

Product Specification

NHD-12864AZ-NSW-BBW-TR

Graphic Liquid Crystal Display Module

| | |
|---------------|--------------------------|
| NHD- | Newhaven Display |
| 12864- | 128 x 64 Pixels |
| AZ- | Model |
| N- | Transmissive |
| SW- | Side White LED Backlight |
| B- | STN Negative, Blue |
| B- | 6:00 Optimal View |
| W- | Wide Temperature |

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Additional Resources

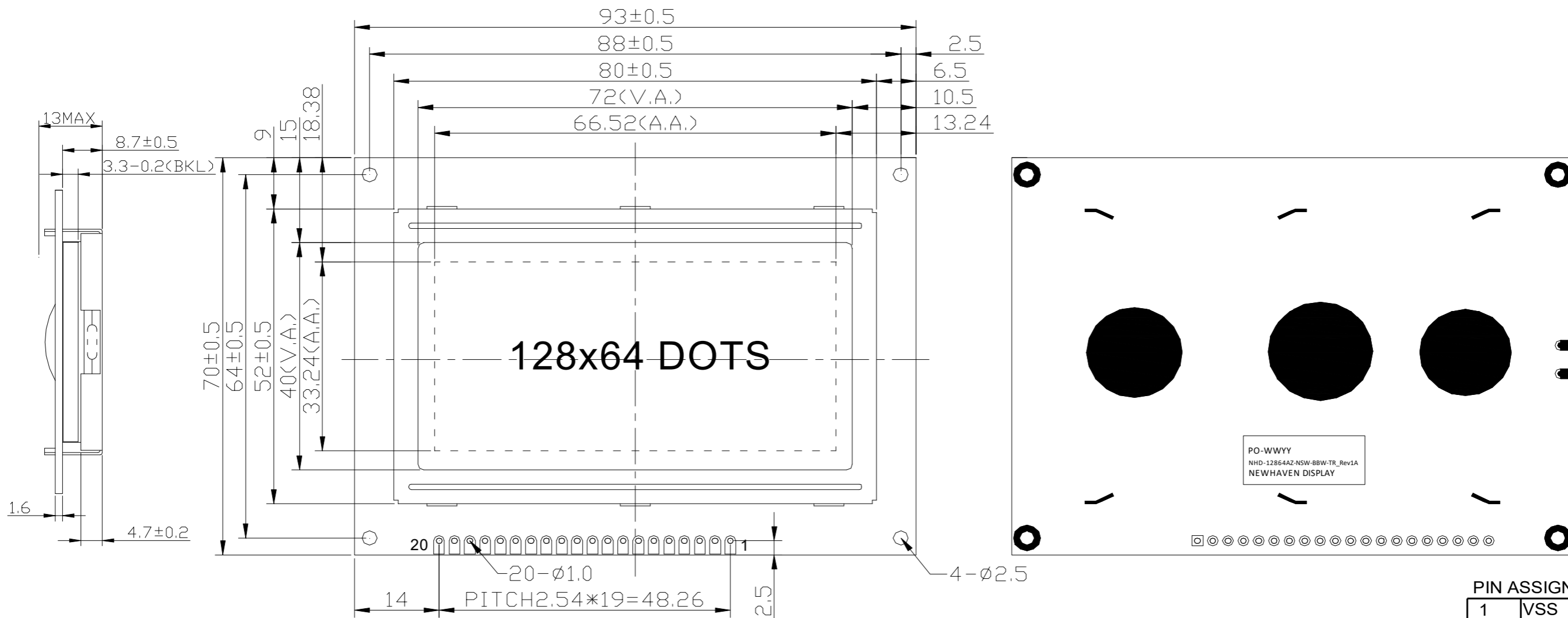
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** 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 | 11/15/2008 | Initial Release | - |
| 1 | 08/25/2009 | User Guide Reformat | BE |
| 2 | 03/24/2010 | Mechanical Drawing/Pin Description Updated | BE |
| 3 | 05/20/2010 | Updated Pin Description and Electrical Characteristics | MC |
| 4 | 12/14/2012 | Controller Information Updated | AK |
| 5 | 04/17/2013 | Temperature Compensation Circuit Information Removed | AK |
| 6 | 10/25/2016 | Electrical & Optical Characteristics Updated | SB |
| 7 | 10/19/2018 | Driver IC, Backlight Current, & Mechanical Drawing Updated | SB |
| 8 | 05/20/2020 | Updated Supply Current for Display & Backlight & Logic Voltages Part Revision Updated to Rev1A | AS |
| 9 | 05/27/2021 | Updated Supply Current and Mechanical Drawing | JT |
| 10 | 11/18/2021 | Updated Mechanical Drawing | ZP |
| 11 | 01/26/2023 | Document Format Updated | KL |

Mechanical Drawing




PIN ASSIGNMENT

| | |
|------|---------|
| 1 | VSS |
| 2 | VDD |
| 3 | V0 |
| 4 | RS |
| 5 | R/W |
| 6 | E |
| 7~14 | DB0~DB7 |
| 15 | CS1 |
| 16 | CS2 |
| 17 | RST |
| 18 | VEE |
| 19 | LED+ |
| 20 | LED- |

Product Description: 128x64 Graphic LCD

1. Driver IC: AiP31108U
2. Driving Mode: 1/64 Duty, 1/9 Bias
3. Interface: 8-Bit Parallel
4. Power Requirement: 5.0V
5. Optical Features: STN (-) Blue, Transmissive, 6:00 View, White Backlight
6. Recommended Pin Header: 1x20pin 2.54mm pitch

| | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------|
| Standard Tolerance: (Unless otherwise specified) Linear: ±0.3mm |  | |
| | Drawing/Part Number: NHD-12864AZ-NSW-BBW-TR | Revision: 1A |
| Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection | Drawn By: K. Lewis | Approved By: K. Lewis |
| | Drawn Date: 01/26/2023 | Approved Date: 01/26/2023 |
| 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. | | |

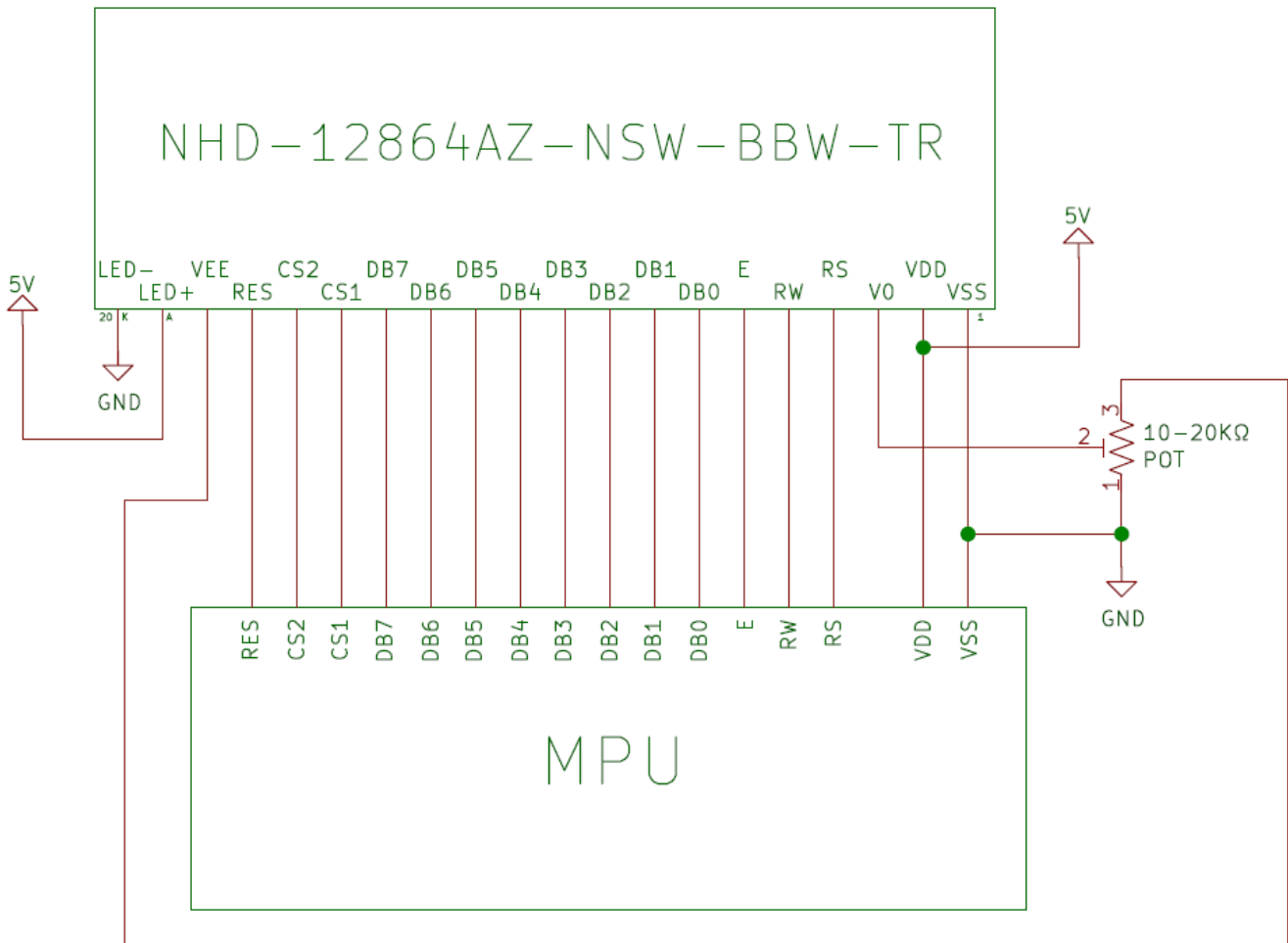
Pin Description

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|-------------------------------------------------------------------------------------------------|
| 1 | V _{SS} | Power Supply | Ground |
| 2 | V _{DD} | Power Supply | Supply Voltage for Logic (+5.0V) |
| 3 | V ₀ | Adj. Power Supply | Supply Voltage for contrast (approx. -4.5V) |
| 4 | RS | MPU | Register Select: 1=Data, 0=Instruction |
| 5 | R/W | MPU | Read/Write select signal, R/W=1: Read R/W: =0: Write |
| 6 | E | MPU | Operation Enable signal. Falling edge triggered. |
| 7-14 | DB0-DB7 | MPU | This is an 8-bit-directional data bus |
| 15 | CS1 | MPU | Chip Selection: CS1=H, CS2=L → select IC1 (left side) CS1=L, CS2=H → select IC2 (right side) |
| 16 | CS2 | MPU | |
| 17 | /RST | MPU | Active LOW Reset signal |
| 18 | VEE | Power Supply | Negative voltage output (-5.0V) |
| 19 | LED+ | Power Supply | Backlight Anode (+5.0V via on-board resistor) |
| 20 | LED- | Power Supply | Backlight Cathode (Ground) |

Recommended LCD connector: 2.54mm pitch pins

Backlight connector: on LCD connector

Wiring Diagram



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|------------------|-------------------------|-----------------|------|-----------------|------|
| Operating Temperature Range | T _{OP} | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | T _{ST} | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | V _{DD} | - | 4.8 | 5.0 | 5.2 | V |
| Supply Current | I _{DD} | V _{DD} = 5.0V | 1.0 | 2.5 | 4.5 | mA |
| Supply for LCD (contrast) | V _{LCD} | T _{OP} = 25°C | 9.3 | 9.5 | 9.7 | V |
| "H" Level input | V _{IH} | - | 2.2 | - | V _{DD} | V |
| "L" Level input | V _{IL} | - | V _{SS} | - | 0.6 | V |
| "H" Level output | V _{OH} | - | 2.4 | - | V _{DD} | V |
| "L" Level output | V _{OL} | - | V _{SS} | - | 0.4 | V |
| | | | | | | |
| Backlight Supply Voltage | V _{LED} | - | 4.8 | 5.0 | 5.2 | V |
| Backlight Supply Current | I _{LED} | V _{LED} = 5.0V | 20 | 40 | 60 | mA |

*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

Optical Characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|--------|----------------|------------------------|------|------|------|------|
| Optimal Viewing Angles | Top | φY+ | CR ≥ 2 | 30 | 40 | - | ° |
| | Bottom | φY- | | 50 | 60 | - | ° |
| | Left | θX- | | 50 | 60 | - | ° |
| | Right | θX+ | | 50 | 60 | - | ° |
| Contrast Ratio | | CR | - | 2 | 5 | - | - |
| Response Time | Rise | T _R | T _{OP} = 25°C | - | 150 | 250 | ms |
| | Fall | T _F | | - | 200 | 300 | ms |

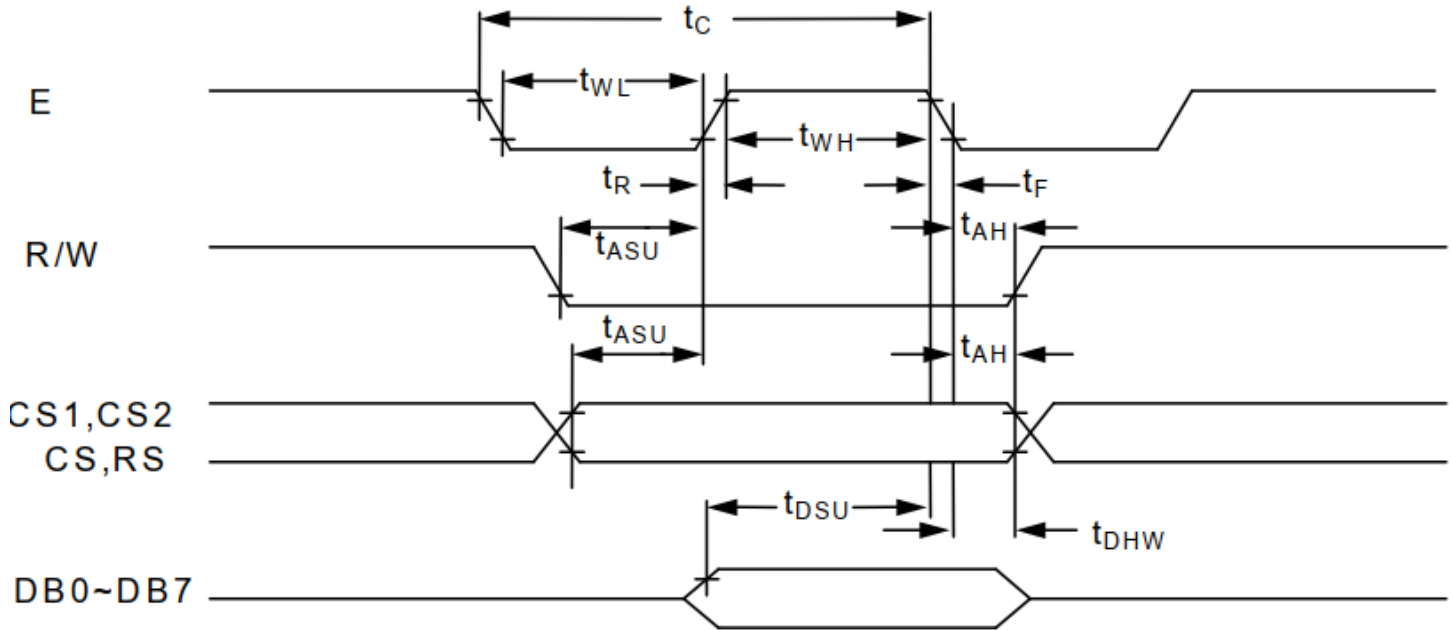
Controller Information

Built-in AiP31108U controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414490987415-AiP31108>

Table of Commands

| Instruction | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Function |
|--------------------------------|----|-----|------------|-----|---------------------------|-------|-----|------------|-----|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Display on/off | L | L | L | L | H | H | H | H | H | L/H | Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON |
| Set address (Y address) | L | L | L | H | Y address (0-63) | | | | | Sets the Y address in the Y address counter. | |
| Set page (X address) | L | L | H | L | H | H | H | Page (0-7) | | | Sets the X address at the X address register. |
| Display Start line (Z address) | L | L | H | H | Display start line (0-63) | | | | | Indicates the display data RAM displayed at the top of the screen. | |
| Status read | L | H | Busy | L | On/Off | Reset | L | L | L | L | Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset |
| Write display data | H | L | Write data | | | | | | | | Writes data (DB0: 7) into display data RAM. After writing instruction, Y address is increased by 1 automatically. |
| Read display data | H | H | Read data | | | | | | | | Reads data (DB0: 7) from display data RAM to the data bus. |

Timing Characteristics



| Characteristic | Symbol | Min | Type | Max | Unit |
|------------------------|-----------|------|------|-----|------|
| E cycle | t_c | 1000 | - | - | ns |
| E high level width | t_{WH} | 450 | - | - | |
| E low level width | t_{WL} | 450 | - | - | |
| E rise time | t_R | - | - | 25 | |
| E fall time | t_F | - | - | 25 | |
| Address set-up time | t_{ASU} | 140 | - | - | |
| Address hold time | t_{AH} | 10 | - | - | |
| Data set-up time | t_{DSU} | 200 | - | - | |
| Data delay time | t_D | - | - | 320 | |
| Data hold time (write) | t_{DHW} | 10 | - | - | |
| Data hold time (read) | t_{DHR} | 20 | - | - | |

Example Initialization Program

```
Sub Init
  Reset P3.2
  Set P3.2
  Reset P3.4
  Reset P3.0
  Reset P3.7
  Reset P3.6
  Reset P3.1
  A = &H3F
  Call Comleft           'display on
  Call Comright        'display on
End Sub
```

```
Sub Comleft
  P1 = A
  Set P3.6
  Reset P3.0
  Set P3.4
  Reset P3.4
  Reset P3.6
End Sub
```

```
Sub Comright
  P1 = A
  Set P3.1
  Reset P3.0
  Set P3.4
  Reset P3.4
  Reset P3.1
End Sub
```

```
Sub Writeleft
  P1 = A
  Set P3.6
  Set P3.0
  Set P3.4
  Reset P3.4
  Reset P3.6
End Sub
```

```
Sub Writeright
  P1 = A
  Set P3.1
  Set P3.0
  Set P3.4
  Reset P3.4
  Reset P3.1
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, for 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes | 3 |
| Static electricity test | Endurance test applying electric static discharge. | VS=800V, RS=1.5kΩ, CS=100pF 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.