

# NHD-C12864AZ-FSY-YBW

## COG (Chip-On-Glass) Liquid Crystal Display Module

NHD- Newhaven Display  
C12864- 128 x 64 pixels  
AZ- Model  
F- Transflective  
SY- Side Yellow/Green LED Backlight  
Y- STN- Yellow/Green  
B- 6:00 view  
W- Wide Temp (-20°C ~ +70°C)  
**RoHS Compliant**

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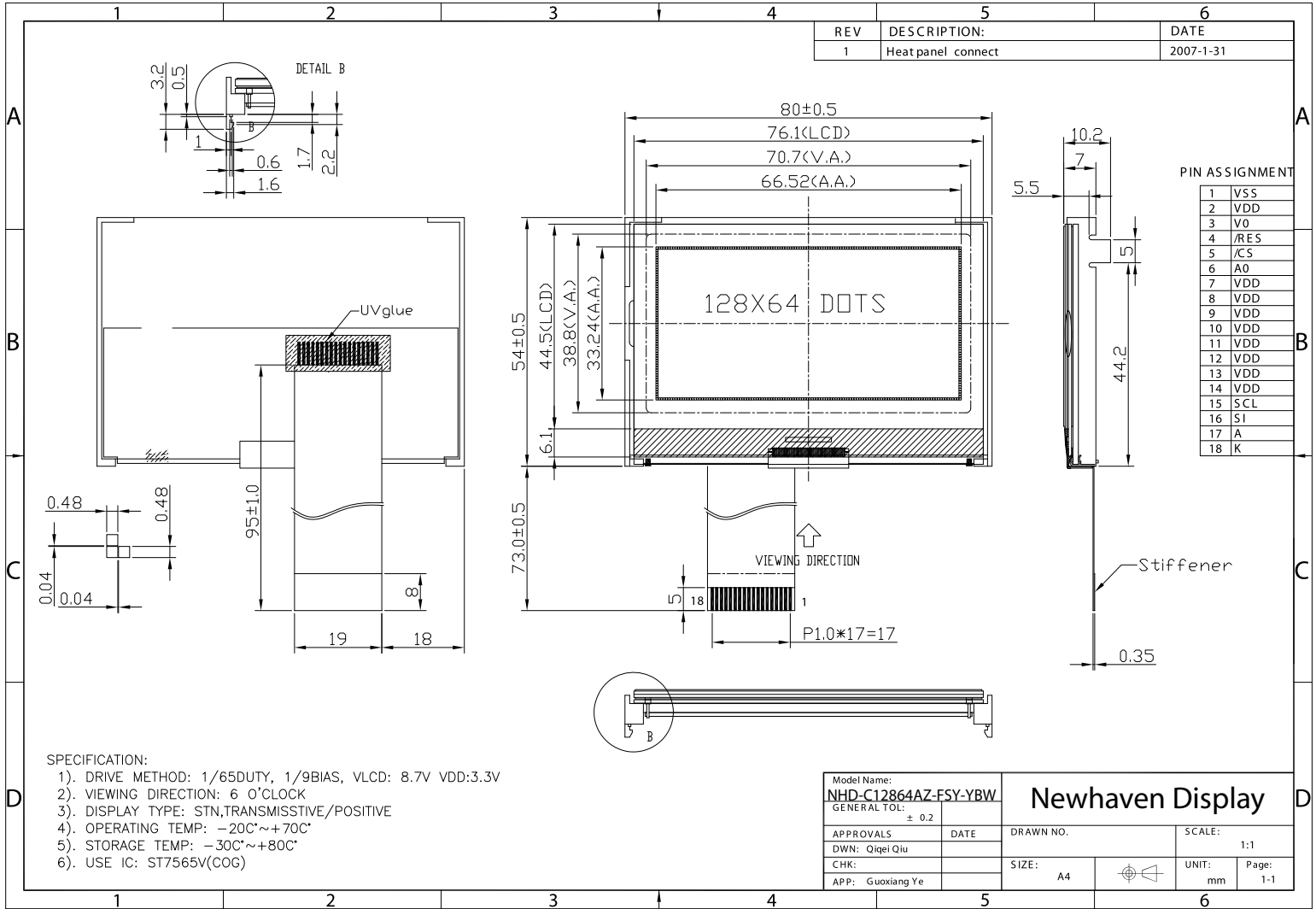
## Document Revision History

| Revision | Date      | Description         | Changed by |
|----------|-----------|---------------------|------------|
| 0        | 9/28/2007 | Initial Release     | -          |
| 1        | 1/31/2008 | User guide reformat | -          |
| 2        | 9/29/2009 | User guide reformat | BE         |

## Functions and Features

- 128 x 64 pixels
- Built-in ST7565P controller
- +3.3V power supply
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant

# Mechanical Drawing

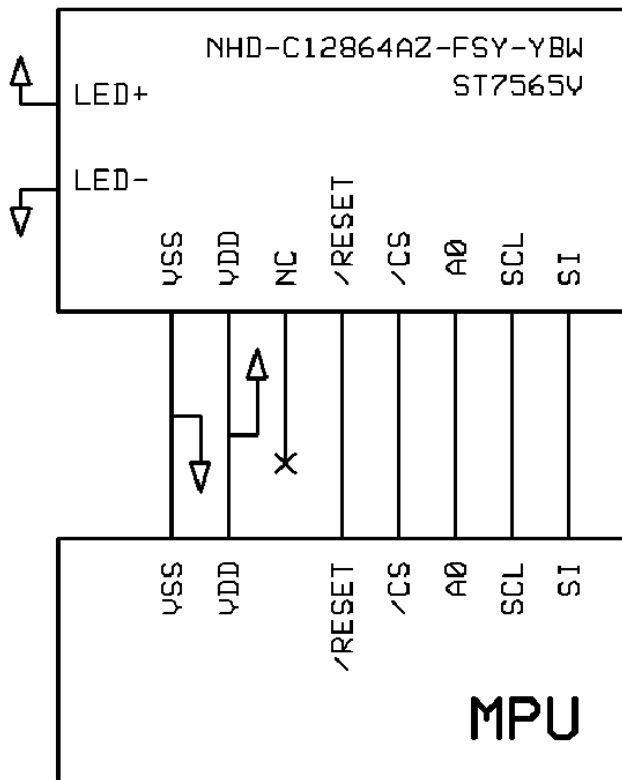


## Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description                                  |
|---------|--------|---------------------|---|
| 1       | VSS    | Power Supply        | Ground  |
| 2       | VDD    | Power Supply        | Power Supply for LCD and logic (+3.3V)                |
| 3       | NC     | -                   | No Connect  |
| 4       | /RES   | MPU                 | Operation Active LOW Reset signal                     |
| 5       | /CS    | MPU                 | Active LOW Chip Select Signal                         |
| 6       | A0     | MPU                 | Register Select. 0: instruction; 1: data              |
| 7-14    | VDD    | Power Supply        | Power Supply for LCD and logic (+3.3V)                |
| 15      | SCL    | MPU                 | Serial clock Input                                    |
| 16      | SI     | MPU                 | Serial data Input                                     |
| 17      | A      | Power Supply        | Power supply for backlight (+5V with on-board 6.8ohm) |
| 18      | K      | Power Supply        | Ground for backlight                                  |

**Recommended LCD connector:** 1.0mm Pitch pins. Molex p/n: 52271-1879

**Backlight connector:** 'A' and 'K' pins on the LCD connector **Mates with:** ---



## Electrical Characteristics

| Item                        | Symbol | Condition         | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|-------------------|------|------|------|------|
| Operating Temperature Range | TOPR   | Absolute Max      | -20  | -    | +70  | °C   |
| Storage Temperature Range   | TSTR   | Absolute Max      | -30  | -    | +80  | °C   |
| Supply Voltage              | VDD    |                   | 2.4  | 3.3  | 3.3  | V    |
| Supply Current              | IDD    | Ta=25°C, VDD=5.0V | -    | -    | 147  | µA   |
| Supply for LCD (contrast)   | VDD-V0 | Ta=25°C           | 8.3  | 8.7  | 9.3  | 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    | VF     |                   | -    | 4.2  | -    | V    |
| Backlight Supply Current    | ILED   | VF=4.2V           | -    | 80   | -    | mA   |

## Optical Characteristics

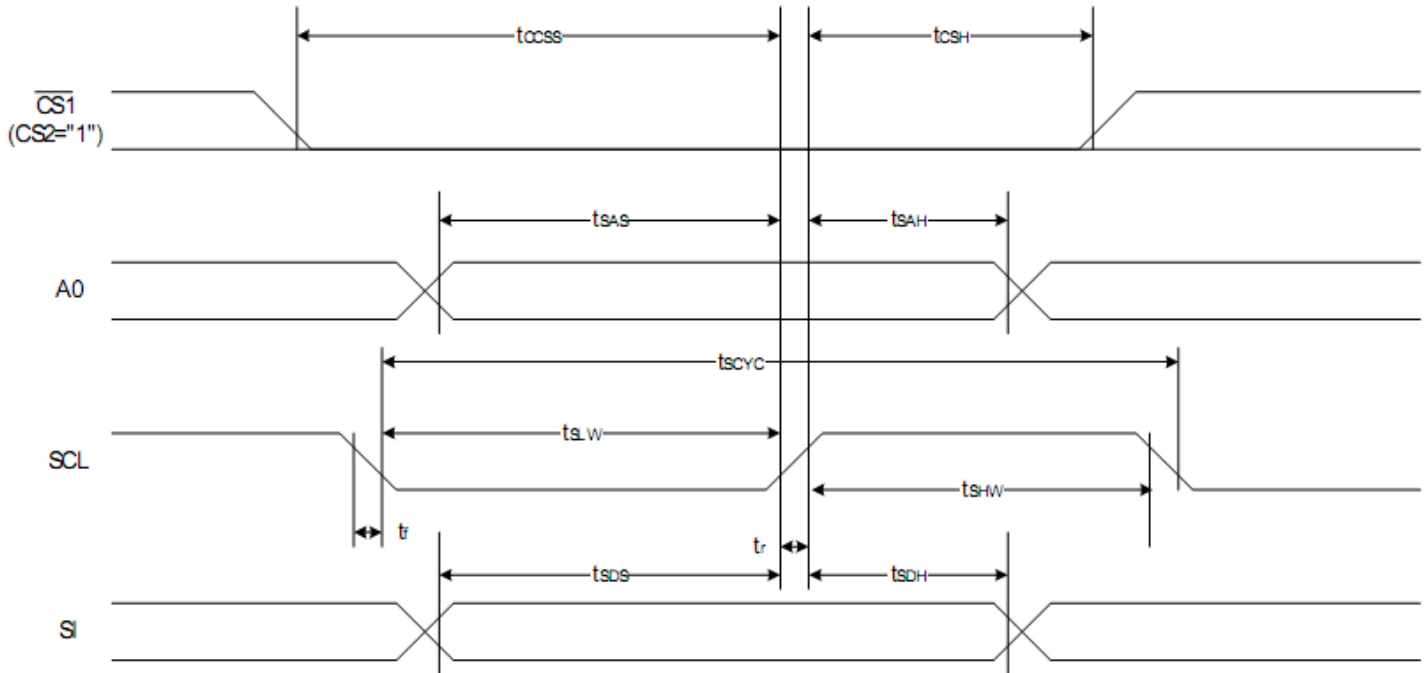
| Item                       | Symbol   | Condition   | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-------------|------|------|------|------|
| Viewing Angle - Vertical   | $\theta$ | CR $\geq$ 2 | -60  | -    | +35  | °    |
| Viewing Angle - Horizontal | $\Phi$   | CR $\geq$ 2 | -40  | -    | +40  | °    |
| Contrast Ratio             | CR       |             | -    | 6    | -    | -    |
| Response Time (rise)       | Tr       |             | -    | 150  | 250  | ms   |
| Response Time (fall)       | Tf       |             | -    | 150  | 250  | ms   |

## Controller Information

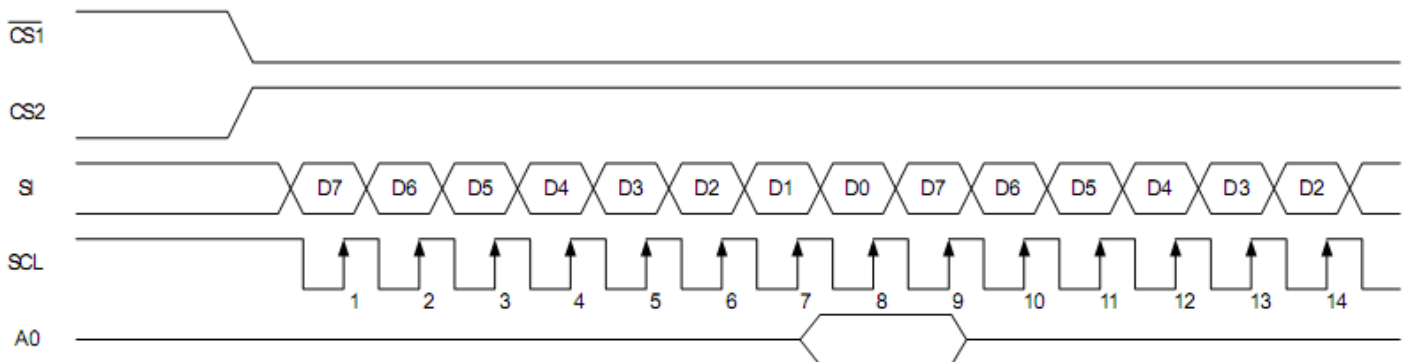
Built-in ST7565P. Download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565.pdf](http://www.newhavendisplay.com/app_notes/ST7565.pdf)

# Timing Characteristics

## The Serial Interface



| Item                | Signal | Symbol     | Condition | Rating |      | Units |
|---------------------|--------|------------|-----------|--------|------|-------|
|                     |        |            |           | Min.   | Max. |       |
| Serial Clock Period | SCL    | $t_{SCYC}$ |           | 400    | —    | ns    |
| SCL "H" pulse width |        | $t_{SHW}$  |           | 120    | —    |       |
| SCL "L" pulse width |        | $t_{SLW}$  |           | 120    | —    |       |
| Address setup time  | A0     | $t_{SAS}$  |           | 50     | —    |       |
| Address hold time   |        | $t_{SAH}$  |           | 50     | —    |       |
| Data setup time     | SI     | $t_{SDS}$  |           | 50     | —    |       |
| Data hold time      |        | $t_{SDH}$  |           | 50     | —    |       |
| CS-SCL time         | CS     | $t_{CSS}$  |           | 50     | —    |       |
| CS-SCL time         |        | $t_{CSH}$  |           | 150    | —    |       |



## Table of Commands

| Command   | Command Code |     |     |            |    |                         |    |                                  |                |    | Function |      |   |
|---|--------------|-----|-----|------------|----|-------------------------|----|----------------------------------|----------------|----|----------|------|---|
|   | A0           | /RD | /WR | D7         | D6 | D5                      | D4 | D3                               | D2             | D1 |          | D0   |   |
| (1) Display ON/OFF                                    | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 1                                | 1              | 1  | 0        | 1    | LCD display ON/OFF<br>0: OFF, 1: ON   |
| (2) Display start line set                            | 0            | 1   | 0   | 0          | 1  | Display start address   |    |                                  |                |    |          | 0    | Sets the display RAM display start line address                                 |
| (3) Page address set                                  | 0            | 1   | 0   | 1          | 0  | 1                       | 1  | Page address                     |                |    |          | 0    | Sets the display RAM page address   |
| (4) Column address set upper bit                      | 0            | 1   | 0   | 0          | 0  | 0                       | 1  | Most significant column address  |                |    |          | 0    | Sets the most significant 4 bits of the display RAM column address.             |
| Column address set lower bit                          | 0            | 1   | 0   | 0          | 0  | 0                       | 0  | Least significant column address |                |    |          | 0    | Sets the least significant 4 bits of the display RAM column address.            |
| (5) Status read                                       | 0            | 0   | 1   | Status     |    |                         |    | 0                                | 0              | 0  | 0        | 0    | Reads the status data   |
| (6) Display data write                                | 1            | 1   | 0   | Write data |    |                         |    |                                  |                |    |          | 0    | Writes to the display RAM   |
| (7) Display data read                                 | 1            | 0   | 1   | Read data  |    |                         |    |                                  |                |    |          | 0    | Reads from the display RAM  |
| (8) ADC select  | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 0              | 0  | 0        | 0    | Sets the display RAM address SEG output correspondence<br>0: normal, 1: reverse |
| (9) Display normal/reverse                            | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 1              | 1  | 0        | 1    | Sets the LCD display normal/reverse<br>0: normal, 1: reverse                    |
| (10) Display all points ON/OFF                        | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 1              | 0  | 0        | 1    | Display all points<br>0: normal display<br>1: all points ON                     |
| (11) LCD bias set                                     | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 0              | 1  | 0        | 1    | Sets the LCD drive voltage bias ratio<br>0: 1/9 bias, 1: 1/7 bias (ST7565)      |
| (12) Read/modify/write                                | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 0  | 0        | 0    | Column address increment<br>At write: +1<br>At read: 0                          |
| (13) End  | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 1                                | 1              | 1  | 0        | 0    | Clear read/modify/write   |
| (14) Reset  | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 0        | 0    | Internal reset  |
| (15) Common output mode select                        | 0            | 1   | 0   | 1          | 1  | 0                       | 0  | 0                                | *              | *  | *        | *    | Select COM output scan direction<br>0: normal direction<br>1: reverse direction |
| (16) Power control set                                | 0            | 1   | 0   | 0          | 0  | 1                       | 0  | 1                                | Operating mode |    |          | 0    | Select internal power supply operating mode                                     |
| (17) Vs voltage regulator internal resistor ratio set | 0            | 1   | 0   | 0          | 0  | 1                       | 0  | 0                                | Resistor ratio |    |          | 0    | Select internal resistor ratio(Rb/Ra) mode                                      |
| (18) Electronic volume mode set                       | 0            | 1   | 0   | 1          | 0  | 0                       | 0  | 0                                | 0              | 0  | 0        | 1    | Set the Vs output voltage electronic volume register                            |
| Electronic volume register set                        |              |     |     | 0          | 0  | Electronic volume value |    |                                  |                |    |          |      |   |
| (19) Static indicator ON/OFF                          | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 1                                | 1              | 0  | 0        | 1    | 0: OFF, 1: ON   |
| Static indicator register set                         |              |     |     | 0          | 0  | 0                       | 0  | 0                                | 0              | 0  | 0        | Mode | 1   |
| (20) Power saver                                      |              |     |     |            |    |                         |    |                                  |                |    |          |      | Display OFF and display all points ON compound command                          |
| (21) NOP  | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 1        | 1    | Command for non-operation   |
| (22) Test   | 0            | 1   | 0   | 1          | 1  | 1                       | 1  | *                                | *              | *  | *        | *    | Command for IC test. Do not use this command                                    |

## Example Initialization Program

```
.....  
Sub Command  
Reset P3.7  
Reset P3.4  
For Writecount = 1 To 8  
Rotate A , Left , 1  
Reset P3.1  
P1 = A  
Set P3.1  
Next Writecount  
Set P3.7  
End Sub  
.....
```

```
Sub Write  
Reset P3.7  
Set P3.4  
For Writecount = 1 To 8  
Rotate A , Left , 1  
Reset P3.1  
P1 = A  
Set P3.1  
Next Writecount  
Set P3.7  
End Sub  
.....
```

```
Sub Init  
Waitms 100  
A = &HA0  
Call Command  
A = &HAE  
Call Command  
A = &HC0  
Call Command  
A = &HA2  
Call Command  
A = &H2F  
Call Command  
A = &H26  
Call Command  
A = &H81  
Call Command  
A = &H11  
Call Command  
A = &HAF  
Call Command  
End Sub  
.....
```



## 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. | +40°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.                  | -0°C,30min -> 25°C,5min -> 50°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)