

NHD-2.8-25664UCY2

Graphic OLED Display Module

| | |
|--------|---------------------------|
| NHD- | Newhaven Display |
| 2.8- | 2.8" Diagonal Size |
| 25664- | 256 x 64 Pixel Resolution |
| UC- | Model |
| Y- | Emitting Color: Yellow |
| 2- | 3V Power Supply |

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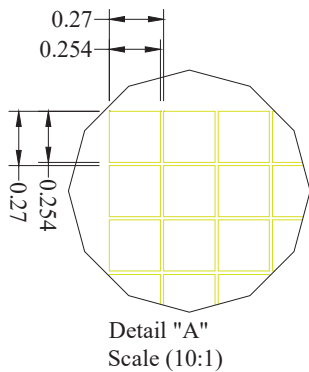
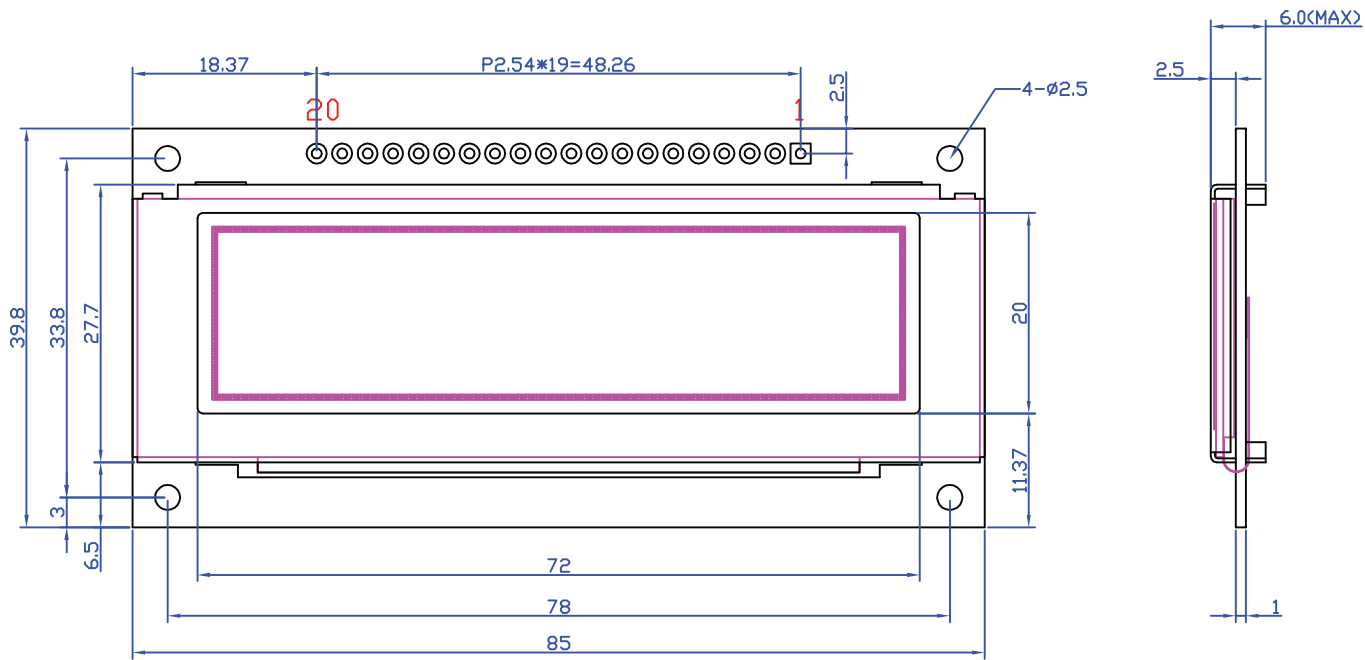
Document Revision History

| Revision | Date | Description | Changed by |
|----------|----------|---|------------|
| 0 | 5/1/11 | Initial Product Release | - |
| 1 | 2/22/13 | Electrical characteristics and mechanical drawing updated | JN |
| 2 | 3/16/20 | Electrical Characteristics & Segment Layout Updated | SB |
| 3 | 10/23/20 | Updated Supply Voltage Range: (3V/3.3V/3.5V) to (2.8V/3V/3.3V) | AS |

Functions and Features

- 256 x 64 pixel resolution
- Built-in SSD1322 controller
- Parallel or serial MPU interface
- Single, low voltage power supply
- RoHS compliant

A
B
C
D
E
F



Notes:

- | | |
|--------------------|--|
| 1. Driver: | 1/64 Duty |
| 2. Display Type: | PMOLED |
| 3. Voltage: | 3V VDD |
| 4. Emitting Color: | Yellow |
| 5. Driver IC: | SD1322 |
| 6. Interface: | 8-Bit 68XX/80XX Parallel, 3-/4-Wire SPI |

1 2 3 4

Interface Description

Parallel Interface:

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|---|
| 1 | V _{SS} | Power Supply | Ground |
| 2 | V _{DD} | Power Supply | Supply Voltage for OLED and logic. |
| 3 | NC | - | No Connect |
| 4 | D/C | MPU | Register select signal. D/C=0: Command; D/C=1: Data |
| 5 | R/W or /WR | MPU | 6800-interface: Read/Write select signal, R/W=1: Read; R/W=0: Write 8080-interface: Active LOW Write signal. |
| 6 | E or /RD | MPU | 6800-interface: Operation enable signal. Falling edge triggered. 8080-interface: Active LOW Read signal. |
| 7-14 | DB0 – DB7 | MPU | 8-bit Bi-directional data bus lines. |
| 15 | NC | - | No Connect |
| 16 | /RES | MPU | Active LOW Reset signal. |
| 17 | /CS | MPU | Active LOW Chip Select signal. |
| 18 | NC | - | No Connect |
| 19 | BS1 | MPU | MPU Interface Select signal. |
| 20 | BS0 | MPU | MPU Interface Select signal. |

Serial Interface:

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|---|
| 1 | V _{SS} | Power Supply | Ground |
| 2 | V _{DD} | Power Supply | Supply Voltage for OLED and logic. |
| 3 | NC | - | No Connect |
| 4 | D/C | MPU | Register select signal. D/C=0: Command; D/C=1: Data Tie LOW for 3-wire Serial Interface. |
| 5-6 | VSS | Power Supply | Ground |
| 7 | SCLK | MPU | Serial Clock signal. |
| 8 | SDIN | MPU | Serial Data Input signal. |
| 9 | NC | - | No Connect |
| 10-14 | VSS | Power Supply | Ground |
| 15 | NC | - | No Connect |
| 16 | /RES | MPU | Active LOW Reset signal. |
| 17 | /CS | MPU | Active LOW Chip Select signal. |
| 18 | NC | - | No Connect |
| 19 | BS1 | MPU | MPU Interface Select signal. |
| 20 | BS0 | MPU | MPU Interface Select signal. |

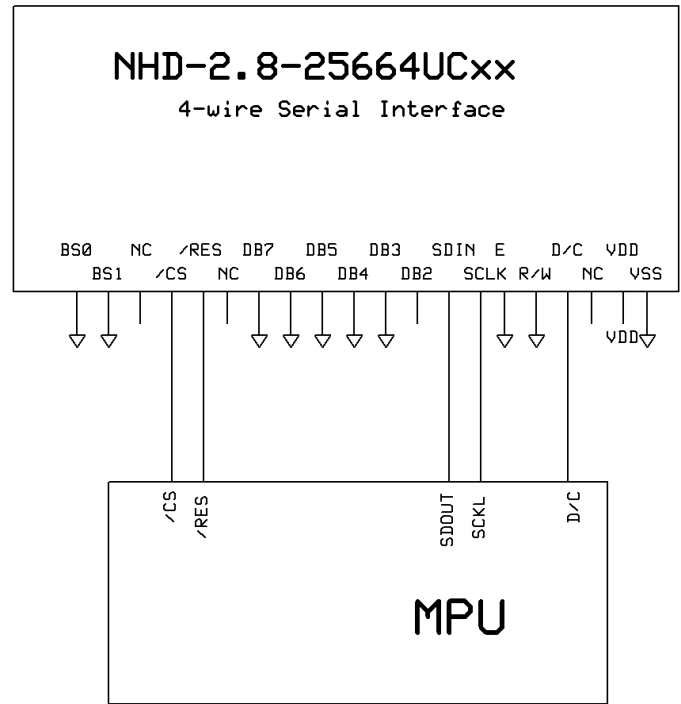
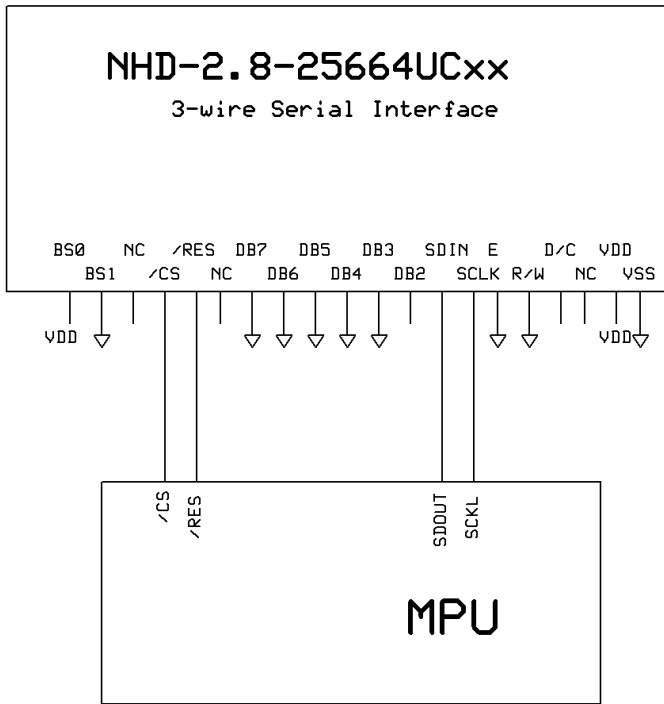
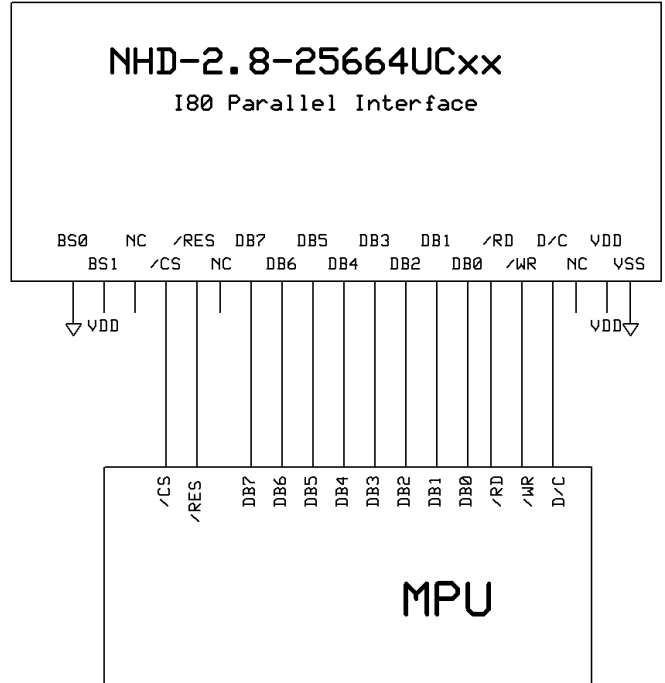
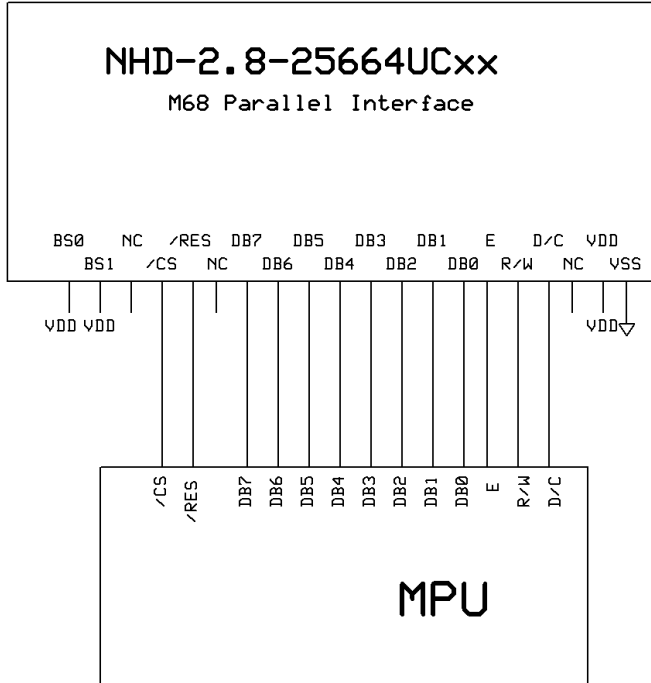
MPU Interface Pin Selections

| Pin Name | 6800 Parallel 8-bit interface | 8080 Parallel 8-bit interface | 3-wire Serial Interface | 4-wire Serial Interface |
|----------|-------------------------------|-------------------------------|-------------------------|-------------------------|
| BS1 | 1 | 1 | 0 | 0 |
| BS0 | 1 | 0 | 1 | 0 |

MPU Interface Pin Assignment Summary

| Bus Interface | Data/Command Interface | | | | | | | | Control Signals | | | | |
|---------------|------------------------|----|----|----|----|------|------|---------|-----------------|-----|---------|------|------|
| | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | E | R/W | /CS | D/C | /RES |
| 8-bit 6800 | D[7:0] | | | | | | | | E | R/W | /CS | D/C | /RES |
| 8-bit 8080 | D[7:0] | | | | | | | | /RD | /WR | /CS | D/C | /RES |
| 3-wire SPI | Tie LOW | | | | NC | SDIN | SCLK | Tie LOW | | /CS | Tie LOW | /RES | |
| 4-wire SPI | Tie LOW | | | | NC | SDIN | SCLK | Tie LOW | | /CS | D/C | /RES | |

Wiring Diagrams



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|-----------------------|--------------------------------|-----------------------|------|-----------------------|------|
| Operating Temperature Range | T _{OP} | Absolute Max | -40 | - | +85 | °C |
| Storage Temperature Range | T _{ST} | Absolute Max | -40 | - | +90 | °C |
| Supply Voltage | V _{DD} | - | 2.8 | 3.0 | 3.3 | V |
| Supply Current (display) | I _{DD} | 50% ON, V _{DD} =3.0V | - | 150 | 175 | mA |
| | | 100% ON, V _{DD} =3.0V | - | 250 | 275 | mA |
| Sleep Mode Current | I _{DD_SLEEP} | - | - | - | 10 | µA |
| "H" Level input | V _{IH} | - | 0.8 * V _{DD} | - | V _{DD} | V |
| "L" Level input | V _{IL} | - | V _{SS} | - | 0.2 * V _{DD} | V |
| "H" Level output | V _{OH} | - | 0.9 * V _{DD} | - | V _{DD} | V |
| "L" Level output | V _{OL} | - | V _{SS} | - | 0.1 * V _{DD} | V |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|----------------|------------------------|----------|--------|------|-------------------|
| Viewing Angle – Top | φY+ | | - | 80 | - | ° |
| Viewing Angle – Bottom | φY- | | - | 80 | - | ° |
| Viewing Angle – Left | θX- | | - | 80 | - | ° |
| Viewing Angle – Right | θX+ | | - | 80 | - | ° |
| Contrast Ratio | CR | - | 10,000:1 | - | - | - |
| Response Time (rise) | T _R | - | - | 10 | - | us |
| Response Time (fall) | T _F | - | - | 10 | - | us |
| Brightness | L _V | T _{OP} = 25°C | 60 | 80 | - | cd/m ² |
| Lifetime | - | 50% Checkerboard | 40,000 | 60,000 | - | Hrs |

Note: Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until **Half-Brightness**. The Display OFF command can be used to extend the lifetime of the display.

Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

Controller Information

Built in SSD1322 Controller

For detailed information please download datasheet: http://www.newhavendisplay.com/app_notes/SSD1322.pdf

6800-MPU Parallel Interface

The parallel interface consists of 8 bi-directional data pins, R/W, D/C, E, and /CS.

A LOW on R/W indicates write operation, and HIGH on R/W indicates read operation.

A LOW on D/C indicates “Command” read or write, and HIGH on D/C indicates “Data” read or write.

The E input serves as data latch signal, while /CS is LOW. Data is latched at the falling edge of E signal.

| Function | E | R/W | /CS | D/C |
|---------------|---|-----|-----|-----|
| Write Command | ↓ | 0 | 0 | 0 |
| Read Status | ↓ | 1 | 0 | 0 |
| Write Data | ↓ | 0 | 0 | 1 |
| Read Data | ↓ | 1 | 0 | 1 |

8080-MPU Parallel Interface

The parallel interface consists of 8 bi-directional data pins, /RD, /WR, D/C, and /CS.

A LOW on D/C indicates “Command” read or write, and HIGH on D/C indicates “Data” read or write.

A rising edge of /RS input serves as a data read latch signal while /CS is LOW.

A rising edge of /WR input serves as a data/command write latch signal while /CS is LOW.

| Function | /RD | /WR | /CS | D/C |
|---------------|-----|-----|-----|-----|
| Write Command | 1 | ↑ | 0 | 0 |
| Read Status | ↑ | 1 | 0 | 0 |
| Write Data | 1 | ↑ | 0 | 1 |
| Read Data | ↑ | 1 | 0 | 1 |

Alternatively, /RD and /WR can be kept stable while /CS serves as the data/command latch signal.

| Function | /RD | /WR | /CS | D/C |
|---------------|-----|-----|-----|-----|
| Write Command | 1 | 0 | ↑ | 0 |
| Read Status | 0 | 1 | ↑ | 0 |
| Write Data | 1 | 0 | ↑ | 1 |
| Read Data | 0 | 1 | ↑ | 1 |

Serial Interface (4-wire)

The 4-wire serial interface consists of serial clock SCLK, serial data SDIN, D/C, and /CS.

D0 acts as SCLK and D1 acts as SDIN. D2 should be left open. D3~D7, E, and R/W should be connected to GND.

| Function | /RD | /WR | /CS | D/C | D0 |
|---------------|---------|---------|-----|-----|----|
| Write Command | Tie LOW | Tie LOW | 0 | 0 | ↑ |
| Write Data | Tie LOW | Tie LOW | 0 | 1 | ↑ |

SDIN is shifted into an 8-bit shift register on every rising edge of SCLK in the order of D7, D6,...D0.

D/C is sampled on every eighth clock and the data byte in the shift register is written to the GDRAM or command register in the same clock.

Note: Read is not available in serial mode.

Serial Interface (3-wire)

The 3-wire serial interface consists of serial clock SCLK, serial data SDIN, and /CS.

D0 acts as SCLK and D1 acts as SDIN. D2 should be left open. D3~D7, E, R/W, and D/C should be connected to GND.

| Function | /RD | /WR | /CS | D/C | D0 |
|---------------|---------|---------|-----|---------|----|
| Write Command | Tie LOW | Tie LOW | 0 | Tie LOW | ↑ |
| Write Data | Tie LOW | Tie LOW | 0 | Tie LOW | ↑ |

SDIN is shifted into an 9-bit shift register on every rising edge of SCLK in the order of D/C, D7, D6,...D0.

D/C (first bit of the sequential data) will determine if the following data byte is written to the Display Data RAM (D/C = 1) or the command register (D/C = 0).

Note: Read is not available in serial mode.

For detailed protocol information, see datasheet: http://www.newhavendisplay.com/app_notes/SSD1322.pdf

Example Initialization Sequence:

```
Set_Command_Lock(0x12);           // Unlock Basic Commands (0x12/0x16)
Set_Display_On_Off(0x00);        // Display Off (0x00/0x01)
Set_Column_Address(0x1C,0x5B);
Set_Row_Address(0x00,0x3F);
Set_Display_Clock(0x91);         // Set Clock as 80 Frames/Sec
Set_Multiplex_Ratio(0x3F);       // 1/64 Duty (0x0F~0x3F)
Set_Display_Offset(0x00);        // Shift Mapping RAM Counter (0x00~0x3F)
Set_Start_Line(0x00);           // Set Mapping RAM Display Start Line (0x00~0x7F)
Set_Remap_Format(0x14);         // Set Horizontal Address Increment
                                // Column Address 0 Mapped to SEG0
                                // Disable Nibble Remap
                                // Scan from COM[N-1] to COM0
                                // Disable COM Split Odd Even
                                // Enable Dual COM Line Mode
Set_GPIO(0x00);                 // Disable GPIO Pins Input
Set_Function_Selection(0x01);    // Enable Internal VDD Regulator
Set_Display_Enhancement_A(0xA0,0xFD); // Enable External VSL
Set_Contrast_Current(0x9F);     // Set Segment Output Current
Set_Master_Current(0x0F);       // Set Scale Factor of Segment Output Current Control
//Set_Gray_Scale_Table();        // Set Pulse Width for Gray Scale Table
Set_Linear_Gray_Scale_Table();  //set default linear gray scale table
Set_Phase_Length(0xE2);         // Set Phase 1 as 5 Clocks & Phase 2 as 14 Clocks
Set_Display_Enhancement_B(0x20); // Enhance Driving Scheme Capability (0x00/0x20)
Set_Precharge_Voltage(0x1F);    // Set Pre-Charge Voltage Level as 0.60*VCC
Set_Precharge_Period(0x08);     // Set Second Pre-Charge Period as 8 Clocks
Set_VCOMH(0x07);               // Set Common Pins Deselect Voltage Level as 0.86*VCC
Set_Display_Mode(0x02);         // Normal Display Mode (0x00/0x01/0x02/0x03)
Set_Partial_Display(0x01,0x00,0x00); // Disable Partial Display
Set_Display_On_Off(0x01);
```

Quality Information

| Test Item | Content of Test | Test Condition | Note |
|---------------------------------------|--|---|------|
| High Temperature storage | Test the endurance of the display at high storage temperature. | +90°C, 240hrs | 2 |
| Low Temperature storage | Test the endurance of the display at low storage temperature. | -40°C, 240hrs | 1,2 |
| High Temperature Operation | Test the endurance of the display by applying electric stress (voltage & current) at high temperature. | +85°C, 240hrs | 2 |
| Low Temperature Operation | Test the endurance of the display by applying electric stress (voltage & current) at low temperature. | -40°C, 240hrs | 1,2 |
| High Temperature / Humidity Operation | Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity. | +60°C, 90% RH, 240hrs | 1,2 |
| Thermal Shock resistance | Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures. | -40°C,30min -> 25°C,5min -> 85°C,30min = 1 cycle 100 cycles | |
| Vibration test | Test the endurance of the display by applying vibration to simulate transportation and use. | 10-22Hz, 15mm amplitude. 22-500Hz, 1.5G 30min in each of 3 directions X, Y, Z | 3 |
| Atmospheric Pressure test | Test the endurance of the display by applying atmospheric pressure to simulate transportation by air. | 115mbar, 40hrs | 3 |
| Static electricity test | Test the endurance of the display by applying electric static discharge. | VS=800V, RS=1.5kΩ, CS=100pF One time | |

Note 1: No condensation to be observed.

Note 2: Conducted after 2 hours of storage at 25°C, 0%RH.

Note 3: Test performed on product itself, not inside a container.

Evaluation Criteria:

- 1: Display is fully functional during operational tests and after all tests, at room temperature.
- 2: No observable defects.
- 3: Luminance >50% of initial value.
- 4: Current consumption within 50% of initial value

Precautions for using OLEDs/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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