

NHD-C12864A1Z-FSW-FBW-HTT

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

| | |
|---------|----------------------------------|
| NHD- | Newhaven Display |
| C12864- | 128 x 64 Pixels |
| A1Z- | Model |
| F- | Transflective |
| SW- | Side White LED Backlight |
| F- | FSTN, Positive |
| B- | 6:00 Optimal View |
| W- | Wide Temp |
| HTT- | With 12V Heater (-40°C to +70°C) |
| | RoHS Compliant |

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Document Revision History

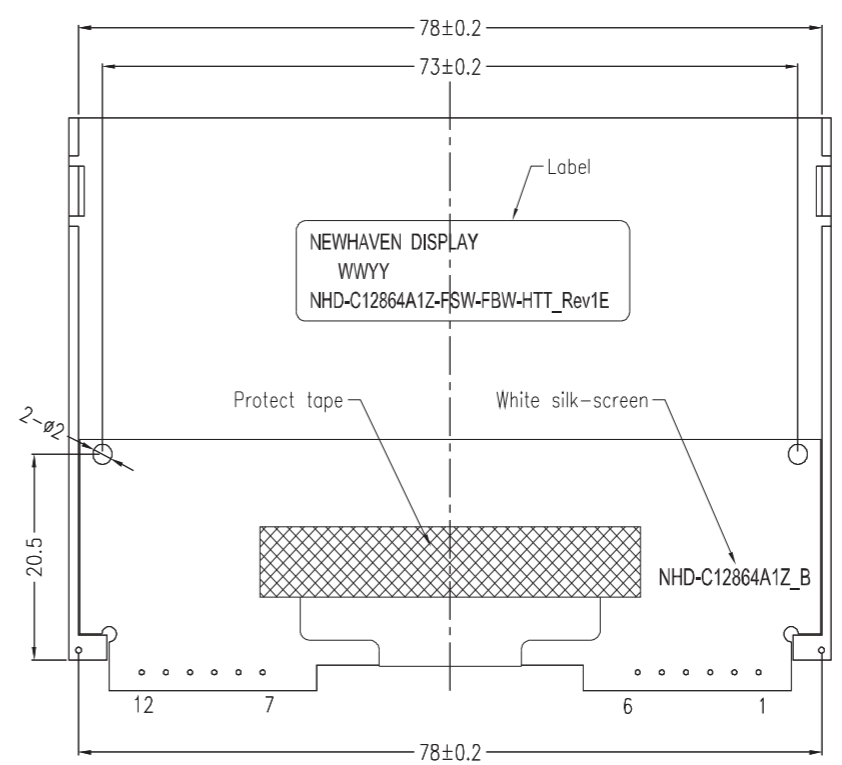
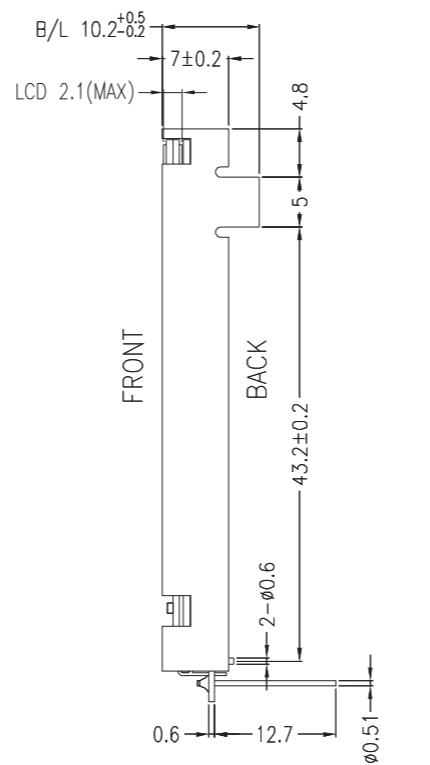
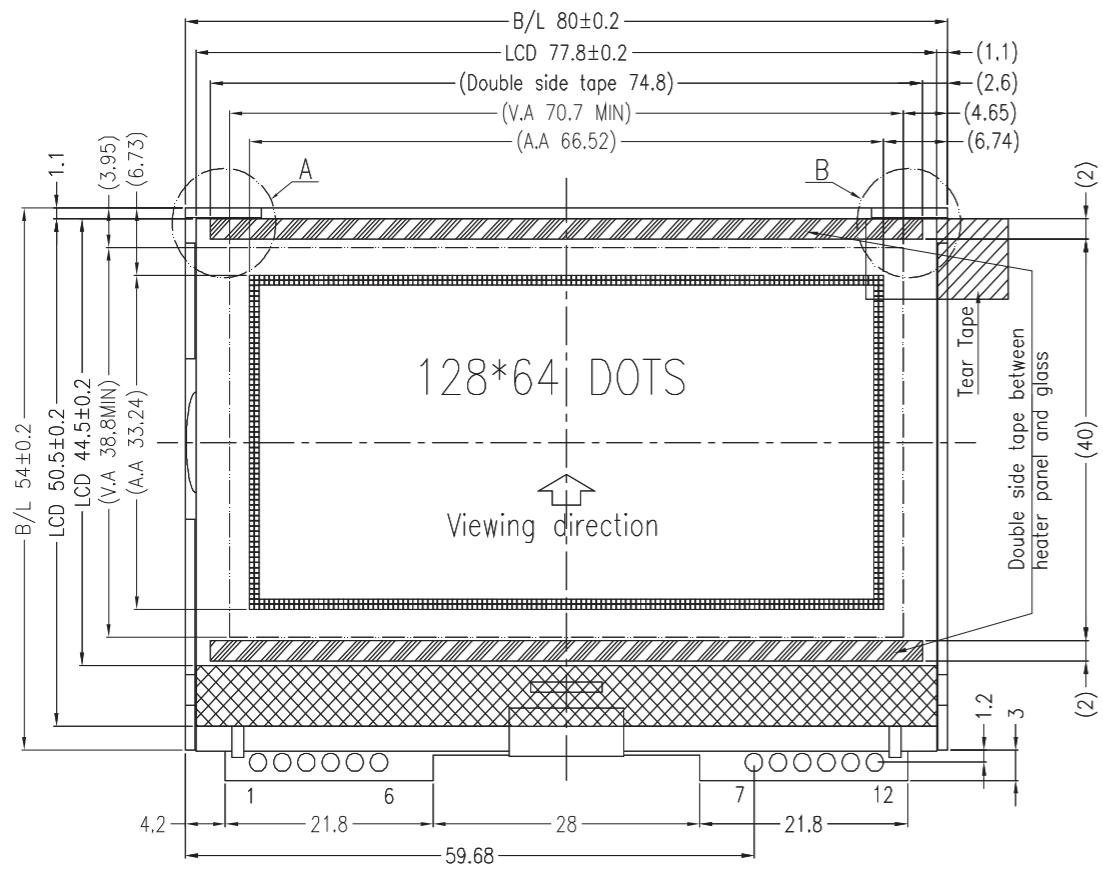
| Revision | Date | Description | Changed by |
|----------|----------|--|------------|
| 0 | 7/17/08 | Initial Release | - |
| 1 | 9/28/09 | User guide reformat | BE |
| 2 | 10/14/09 | Updated Electrical Characteristic | MC |
| 3 | 11/20/09 | Updated backlight supply current | MC |
| 4 | 10/26/10 | Updated backlight current | BE |
| 5 | 10/27/10 | Supply current updated | BE |
| 6 | 08/31/15 | Electrical characteristics, Optical characteristics, Mechanical drawings updated | SB |
| 7 | 8/3/2016 | Updated Electrical Characteristics and Quality Info | TM |
| 8 | 9/23/16 | Updated Electrical Characteristics | TM |
| 9 | 3/30/17 | Updated Electrical Characteristics | TM |
| 10 | 12/20/18 | Updated Heater Resistance, Response time & Double-Sided Tape added to drawing | SB |
| 11 | 3/21/19 | Heater Resistance Updated | SB |
| 12 | 5/14/19 | Heater Resistance Modified, Backlight Current Updated | SB |
| 13 | 5/23/19 | Heater Note Added | SB |
| 14 | 6/4/19 | Added PCB Footprint Drawing | AS |
| 15 | 1/24/20 | Heater Resistance, Backlight Design & Electrical Characteristics Updated | SB |
| 16 | 7/16/20 | Updated Serial Interface Timing Characteristics | AS |
| 17 | 10/9/20 | Updated LCD Contrast Range from 8.7V/9.0V/9.3V to 8.8V/9.0V/9.2V Part Revision Upgraded to Rev1D | AS |
| 18 | 3/26/21 | Updated MIN Backlight Current & MAX Supply Voltage | AS |
| 19 | 4/8/21 | Updated the Electrical, Optical Characteristics, Table of Commands, Quality Information and Mechanical Drawing | JT |

Functions and Features

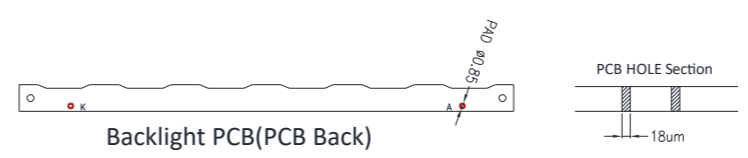
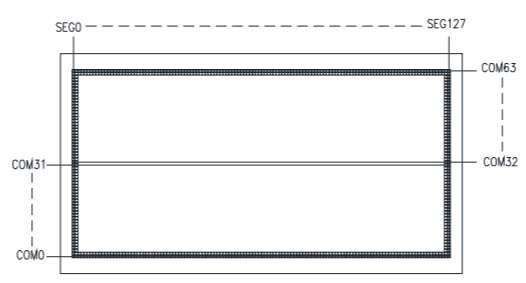
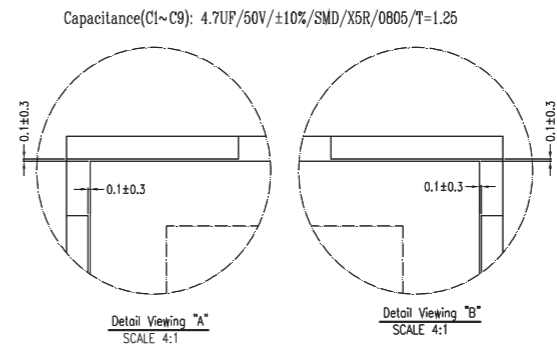
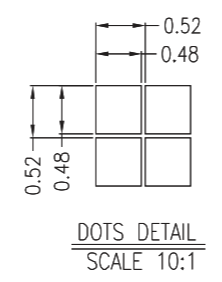
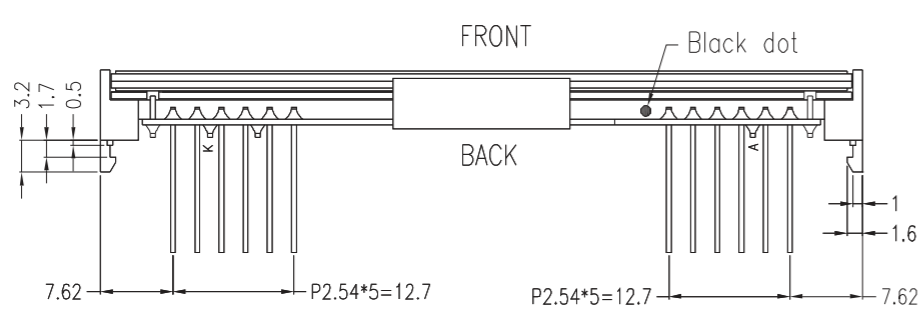
- 128 x 64 pixels
- Built-in ST7565P controller
- +3.0V power supply
- 1/65 duty cycle; 1/9 bias
- Built-in Heater
- RoHS Compliant

Mechanical Drawing

| SYMBOL | REVISION | DATE |
|--------|----------|------|
| | | |



| Pin assignment | |
|----------------|--------|
| NO. | Symbol |
| 1 | SCL |
| 2 | SI |
| 3 | VDD |
| 4 | A0 |
| 5 | /RESET |
| 6 | /CS |
| 7 | VSS |
| 8 | H |
| 9 | H |
| 10 | LED- |
| 11 | LED+ |
| 12 | NC |



- Notes:**
- Driving: 1/65 duty, 1/9 bias
 - Voltage: 3.0V V_{DD}, 9V V_{LCD}
 - Display Type: FSTN Positive / Transflective
 - Optimal View: 6:00
 - Backlight: White Edge light LED`
 - Driver IC: ST7565P 2-Line SPI Interface
 - Built-in Heater

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

UNLESS OTHERWISE SPECIFIED:
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C12864A1Z-FSW-FBW-HTT

REVISION: 1E
SIZE: A3
SCALE: NS

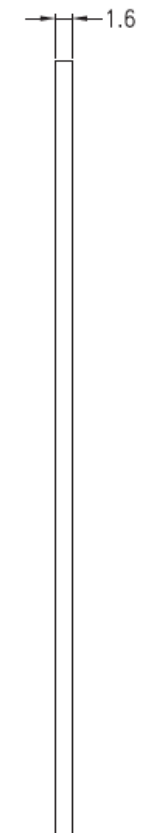
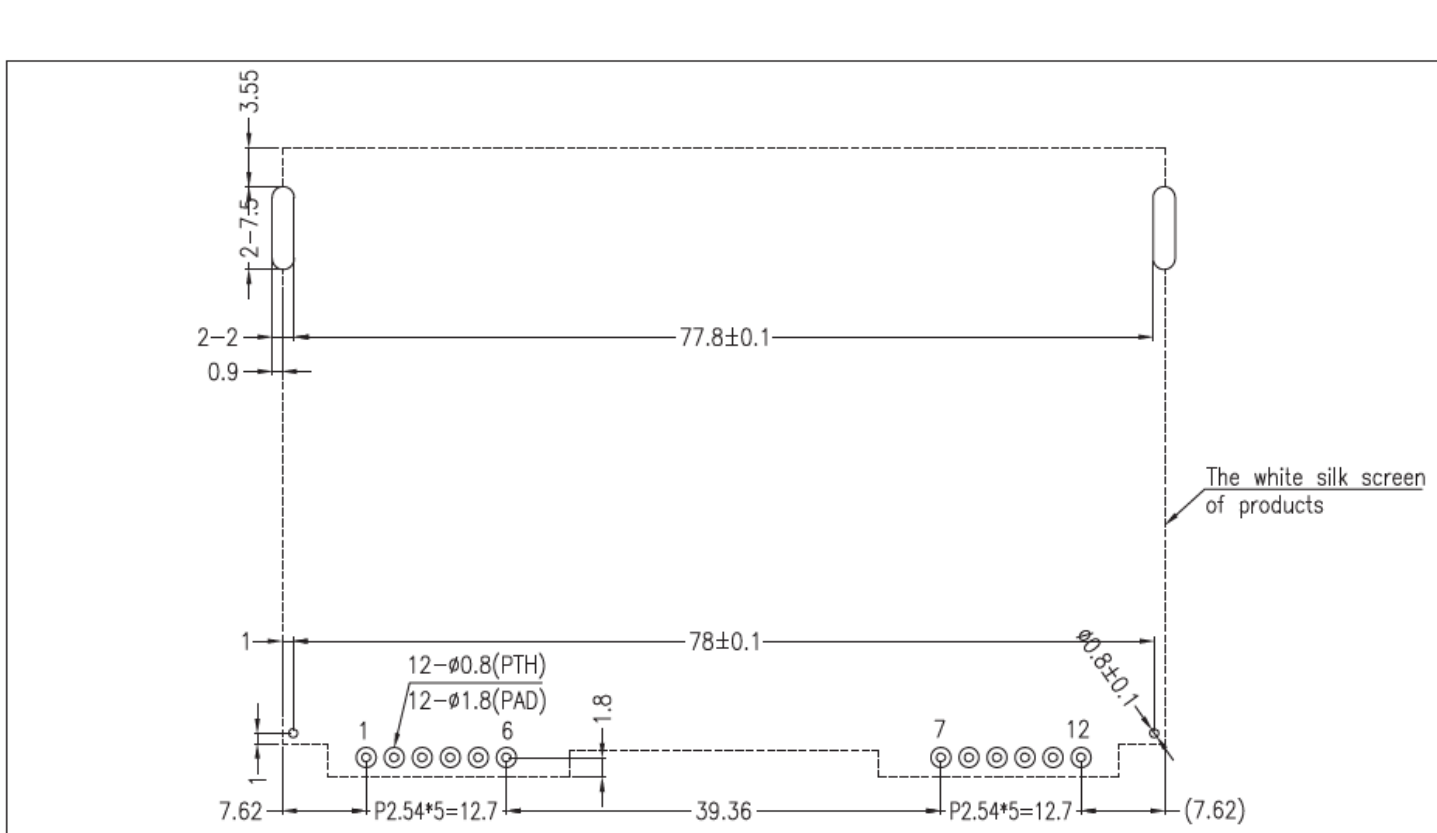
DRAWN BY: J.Thomas
APPROVED BY: J.Thomas
DRAWN DATE: 4/8/21
APPROVED DATE: 4/8/21

DO NOT SCALE DRAWING SHEET 1 OF 1

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Recommended PCB Footprint

| SYMBOL | REVISION | DATE |
|--------|----------|------|
| | | |



Applicable Displays:

- 1) NHD-C12864A1Z-FSW-FBW-HTT
- 2) NHD-C12864A1Z-FSR-FBW-HTT
- 3) NHD-C12864A1Z-FSB-FBW-HTT

| | | | |
|---|-----------------------|--|-------------------------|
| STANDARD TOLERANCE: UNLESS OTHERWISE SPECIFIED | | | |
| LINEAR: ±0.3mm | | DRAWING/PART NUMBER: NHD-C12864A1Z-Monochrome-Footprint | REVISION: 1.0 |
| UNLESS OTHERWISE SPECIFIED: | | DRAWN BY: A. Shah | APPROVED BY: A. Khan |
| - DIMENSIONS ARE IN MILLIMETERS | DRAWN DATE: 6/3/19 | APPROVED DATE: 6/3/19 | SCALE: NS |
| - THIRD ANGLE PROJECTION: | DO NOT SCALE DRAWING | | SHEET 1 OF 1 |
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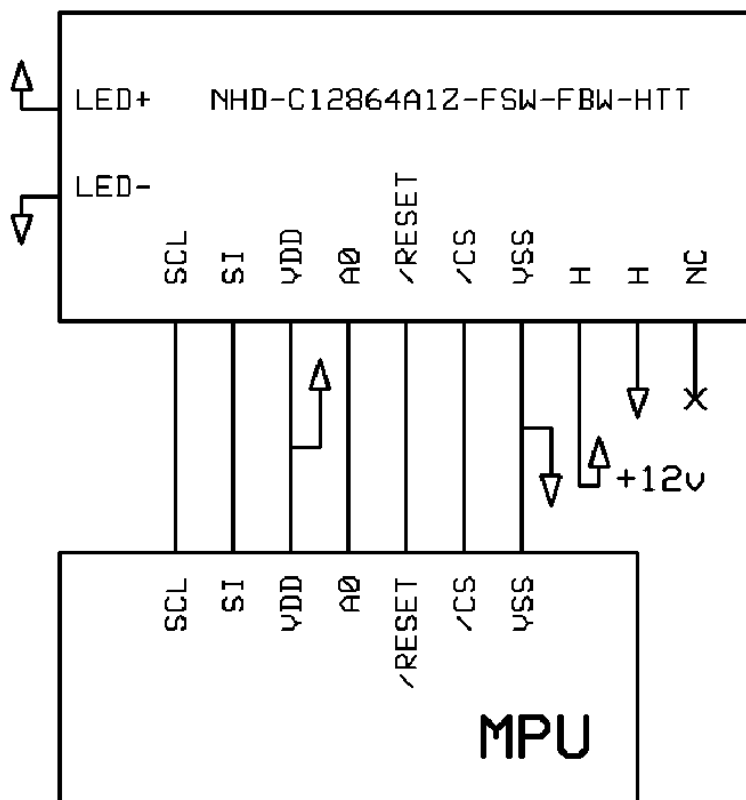
Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|--|
| 1 | SCL | MPU | Serial Clock input |
| 2 | SI | MPU | Serial Data input |
| 3 | V _{DD} | Power Supply | Supply Voltage for LCD and logic (+3.0V) |
| 4 | A0 | MPU | Register Select. 0: instruction; 1: data |
| 5 | /RESET | MPU | Operation Active LOW Reset signal |
| 6 | /CS | MPU | Active LOW Chip Select Signal |
| 7 | V _{SS} | Power Supply | Ground |
| 8 | H | Power Supply | Heater Connection (+12V) |
| 9 | H | Power Supply | Heater Connection (GND) |
| 10 | LED- | Power Supply | Backlight Cathode (Ground) |
| 11 | LED+ | Power Supply | Backlight Anode (+3.3V) |
| 12 | NC | - | No Connect |

Recommended LCD connector: 2.54mm pitch thru-hole connection on PCB

Backlight connector: --- **Mates with:** ---

Recommended Breakout Board: [NHD-PCB40](#)



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|-------------------|--|---------------------|------|---------------------|------|
| Operating Temperature Range ¹ | T _{OP} | V _H = 0V | -20 | - | +70 | °C |
| | | V _H = 12.0V | -40 | - | +70 | °C |
| Storage Temperature Range | T _{ST} | - | -40 | - | +80 | °C |
| Supply Voltage | V _{DD} | - | 2.8 | 3.0 | 3.2 | V |
| Supply Current | I _{DD} | V _{DD} = 3.0V T _{OP} = 25°C | 0.1 | 0.2 | 1.0 | mA |
| Supply for LCD (contrast) | V _{LCD} | | 8.8 | 9.0 | 9.2 | V |
| "H" Level input | V _{IH} | - | 0.8*V _{DD} | - | V _{DD} | V |
| "L" Level input | V _{IL} | - | 0 | - | 0.2*V _{DD} | V |
| "H" Level output | V _{OH} | - | 0.8*V _{DD} | - | V _{DD} | V |
| "L" Level output | V _{OL} | - | V _{SS} | - | 0.2*V _{DD} | V |
| Backlight Supply Voltage | V _{LED} | - | 3.2 | 3.3 | 3.4 | V |
| Backlight Supply Current | I _{LED} | V _{LED} = 3.3V | 20 | 50 | 60 | mA |
| Heater Panel Resistance ² | R _{H+/-} | T = 25°C | 5 | 20 | 35 | Ω |
| Heater Voltage Supply | V _H | - | - | 12 | 15 | V |

¹Heater **MUST** be activated when operating temperature drops below -20°C

²Heater measured using digital multi-meter

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|--------|---|------|------|------|------|
| Optimal Viewing Angles | Top | CR ≥ 3 | - | 20 | - | ° |
| | Bottom | | - | 40 | - | ° |
| | Left | | - | 40 | - | ° |
| | Right | | - | 40 | - | ° |
| Contrast Ratio | CR | - | 2 | 4 | 10 | - |
| Response Time | Rise | T _{OP} = 25°C | - | 135 | 240 | ms |
| | Fall | | - | 235 | 325 | ms |
| | Rise | T _{OP} = -40°C V _H = 12V | - | 7.3 | - | s |
| | Fall | | - | 6.7 | - | s |

Controller Information

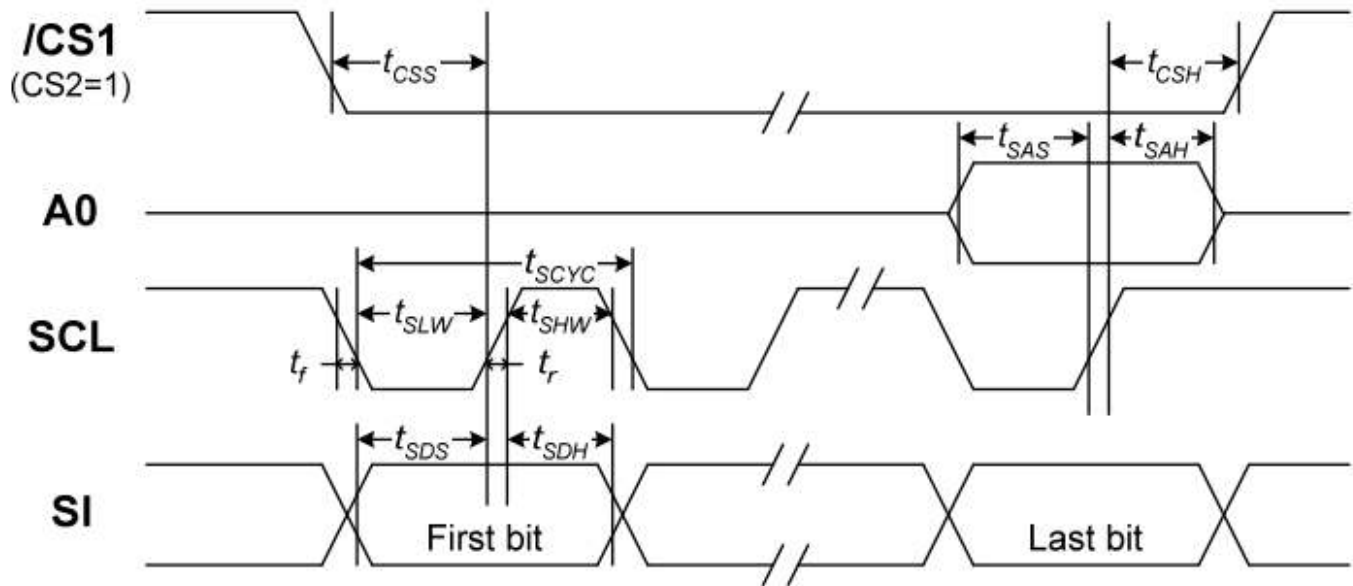
Built-in ST7565P controller.

Please download specification at

https://www.newhavendisplay.com/resources_dataFiles/datasheets/LCDs/ST7565P.pdf

Timing Characteristics

The Serial Interface



| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|--------|------------|-----------|--------|------|-------|
| | | | | Min. | Max. | |
| Serial Clock Period | SCL | t_{SCYC} | | 50 | — | ns |
| SCL "H" pulse width | | t_{SHW} | | 25 | — | |
| SCL "L" pulse width | | t_{SLW} | | 25 | — | |
| Address setup time | A0 | t_{SAS} | | 20 | — | |
| Address hold time | | t_{SAH} | | 10 | — | |
| Data setup time | SI | t_{SDS} | | 20 | — | |
| Data hold time | | t_{SDH} | | 10 | — | |
| CS-SCL time | CS | t_{CSS} | | 20 | — | |
| CS-SCL time | | t_{CSH} | | 40 | — | |

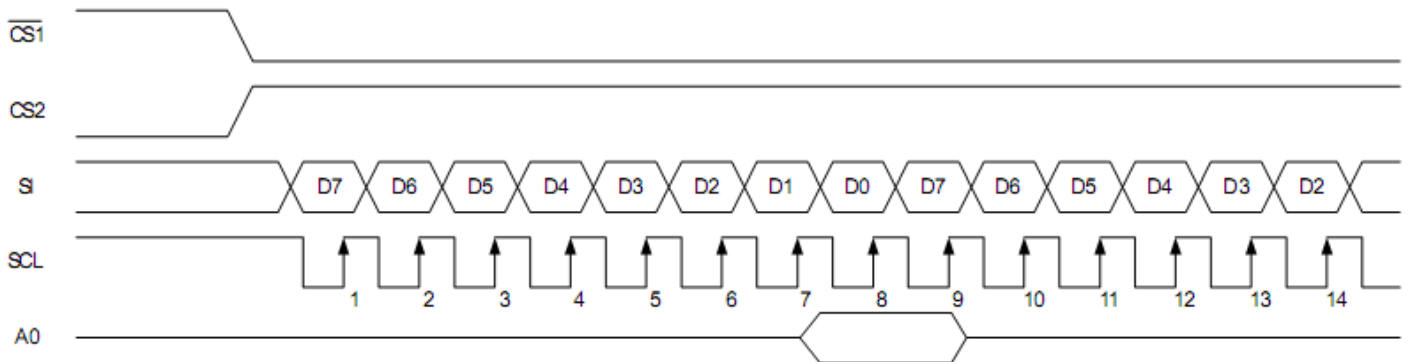


Table of Commands

| 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 0: OFF, 1: ON | |
| (2) Display start line set | 0 | 1 | 0 | 0 | 1 | Display start address | | | | | | Sets the display RAM display start line address | | |
| (3) Page address set | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Page address | | | | | Sets the display RAM page address | |
| (4) Column address set upper bit | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Most significant column address | | | | | Sets the most significant 4 bits of the display RAM column address. Sets the least 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 | | | | | | |
| (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 | | | | | | | | Writes to the display RAM | | |
| (7) Display data read | 1 | 0 | 1 | Read data | | | | | | | | Reads from the display RAM | | |
| (8) ADC select | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Sets the display RAM address SEG output correspondence 0: normal, 1: reverse |
| (9) Display normal/reverse | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | Sets the LCD display normal/reverse 0: normal, 1: reverse |
| (10) Display all points ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Display all points 0: normal display 1: all points ON |
| (11) LCD bias set | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P) |
| (12) Read/modify/write | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Column address increment At write: +1 At read: 0 |
| (13) End | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | Clear read/modify/write | | |
| (14) Reset | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Internal reset | | |
| (15) Common output mode select | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | * | * | * | * | * | Select COM output scan direction 0: normal direction 1: reverse direction |
| (16) Power control set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | Operating mode | | | | Select internal power supply operating mode | |
| (17) V ₀ voltage regulator internal resistor ratio set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Resistor ratio | | | | Select internal resistor ratio(Rb/Ra) mode | |
| (18) Electronic volume mode set Electronic volume register set | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set the V ₀ output voltage electronic volume register |
| (20) Booster ratio set | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x |
| (21) Power saver | | | | | | | | | | | | | | Display OFF and display all points ON compound command |
| (22) NOP | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Command for non-operation | | |
| (23) 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 , 96hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -40°C , 96hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C , 96hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -40°C /-20°C, 96hrs | 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 , 96hrs | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -40°C /-20°C , 60min --> 70°C , 60min = 1 cycle For 20 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-50Hz , Acceleration of Gravity:5G 30 min in each of 3 directions X,Y,Z | 3 |
| Static electricity test | Endurance test applying electric static discharge. | Air: ±8kV 150pF/330Ω, 5 Times | |
| | | Contact: ±4kV 150pF/330Ω, 5 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 and Terms & Conditions

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