

NHD-1.8-128160EF-CTXI#-F

TFT (Thin-Film Transistor) Liquid Crystal Display Module

| | |
|---------|-------------------------------------|
| NHD- | Newhaven Display |
| 1.8- | 1.8" Diagonal |
| 128160- | 128 x 160 Pixels (Portrait Mode) |
| EF- | Model |
| C- | Built-in Controller |
| T- | White LED Backlight |
| X- | TFT |
| I- | 6:00 Optimal View, Wide Temperature |
| #- | RoHS Compliant |
| F- | FFC ZIF Connection Style |

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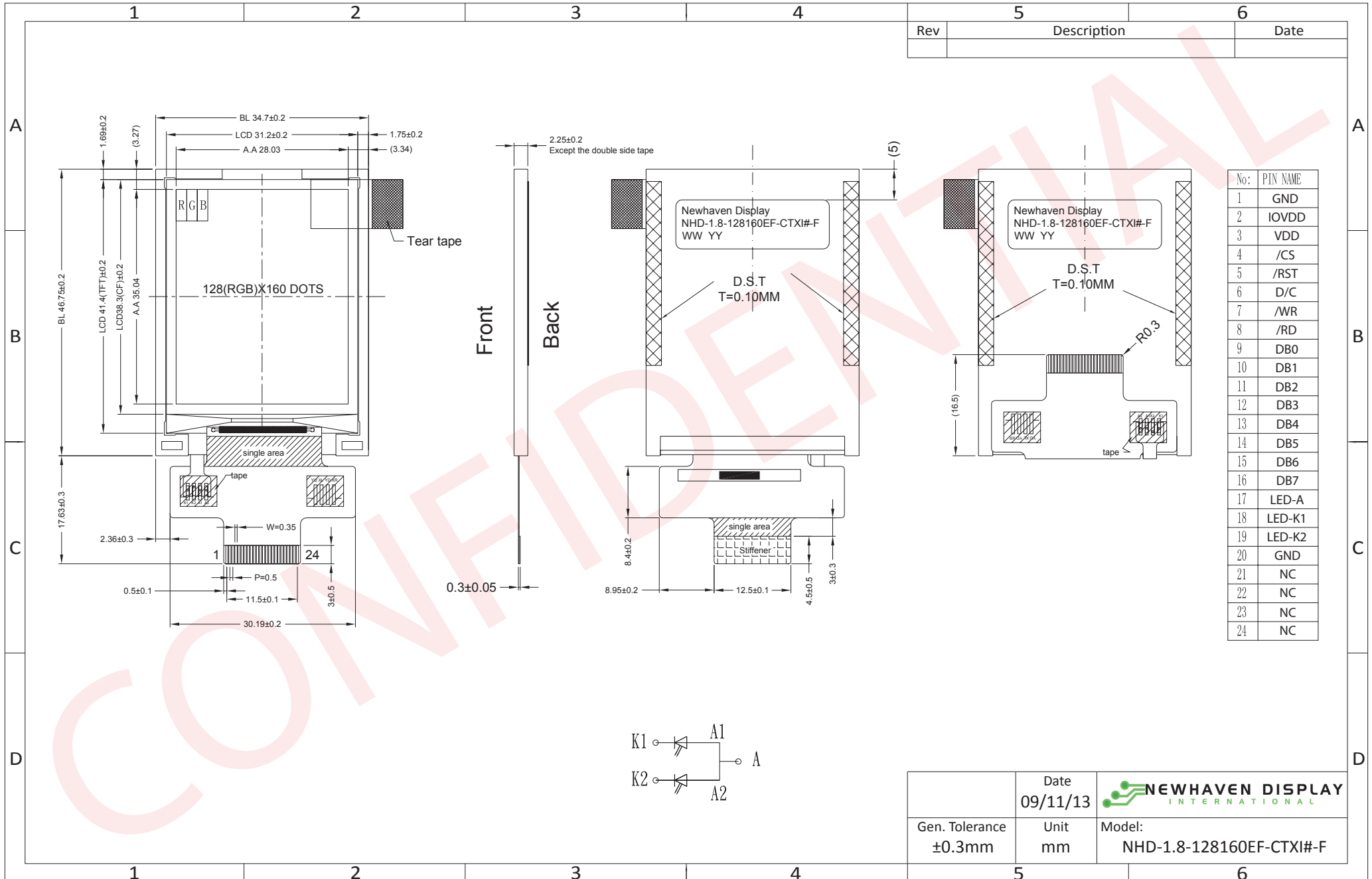
Document Revision History

| Revision | Date | Description | Changed by |
|----------|-----------|-----------------|------------|
| 0 | 9/11/2013 | Initial Release | AK |


Functions and Features

- 128 x 160 pixels (portrait mode)
- LED backlight
- 2.8V power supply
- 8-bit Parallel interface
- Built-in ILI9163C controller

Mechanical Drawing



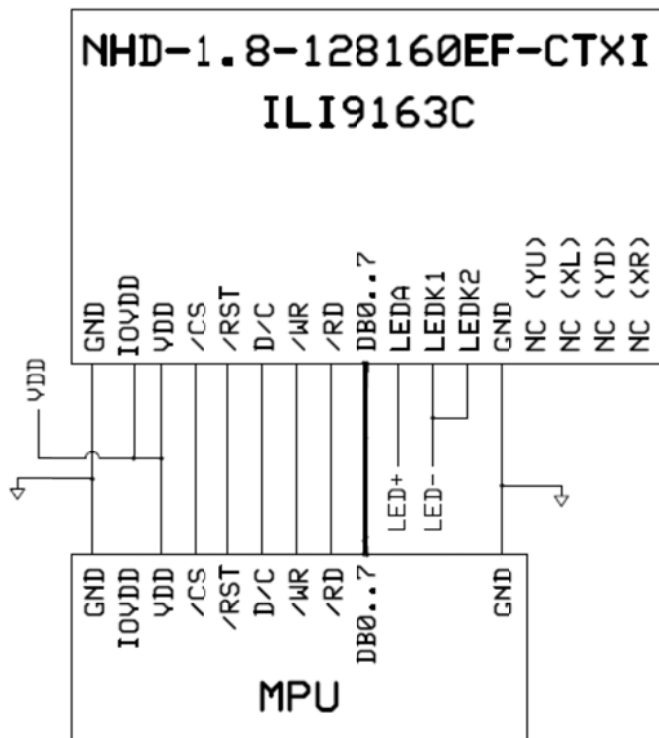
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| | | |
|--------------------------|------------------|---|
| | Date 09/11/13 |  NEWHAVEN DISPLAY INTERNATIONAL |
| Gen. Tolerance ±0.3mm | Unit mm | |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|--------|---------------------|--|
| 1 | GND | Power Supply | Ground |
| 2 | IOVDD | Power Supply | Supply Voltage for Logic (2.8V) – Can be tied to VDD |
| 3 | VDD | Power Supply | Supply Voltage for LCD (2.8V) |
| 4 | /CS | MPU | Active LOW Chip Select signal |
| 5 | /RST | MPU | Active LOW Reset signal |
| 6 | D/C | MPU | Data / Command selection: '1' = Data ; '0' = Command |
| 7 | /WR | MPU | Active LOW Write signal |
| 8 | /RD | MPU | Active LOW Read signal |
| 9 | DB0 | MPU | 8-bit bi-directional data bus |
| 10 | DB1 | MPU | |
| 11 | DB2 | MPU | |
| 12 | DB3 | MPU | |
| 13 | DB4 | MPU | |
| 14 | DB5 | MPU | |
| 15 | DB6 | MPU | |
| 16 | DB7 | MPU | |
| 17 | LED-A | Power Supply | Backlight Anode |
| 18 | LED-K1 | Power Supply | Backlight Cathode |
| 19 | LED-K2 | Power Supply | Backlight Cathode |
| 20 | GND | Power Supply | Ground |
| 21 | NC | - | No Connect |
| 22 | NC | - | No Connect |
| 23 | NC | - | No Connect |
| 24 | NC | - | No Connect |

LCD connector: 24pin 0.5mm FFC connector. Molex P/N: 52435-2471



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 for Logic | IOVDD | | 1.65 | 2.8 | 3.3 | V |
| Supply Voltage for LCD | VDD | | 2.5 | 2.8 | 3.3 | V |
| Supply Current | IDD | | - | 3 | - | mA |
| "H" Level input | Vih | | 0.7*IOVDD | - | IOVDD | V |
| "L" Level input | Vil | | GND | - | 0.3*IOVDD | V |
| "H" Level output | Voh | | 0.8*IOVDD | - | IOVDD | V |
| "L" Level output | Vol | | GND | - | 0.2*IOVDD | V |
| | | | | | | |
| Backlight Supply Voltage | Vled | | 3.0 | 3.2 | 3.4 | V |
| Backlight Supply Current | Iled | Vled=3.2V | - | 30 | 40 | mA |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|-----------|------|------|------|-------------------|
| Viewing Angle – Top | | Cr ≥ 10 | - | 50 | - | ° |
| Viewing Angle – Bottom | | | - | 20 | - | ° |
| Viewing Angle – Left | | | - | 45 | - | ° |
| Viewing Angle – Right | | | - | 45 | - | ° |
| Contrast Ratio | Cr | | 400 | 500 | - | - |
| Luminance | Lv | Iled=30mA | 290 | 350 | - | cd/m ² |
| Response Time (rise + fall) | Tr+Tf | | - | 20 | 30 | ms |

Viewing angles based on 12:00 gray scale inversion

Controller Information

Built-in ILI9163C controller.

Please download specification at http://www.newhavendisplay.com/app_notes/ILI9163.pdf

Table of Commands

| Hex Code | Command | Description | Number of Parameters | Display Architecture Implementation Requirement | | |
|----------|-----------------------|---|----------------------|---|--------|--------|
| | | | | Type 1 | Type 2 | Type 3 |
| 00h | nop | No Operation | 0 | Yes | Yes | Yes |
| 01h | soft_reset | Software Reset | 0 | Yes | Yes | Yes |
| 06h | get_red_channel | Get the red component of the pixel at (0, 0). | 1 | No | Yes | Yes |
| 07h | get_green_channel | Get the green component of the pixel at (0, 0). | 1 | No | Yes | Yes |
| 08h | get_blue_channel | Get the blue component of the pixel at (0, 0). | 1 | No | Yes | Yes |
| 0Ch | get_pixel_format | Get the current pixel format. | 1 | Yes | Yes | Yes |
| 0Ah | get_power_mode | Get the current power mode. | 1 | Yes | Yes | Yes |
| 0Bh | get_address_mode | Get the frame memory to the display panel read order. | 1 | Yes | Yes | Yes |
| 0Dh | get_display_mode | Get the current display mode from the peripheral. | 1 | Yes | Yes | Yes |
| 0Eh | get_signal_mode | Get display module signaling mode. | 1 | Yes | Yes | Yes |
| 0Fh | get_diagnostic_result | Get Peripheral Self-Diagnostic Result | 1 | Yes | Yes | Yes |
| 10h | enter_sleep_mode | Power for the display panel is off. | 0 | Yes | Yes | Yes |
| 11h | exit_sleep_mode | Power for the display panel is on. | 0 | Yes | Yes | Yes |
| 12h | enter_partial_mode | Part of the display area is used for image display. | 0 | Yes | Yes | No |
| 13h | enter_normal_mode | The whole display area is used for image display. | 0 | Yes | Yes | No |
| 20h | exit_invert_mode | Displayed image colors are not inverted. | 0 | Yes | Yes | Yes |
| 21h | enter_invert_mode | Displayed image colors are inverted. | 0 | Yes | Yes | Yes |
| 26h | set_gamma_curve | Selects the gamma curve used by the display device. | 1 | Yes | Yes | Yes |
| 28h | set_display_off | Blanks the display device. | 0 | Yes | Yes | Yes |
| 29h | set_display_on | Show the image on the display device. | 0 | Yes | Yes | Yes |
| 2Ah | set_column_address | Set the column extent. | 4 | Yes | Yes | No |
| 2Bh | set_page_address | Set the page extent. | 4 | Yes | Yes | No |
| 2Ch | write_memory_start | Transfer image data from the Host Processor to the peripheral starting at the location provided by set_column_address and set_page_address. | Variable | Yes | Yes | No |
| 2Dh | write_LUT | Fills the peripheral look-up table with the provided data. | Variable | optional | No | No |
| 2Eh | read_memory_start | Transfer image data from the peripheral to the Host Processor interface starting at the location provided by set_column_address and set_page_address. | Variable | Yes | Yes | No |
| 30h | set_partial_area | Defines the partial display area on the display device. | 4 | Yes | Yes | No |
| 33h | set_scroll_area | Defines the vertical scrolling and fixed area on display device. | 6 | Yes | No | No |
| 34h | set_tear_off | Synchronization information is not sent from the display module to the host processor. | 0 | Yes | No | No |
| 35h | set_tear_on | Synchronization information is sent from the display module to the host processor at the start of VFP. | 1 | Yes | No | No |

| | | | | | | |
|-----|-----------------------|--|----------|-----|-----|-----|
| 36h | set_address_mode | Set the read order from frame memory to the display panel. | 1 | Yes | Yes | Yes |
| 37h | set_scrdl_start | Defines the vertical scrolling starting point. | 2 | Yes | No | No |
| 38h | exit_idle_mode | Full color depth is used on the display panel. | 0 | Yes | No | No |
| 39h | enter_idle_mode | Reduced color depth is used on the display panel. | 0 | Yes | No | No |
| 3Ah | set_pixel_format | Defines how many bits per pixel are used in the interface. | 1 | Yes | Yes | Yes |
| 3Ch | write_memory_continue | Transfer image information from the Host Processor interface to the peripheral from the last written location. | Variable | Yes | Yes | No |
| 3Eh | read_memory_continue | Read image data from the peripheral continuing after the last read_memory_continue or read_memory_start. | Variable | Yes | Yes | No |
| 44h | set_tear_scanline | Synchronization information is sent from the display module to the host processor when the display device refresh reaches the provided scanline. | 2 | Yes | No | No |
| 45h | get_scanline | Get the current scanline. | 2 | Yes | Yes | No |
| Dah | Read ID1 | | | | | |
| DBh | Read ID2 | | | | | |
| DCh | Read ID3 | | | | | |

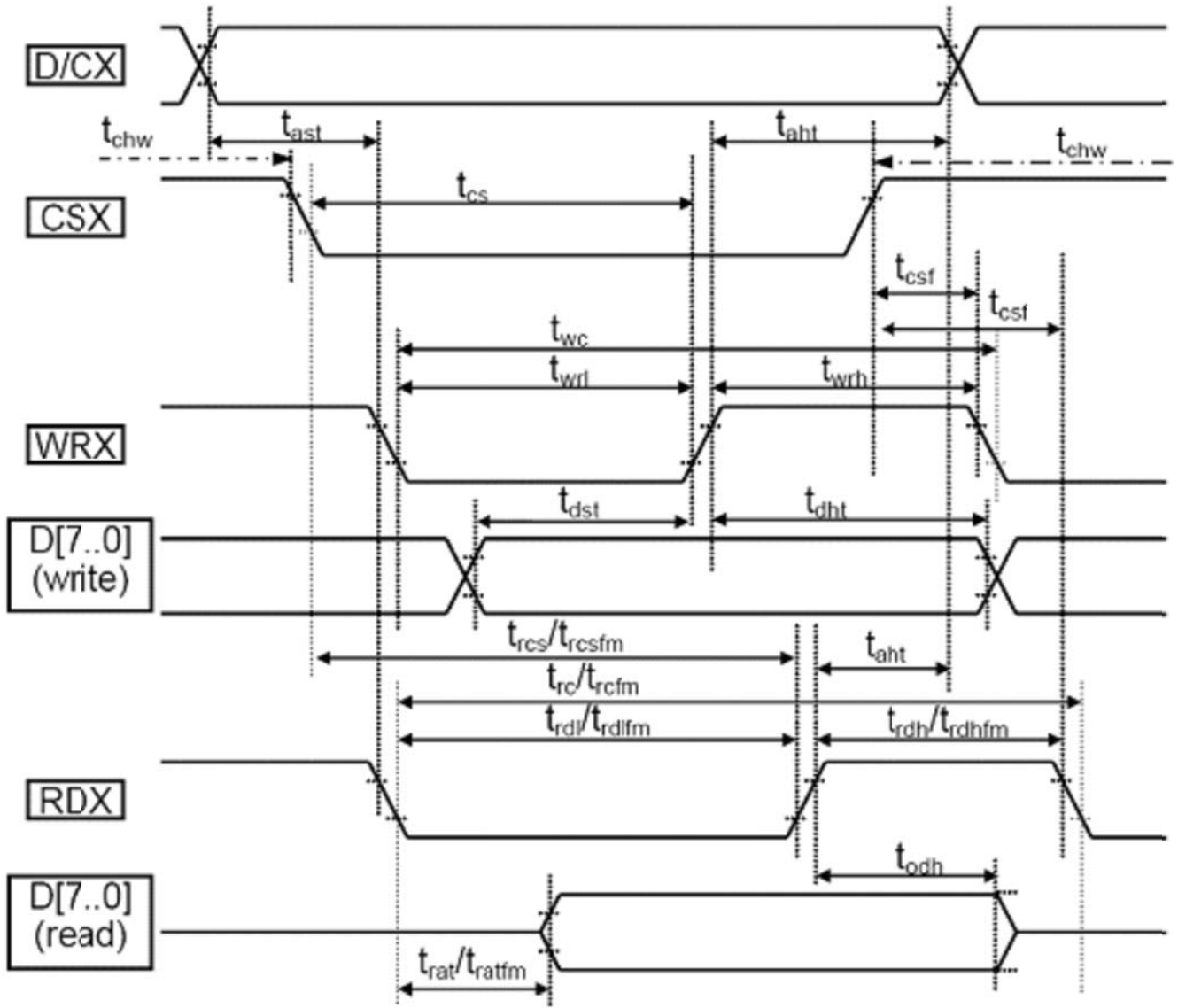
Notes:

1. There will be no abnormal visible effects on the display when S/W or H/W Reset are applied.
2. After Powered-On Reset finishes within 10 μ s after both VDD & VDDI are applied.
3. Mode 1 means Tearing Effect Output Line consists of V-Blanking Information only.

For Command Descriptions, please see: http://www.newhavendisplay.com/app_notes/ILI9163.pdf

Timing Characteristics

Parallel 8-bit Bus



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

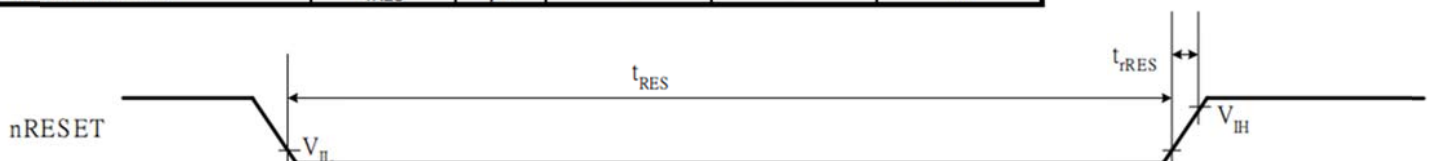
| Signal | Symbol | Parameter | min | max | unit | description |
|----------|--------|-----------------------------------|-----|-----|------|---|
| D/CX | tast | Address setup time | 0 | | ns | |
| | taht | Address hold time(Write/Read) | 10 | | ns | |
| CSX | tchw | "S""H" Pulse Width | 0 | | ns | |
| | tcs | Chip Select setup time (Write) | 10 | | ns | |
| | trcs | Chip Select setup time (Read ID) | 45 | | ns | |
| | trcsfm | Chip Select setup time (Read FM) | 355 | | ns | |
| | tcsf | Chip Select Wait time(Write/read) | 10 | | ns | |
| WRX | twc | Write cycle | 66 | | ns | |
| | twrh | Control pulse H duration | 15 | | ns | |
| | twrl | Control pulse L duration | 15 | | ns | |
| RDX | trc | Read cycle (ID) | 160 | | ns | When read ID data |
| | trdh | Control pulse H duration(ID) | 90 | | ns | |
| | trdl | Control pulse L duration(ID) | 45 | | ns | |
| RDX | trcfm | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | trdhfm | Control pulse H duration (FM) | 90 | | ns | |
| | trdlfm | Control pulse L duration (FM) | 355 | | ns | |
| D[17..0] | tdst | Data setup time | 10 | | ns | For maximum CL = 30pF For minimum CL = 8pF |
| | tdht | Data hold time | 10 | | ns | |
| | trat | Read access time (ID) | | 40 | ns | |
| | tratfm | Read access time (FM) | | 340 | ns | |
| | todh | Output disable time | 20 | 80 | ns | |

Note 1: VDDI 1.65 to 3.3V, VDD=2.6 to 3.3V, AGND=GND=0V, Ta=-30 to 70 °C (to +85°C no damage)

Note 2: This input signal rise time and fall time (tr, tf) is specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals

Reset Timing

| Item | Symbol | Unit | Min. | Typ. | Max. |
|-----------------------|------------|------|------|------|------|
| Reset low-level width | t_{RES} | ms | 1 | - | - |
| Reset rise time | t_{rRES} | µs | - | - | 10 |



Example Program Code

```
void TFT_18E_Init(void)
{
    GPIO_ResetBits(GPIOC, CS1);
    GPIO_SetBits(GPIOC, nRD);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_WriteBit(GPIOC, RES, Bit_RESET);
    delay(5);
    TFT_delay(10);
    GPIO_WriteBit(GPIOC, RES, Bit_SET);
    delay(100);
    TFT_delay(10);
    TFT_18E_Write_Command(0x11);
    TFT_delay(100);
    TFT_18E_Write_Command(0x26);TFT_18E_Write_Data(0x04);
    TFT_18E_Write_Command(0xF2);TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Command(0xB1);TFT_18E_Write_Data(0x0A);TFT_18E_Write_Data(0x14);
    TFT_18E_Write_Command(0xC0);TFT_18E_Write_Data(0x0A);TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Command(0xC1);TFT_18E_Write_Data(0x02);
    TFT_18E_Write_Command(0xC5);TFT_18E_Write_Data(0x2F);TFT_18E_Write_Data(0x3E);
    TFT_18E_Write_Command(0xC7);TFT_18E_Write_Data(0x40);
    TFT_18E_Write_Command(0x2A);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x7F);
    TFT_18E_Write_Command(0x2B);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x00);
    TFT_18E_Write_Data(0x9F);
    TFT_18E_Write_Command(0x36);TFT_18E_Write_Data(0x48);
    TFT_18E_Write_Command(0x3A);TFT_18E_Write_Data(0xC5);
    TFT_18E_Write_Command(0x29);
    TFT_18E_Write_Command(0x2C);
}
/*****/
void TFT_18E_Write_Command(unsigned char command)
{
    GPIO_ResetBits(GPIOC, RS);
    GPIO_Write(GPIOB, command);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_SetBits(GPIOC, nWR);
}
/*****/
void TFT_18E_Write_Data(unsigned char data1)
{
    GPIO_SetBits(GPIOC, RS);
    GPIO_Write(GPIOB, data1);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_SetBits(GPIOC, nWR);
}
/*****/
```

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 , 48hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C , 48hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C , 48hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C , 48hrs | 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. | +50°C , 90% RH , 48hrs | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -20°C 30 min ~ +70°C 30 min, 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-55Hz , 1.5mm amplitude. 2 hours in each of 3 directions X,Y,Z. For 6 hours total | 3 |
| Static electricity test | Endurance test applying electric static discharge. | VS=4KV, RS=330Ω, CS=150pF Five times | |

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



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