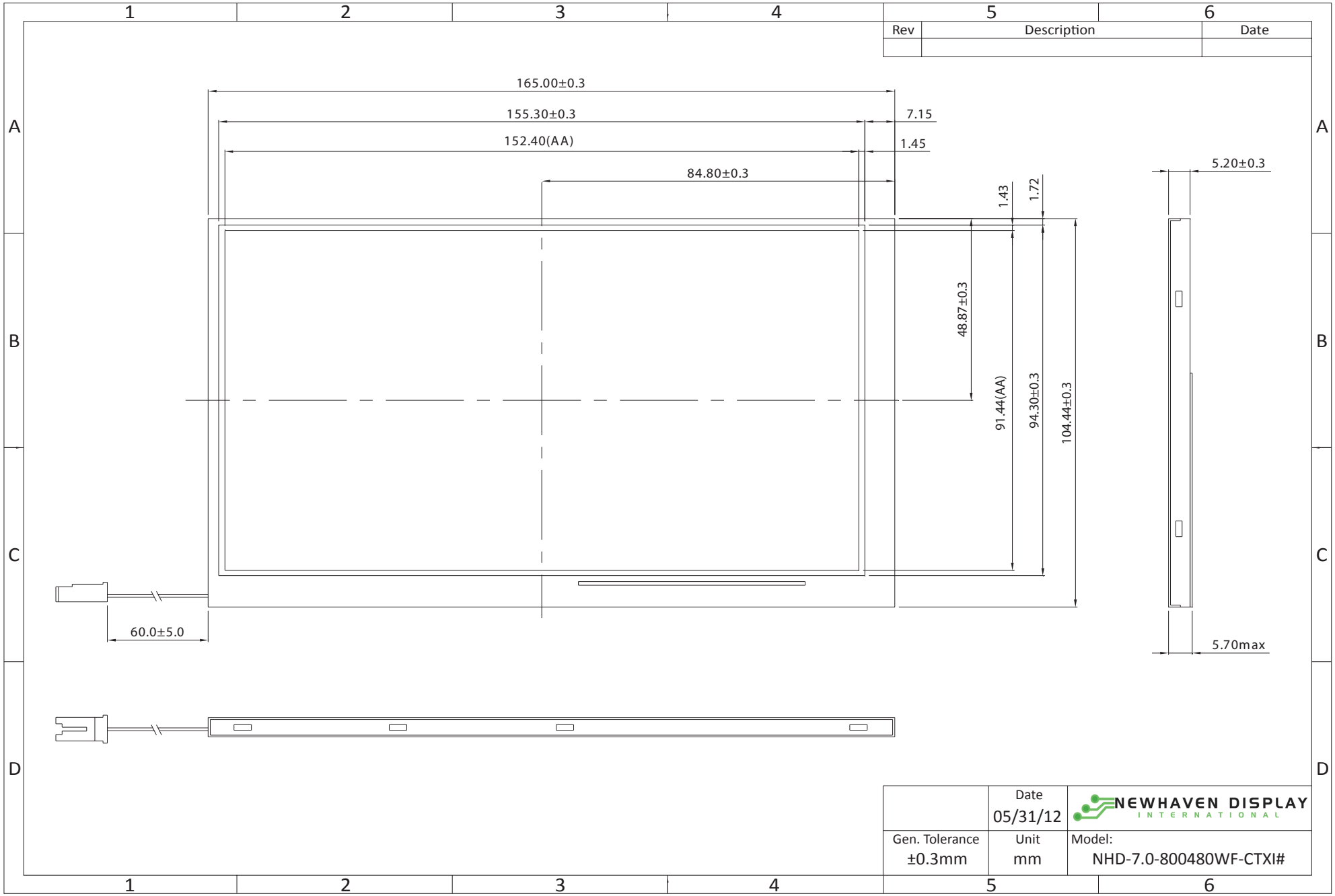
## Document Revision History

| 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 | 3/3/2011 | Mechanical drawing updated | BE |
| 5 | 10/7/2011 | Backlight pin description added | AK |
| 6 | 1/6/2012 | Pixel data format updated | AK |
| 7 | 5/31/2012 | Mechanical drawing updated | AK |

## Functions and Features

- **800xRGBx480 resolution**
- **LED backlight**
- **8-bit digital RGB interface**
- **262,144 colors**
- **SSD1963 8-bit controller**

# Mechanical Drawing



| Rev | Description | Date |
|---|---|---|
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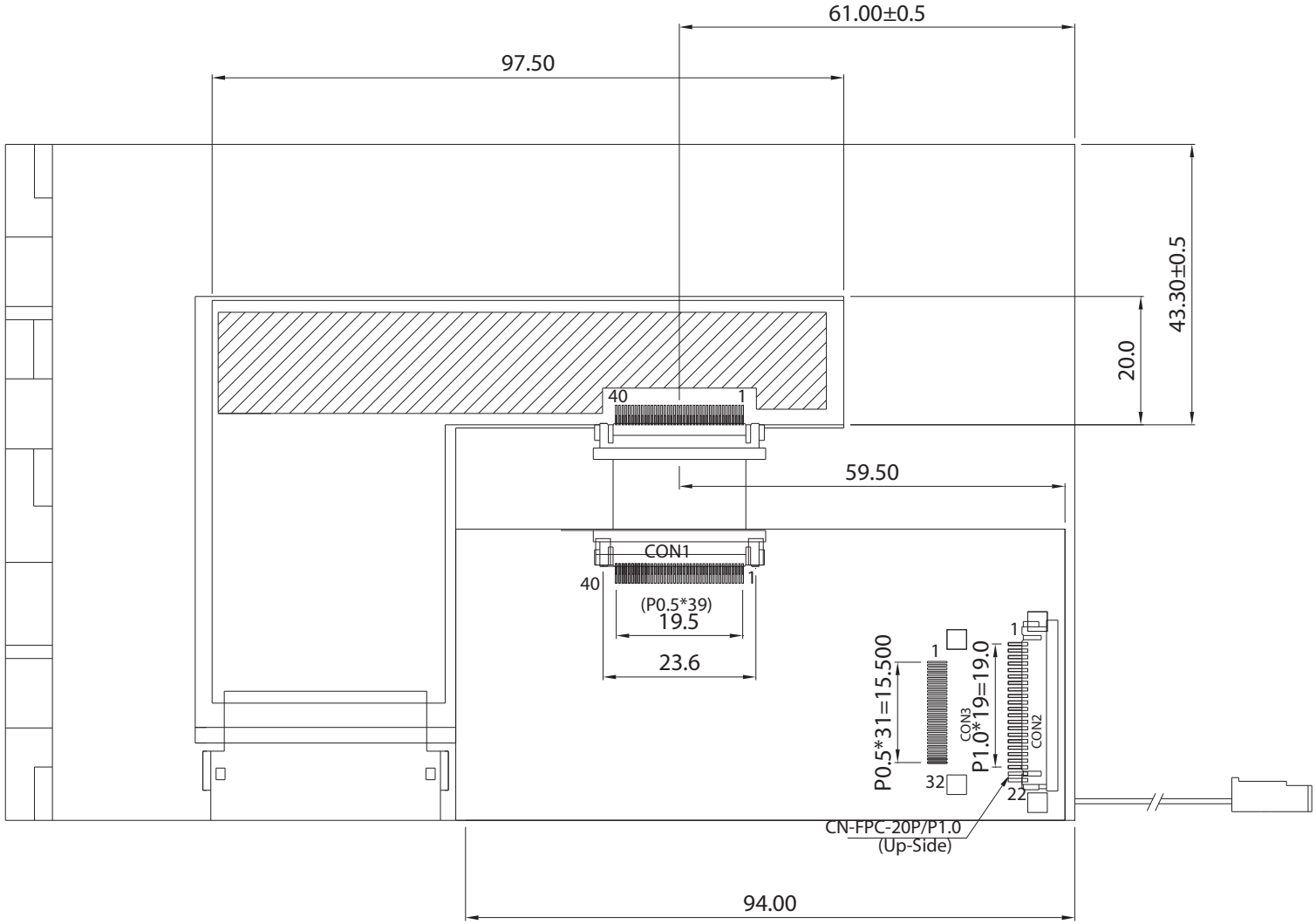



| PIN NO. | SYMBOL |
|---|---|
| 1 | GND |
| 2 | VDD |
| 3 | NC |
| 4 | A0 |
| 5 | R/W |
| 6 | E |
| 7 | DB0 |
| 8 | DB1 |
| 9 | DB2 |
| 10 | DB3 |
| 11 | DB4 |
| 12 | DB5 |
| 13 | DB6 |
| 14 | DB7 |
| 15 | CS |
| 16 | NC |
| 17 | NC |
| 18 | RST |
| 19 | NC |
| 20 | NC |

| | Date | |
|---|---|---|
| | 05/31/12 | NEWHAVEN DISPLAY INTERNATIONAL |
| Gen. Tolerance | Unit | Model: |
| ±0.3mm | mm | NHD-7.0-800480WF-CTXI# |

## 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 |

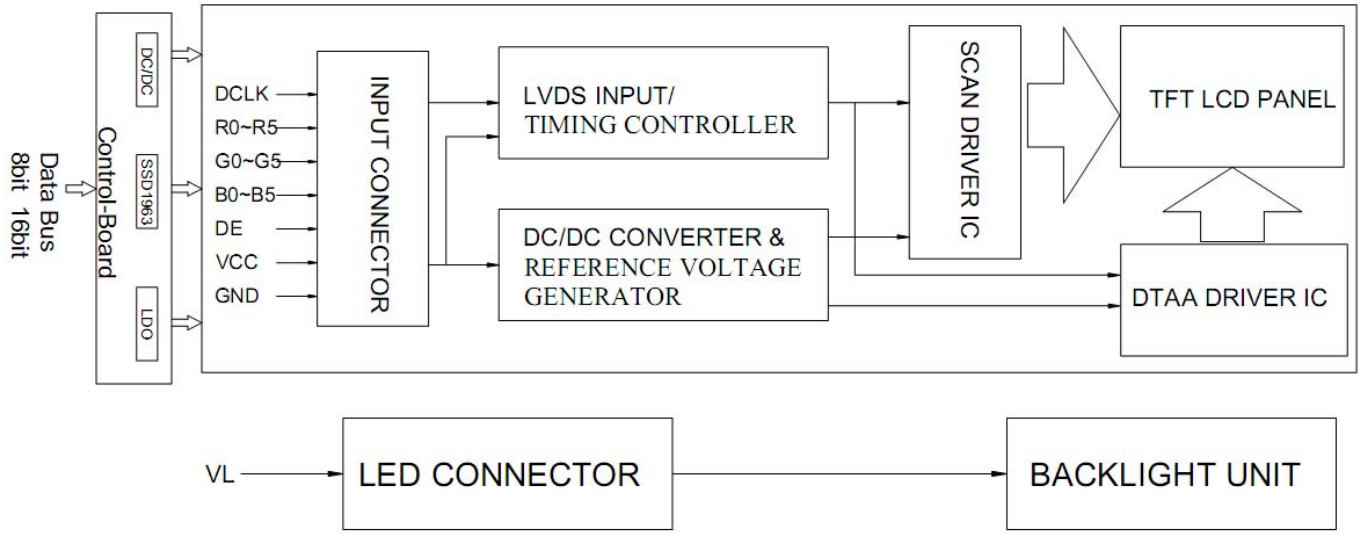
**Backlight connector**: JST p/n: BHSR-02VS-1
**Recommended mating connector**: JST p/n: SM 02B-BHSS-1

## 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 | 3.5 | V |
| Supply Current | IDD | VDD=3.3V 25°C | - | 200 | 260 | mA |
| "H" Level input | Vih | | 0.8VDD | - | VDD+ 0.5 | V |
| "L" Level input | Vil | | - | - | 0.2VDD | 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 –Vertical (Top) | AV | Cr ≥10 | 50 | 60 | - | o |
| Viewing Angle –Vertical (Bottom) | AV | Cr ≥10 | 60 | 70 | - | o |
| Viewing Angle – Horizontal (Left) | AH | Cr ≥10 | 60 | 70 | - | o |
| Viewing Angle – Horizontal (Right) | AH | Cr ≥10 | 60 | 70 | - | o |
| Contrast Ratio | Cr | - | 250 | 400 | - | - |
| Luminance | YL | - | 300 | 350 | - | $cd/m^2$ |
| 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 | 1st | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 |
| | 2nd | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 |
| | 3rd | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |

## Example Initialization Program

```
/*******************************************************************************
* 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

# Warranty Information and Terms & Conditions

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

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