

## Product Specification

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# NHD-C12864GG-RN-GBW

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

|                |                   |
|----------------|-------------------|
| <b>NHD-</b>    | Newhaven Display  |
| <b>C12864-</b> | 128 x 64 Pixels   |
| <b>GG-</b>     | Model             |
| <b>R-</b>      | Reflective        |
| <b>N-</b>      | No Backlight      |
| <b>G-</b>      | STN (+) Gray      |
| <b>B-</b>      | 6:00 Optimal View |
| <b>W-</b>      | Wide Temperature  |

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## Additional Resources

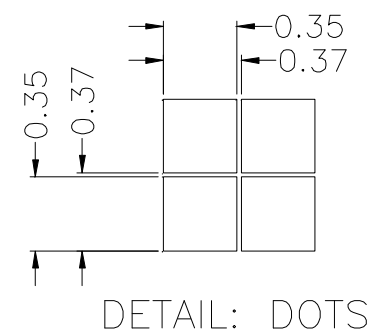
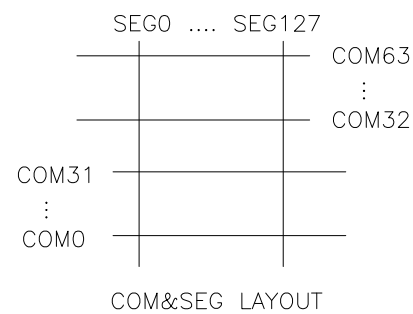
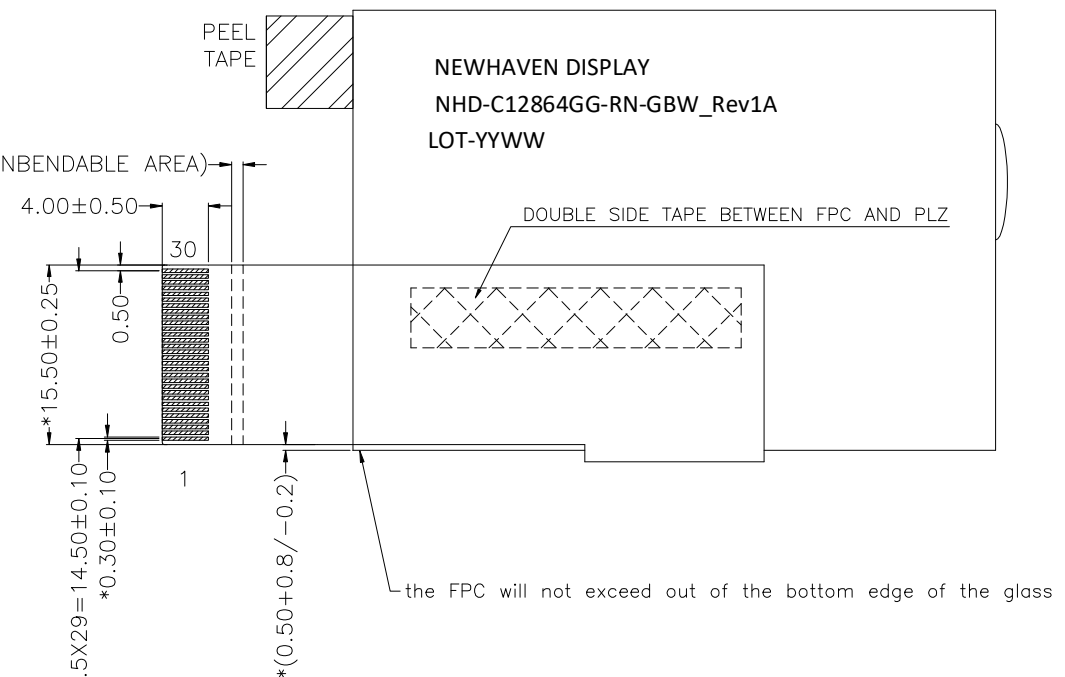
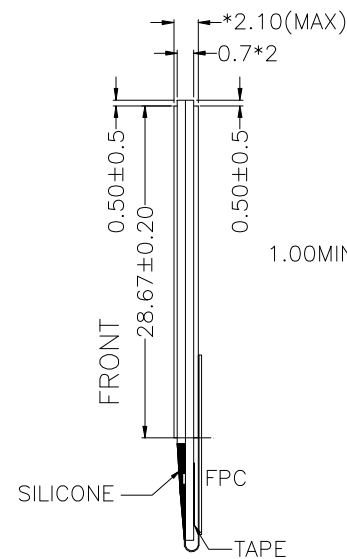
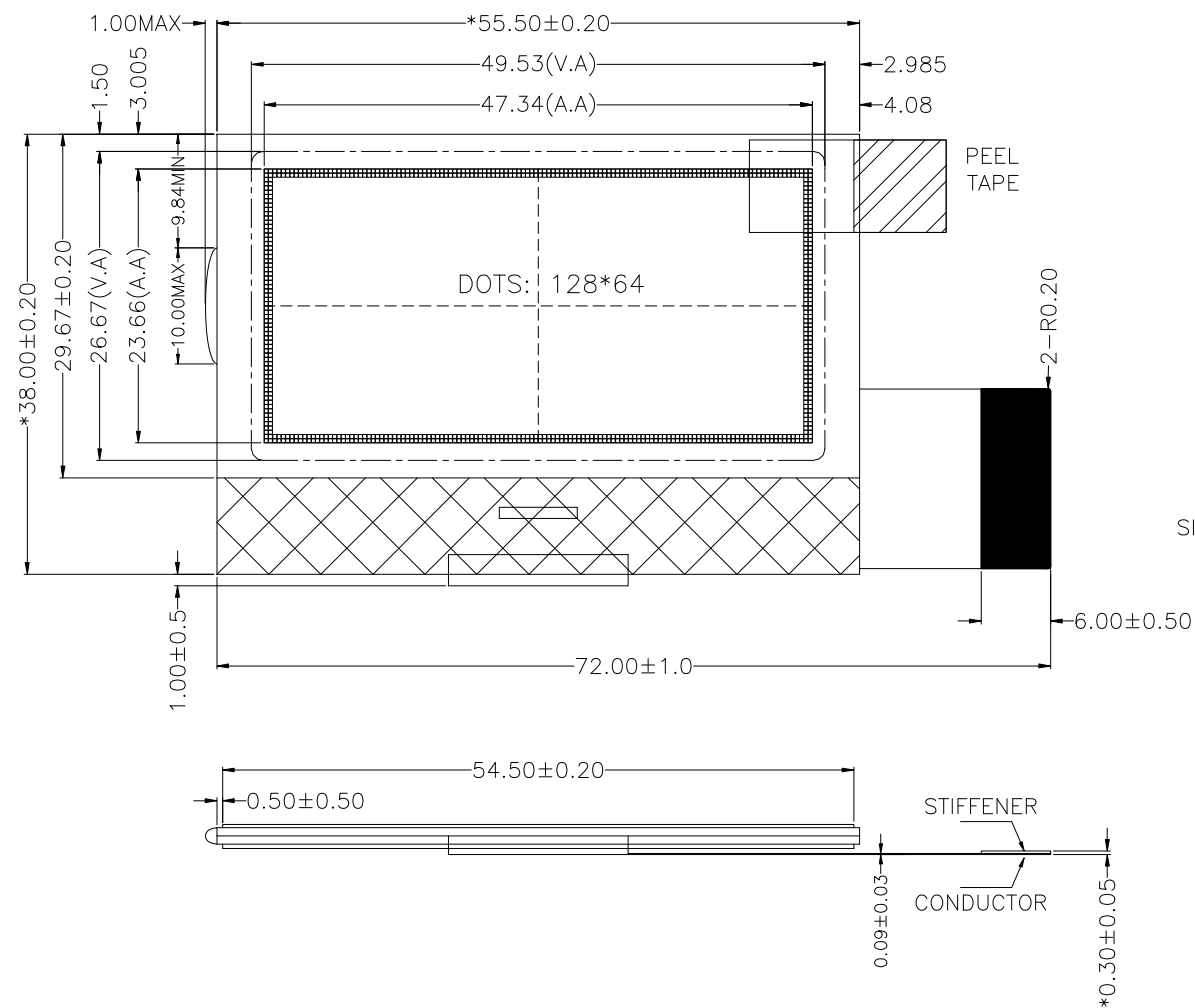
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](https://www.newhavendisplay.com/quality_center.html)
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



## Document Revision History

| Revision | Date       | Description                                                                                   | Changed By |
|----------|------------|-----------------------------------------------------------------------------------------------|------------|
| 0        | 03/25/2008 | Initial Release                                                                               | -          |
| 1        | 09/10/2009 | User Guide Reformat                                                                           | BE         |
| 2        | 10/08/2009 | Update Pin Description                                                                        | BE         |
| 3        | 10/13/2009 | Updated Electrical Characteristic                                                             | MC         |
| 4        | 10/09/2013 | Mechanical Drawing, Pin Description, Electrical/Optical Characteristics, Example Code updated | ML         |
| 5        | 11/01/2017 | Mech. Drawing, Supply Current & Contrast Voltage Updated                                      | SB         |
| 6        | 11/12/2020 | Updated Mechanical Drawing, Viewing Angles & Response Times                                   | AS         |
| 7        | 05/31/2023 | Mechanical Drawing Updated                                                                    | KL         |
| 8        | 06/27/2023 | Part Changed to Rev1A                                                                         | KL         |
| 9        | 07/28/2023 | Mechanical Drawing and Quality Information Updated                                            | KL         |
| 10       | 08/01/2023 | Electrical Characteristics Updated                                                            | KL         |
| 11       | 08/14/2025 | Updated Example Initialization Code                                                           | KL         |

# Mechanical Drawing



| PIN ASSIGNMENT |         |
|----------------|---------|
| NO.            | SIGNAL  |
| 1              | ESD-GND |
| 2              | /CS1    |
| 3              | /RES    |
| 4              | A0      |
| 5              | /WR     |
| 6              | /RD     |
| 7              | D0      |
| 8              | D1      |
| 9              | D2      |
| 10             | D3      |
| 11             | D4      |
| 12             | D5      |
| 13             | D6      |
| 14             | D7      |
| 15             | VDD     |
| 16             | VSS     |
| 17             | VOUT    |
| 18             | CAP3P   |
| 19             | CAP1N   |
| 20             | CAP1P   |
| 21             | CAP2P   |
| 22             | CAP2N   |
| 23             | CAP4P   |
| 24             | V4      |
| 25             | V3      |
| 26             | V2      |
| 27             | V1      |
| 28             | V0      |
| 29             | ESD-GND |
| 30             | NC      |

## Product Description: 128x64 Graphic COG LCD

1. Driver IC: ST7565R
2. Driving Mode: 1/65 Duty, 1/9 Bias
3. Interface: 8080 Parallel
4. Power Requirement: 3.0V
5. Optical Features: STN (+) Gray, Reflective, 6:00 View,
6. Recommended FFC Connector: 30pin 0.5 pitch

|                                                                                                                                                                                                                                           |                                                                                                                                |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Standard Tolerance:</b><br>(Unless otherwise specified)<br><br>Linear: ±0.3mm                                                                                                                                                          |  <b>NEWHAVEN DISPLAY</b><br>INTERNATIONAL |                                  |
|                                                                                                                                                                                                                                           | Drawing/Part Number:<br><b>NHD-C12864GG-RN-GBW</b>                                                                             | Revision:<br><b>1A</b>           |
| <b>Unless otherwise specified:</b> <ul style="list-style-type: none"><li>• Dimensions are in Millimeters</li><li>• Third Angle Projection </li></ul> | Drawn By: <b>K. Lewis</b>                                                                                                      | Approved By: <b>K. Lewis</b>     |
|                                                                                                                                                                                                                                           | Drawn Date: <b>07/28/2023</b>                                                                                                  | Approved Date: <b>07/28/2023</b> |
| This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.                     |                                                                                                                                |                                  |

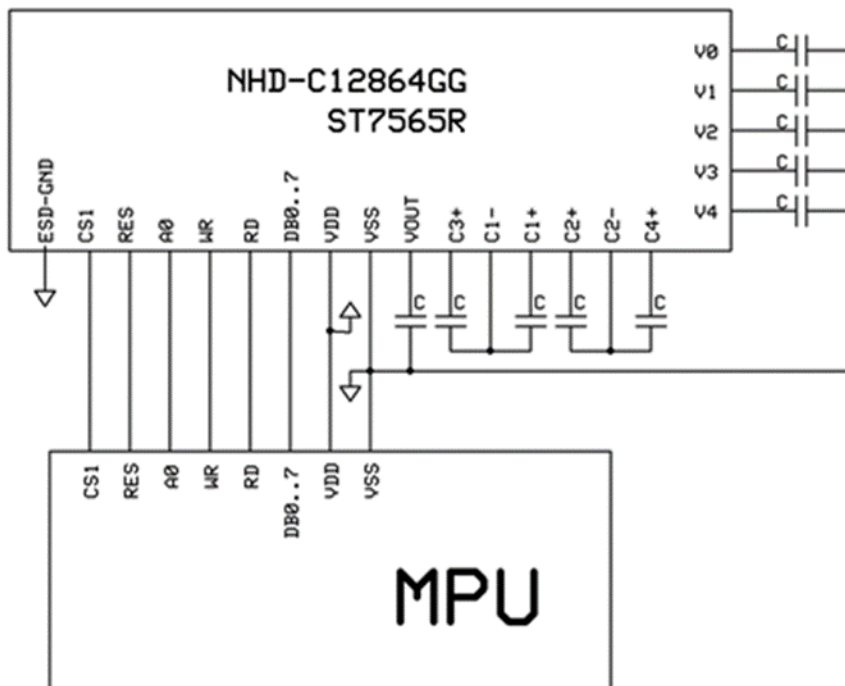
## Pin Description

| Pin No. | Symbol           | External Connection | Function Description                                                           |
|---------|------------------|---------------------|--------------------------------------------------------------------------------|
| 1       | ESD-GND          | Power Supply        | Ground (can be a No Connect)                                                   |
| 2       | /CS1             | MPU                 | Active LOW Chip Select signal                                                  |
| 3       | /RES             | MPU                 | Active LOW Reset signal                                                        |
| 4       | A0               | MPU                 | Register Select: '0' = Command, '1' = Data                                     |
| 5       | /WR              | MPU                 | Active LOW Write signal                                                        |
| 6       | /RD              | MPU                 | Active LOW Read signal                                                         |
| 7-14    | D0-D7            | MPU                 | 8-bit bi-directional data bus                                                  |
| 15      | V <sub>DD</sub>  | Power Supply        | Supply Voltage for LCD and Logic (3.0V)                                        |
| 16      | V <sub>SS</sub>  | Power Supply        | Ground                                                                         |
| 17      | V <sub>OUT</sub> | Power Supply        | 1.0uF-2.2uF Capacitor to V <sub>SS</sub>                                       |
| 18      | C <sub>3+</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>1-</sub> (Pin-19)                              |
| 19      | C <sub>1-</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>3+</sub> (Pin-18) and C <sub>1+</sub> (Pin-20) |
| 20      | C <sub>1+</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>1-</sub> (Pin-19)                              |
| 21      | C <sub>2+</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>2-</sub> (Pin-22)                              |
| 22      | C <sub>2-</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>2+</sub> (Pin-21) and C <sub>4+</sub> (Pin-23) |
| 23      | C <sub>4+</sub>  | Power Supply        | 1.0uF-2.2uF Capacitor to C <sub>2-</sub> (Pin-22)                              |
| 24      | V <sub>4</sub>   | Power Supply        | 0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>                    |
| 25      | V <sub>3</sub>   | Power Supply        | 0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>                    |
| 26      | V <sub>2</sub>   | Power Supply        | 0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>                    |
| 27      | V <sub>1</sub>   | Power Supply        | 0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>                    |
| 28      | V <sub>0</sub>   | Power Supply        | 0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>                    |
| 29      | ESD-GND          | Power Supply        | Ground (can be a No Connect)                                                   |
| 30      | NC               | -                   | No Connect                                                                     |

**Recommended LCD connector:** 0.5mm pitch, 30 conductor FFC. Molex p/n: 52892-3095

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

## Wiring Diagram



## Electrical Characteristics

| Item                        | Symbol           | Condition                                        | Min.                  | Typ. | Max.                  | Unit |
|-----------------------------|------------------|--------------------------------------------------|-----------------------|------|-----------------------|------|
| Operating Temperature Range | T <sub>OP</sub>  | Absolute Max                                     | -20                   | -    | +70                   | °C   |
| Storage Temperature Range   | T <sub>ST</sub>  | Absolute Max                                     | -30                   | -    | +80                   | °C   |
| Supply Voltage              | V <sub>DD</sub>  | -                                                | 2.8                   | 3.0  | 3.3                   | V    |
| Supply Current              | I <sub>DD</sub>  | V <sub>DD</sub> = 3.0V<br>T <sub>OP</sub> = 25°C | 0.05                  | 0.5  | 1.0                   | mA   |
| Supply for LCD (contrast)   | V <sub>LCD</sub> |                                                  | 8.6                   | 8.8  | 9.0                   | V    |
| "H" Level input             | V <sub>IH</sub>  | -                                                | 0.8 * V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    |
| "L" Level input             | V <sub>IL</sub>  | -                                                | V <sub>SS</sub>       | -    | 0.2 * V <sub>DD</sub> | V    |
| "H" Level output            | V <sub>OH</sub>  | -                                                | 0.8 * V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    |
| "L" Level output            | V <sub>OL</sub>  | -                                                | V <sub>SS</sub>       | -    | 0.2 * V <sub>DD</sub> | V    |

\*User should employ SW/HW methods for tuning contrast. (Refer to Electronic Volume Register)

## Optical Characteristics

| Item                   |        | Symbol         | Condition              | Min. | Typ. | Max. | Unit |
|------------------------|--------|----------------|------------------------|------|------|------|------|
| Optimal Viewing Angles | Top    | φY+            | CR ≥ 2                 | -    | 40   | -    | °    |
|                        | Bottom | φY-            |                        | -    | 60   | -    | °    |
|                        | Left   | θX-            |                        | -    | 60   | -    | °    |
|                        | Right  | θX+            |                        | -    | 60   | -    | °    |
| Contrast Ratio         |        | CR             | -                      | 2    | 5    | -    | -    |
| Response Time          | Rise   | T <sub>R</sub> | T <sub>OP</sub> = 25°C | -    | 150  | 250  | ms   |
|                        | Fall   | T <sub>F</sub> |                        | -    | 200  | 300  | ms   |

## Controller Information

Built-in ST7565R Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414899357591-ST7565R>

## Table of Commands

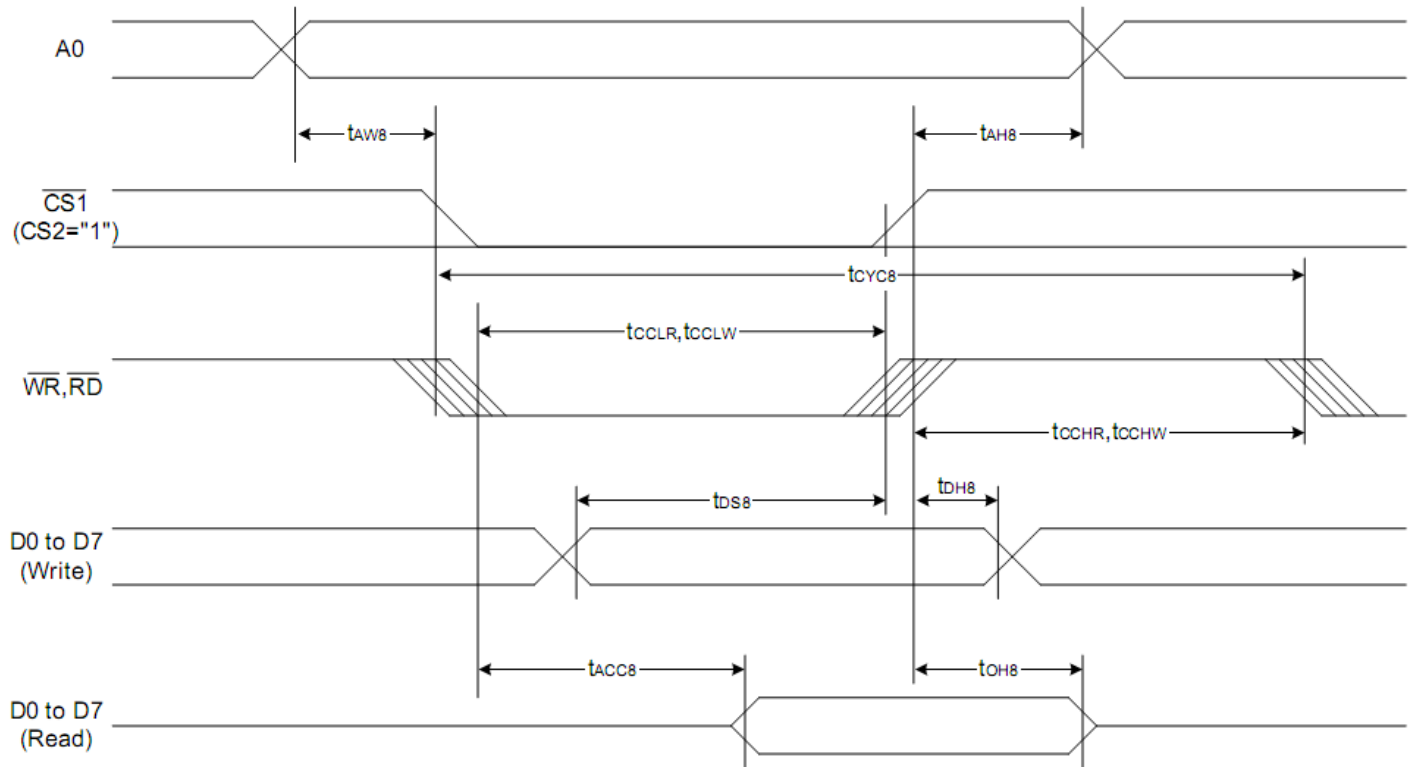
| Command                                                           | Command Code |     |     |            |    |                       |        |                                                                     |                |    | Function                                        |                                                                                                                                             |
|-------------------------------------------------------------------|--------------|-----|-----|------------|----|-----------------------|--------|---------------------------------------------------------------------|----------------|----|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | 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<br>1                                          | LCD display ON/OFF<br>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<br>Column address set lower bit  | 0            | 1   | 0   | 0          | 0  | 0                     | 1<br>0 | Most significant column address<br>Least significant column address |                |    |                                                 | Sets the most significant 4 bits of the display RAM column address.<br>Sets the least significant 4 bits of the display RAM column address. |
| (5) Status read                                                   | 0            | 0   | 1   | Status     |    |                       | 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<br>1                                          | 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<br>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<br>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<br>1                                          | Sets the LCD drive voltage bias ratio<br>0: 1/9 bias, 1: 1/7 bias (ST7565R)                                                                 |
| (12) Read-modify-write                                            | 0            | 1   | 0   | 1          | 1  | 1                     | 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                                               | 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<br>0: normal direction<br>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 <sub>0</sub> 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<br>Electronic volume register set | 0            | 1   | 0   | 1          | 0  | 0                     | 0      | 0                                                                   | 0              | 0  | 1<br>0                                          | Set the V <sub>0</sub> output voltage electronic volume register                                                                            |
| (19) Sleep mode set                                               | 0            | 1   | 0   | 1          | 0  | 1                     | 0      | 1                                                                   | 1              | 0  | 0<br>1<br>* * * * *                             | 0: Sleep mode, 1: Normal mode                                                                                                               |
| (20) Booster ratio set                                            | 0            | 1   | 0   | 1          | 1  | 1                     | 1      | 1                                                                   | 0              | 0  | 0<br>0<br>step-up value                         | select booster ratio<br>00: 2x,3x,4x<br>01: 5x<br>11: 6x                                                                                    |
| (21) NOP                                                          | 0            | 1   | 0   | 1          | 1  | 1                     | 0      | 0                                                                   | 0              | 1  | 1                                               | Command for non-operation                                                                                                                   |
| (22) Test                                                         | 0            | 1   | 0   | 1          | 1  | 1                     | 1      | *                                                                   | *              | *  | *                                               | Command for IC test. Do not use this command                                                                                                |

## Timing Characteristics

### 8080 MPU Interface

| Item                        | Signal  | Symbol            | condition | Min. | Max. | Unit |
|-----------------------------|---------|-------------------|-----------|------|------|------|
| Address hold time           | A0      | t <sub>AH8</sub>  |           | 0    | -    | ns   |
| Address setup time          |         | t <sub>AW8</sub>  |           | 0    | -    |      |
| Address cycle time          |         | t <sub>CYC8</sub> |           | 240  | -    |      |
| Enable L pulse width(write) | WR      | t <sub>CCLW</sub> |           | 80   | -    |      |
| Enable H pulse width(write) |         | t <sub>CCHW</sub> |           | 80   | -    |      |
| Enable L pulse width(read)  | RD      | t <sub>CCLR</sub> |           | 140  | -    |      |
| Enable H pulse width(read)  |         | t <sub>CCHR</sub> |           | 80   | -    |      |
| Write data setup time       | DB0~DB7 | t <sub>DS8</sub>  |           | 40   | -    |      |
| Write address hold time     |         | t <sub>DH8</sub>  |           | 0    | -    |      |
| Read access time            |         | t <sub>ACC8</sub> | CL=100Pf  | -    | 70   |      |
| Read output disable time    |         | t <sub>OH8</sub>  | CL=100Pf  | 5    | 50   |      |

| Item                  | Signal | Symbol          | Min. | Typ. | Max. | Unit |
|-----------------------|--------|-----------------|------|------|------|------|
| Reset time            |        | t <sub>R</sub>  | -    | -    | 1.0  | us   |
| Reset 'L' pulse width | /RES   | t <sub>RW</sub> | 1.0  | -    | -    |      |



## Example Initialization Code

```
void init()
{
  RDD = 1;

  WRT = 1;

  CS1 = 0;

  RST = 0;

  delay(150);

  RST = 1;

  delay(150);


  comm_out(0xA2); //LCD Bias Set: 1/9 Bias
  comm_out(0xA0); //ADC Select: Seg0->Seg131
  comm_out(0xC0); //Common Output Mode Select: COM0->COM63
  comm_out(0xF8); //Set Booster
  comm_out(0x01); //X5
  comm_out(0x25); //V0 Voltage Regulator Internal Resistor Ratio Set: 5.5
  comm_out(0x81); // The Electronic Volume(Double Byte Command)
  comm_out(0x19); // VOP=8.8V
  comm_out(0x2C); //Power Controller Set: VB ON
  delay(50);
  comm_out(0x2E); //Power Controller Set: VB ON, VR ON
  delay(50);
  comm_out(0x2F); //Power Controller Set: VB ON, VR ON, VF ON
  delay(50);
  comm_out(0x40); //Display Start Line Set: COM0
  comm_out(0xA6); //Display Normal/Reverse
  comm_out(0xA4); //Display All Points: Normal display mode
  comm_out(0xAF); //Display ON


  delay(10);
}
```

## 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.                                           | -30°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.    | -20°C , 96hrs                                                                                        | 1,2  |
| High Temperature / Humidity Storage | Endurance test applying the high storage temperature and humidity for a long time.                             | +40°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. | -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, 1.5mm amplitude.<br>2g Acceleration. 60 sec in each of 3 directions X,Y,Z<br>For 30 minutes | 3    |
| Static electricity test             | Endurance test applying electric static discharge.                                                             | Air: ±8KV, Contact: ±4KV                                                                             | 4    |

**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.