

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 |
| | RoHS Compliant |

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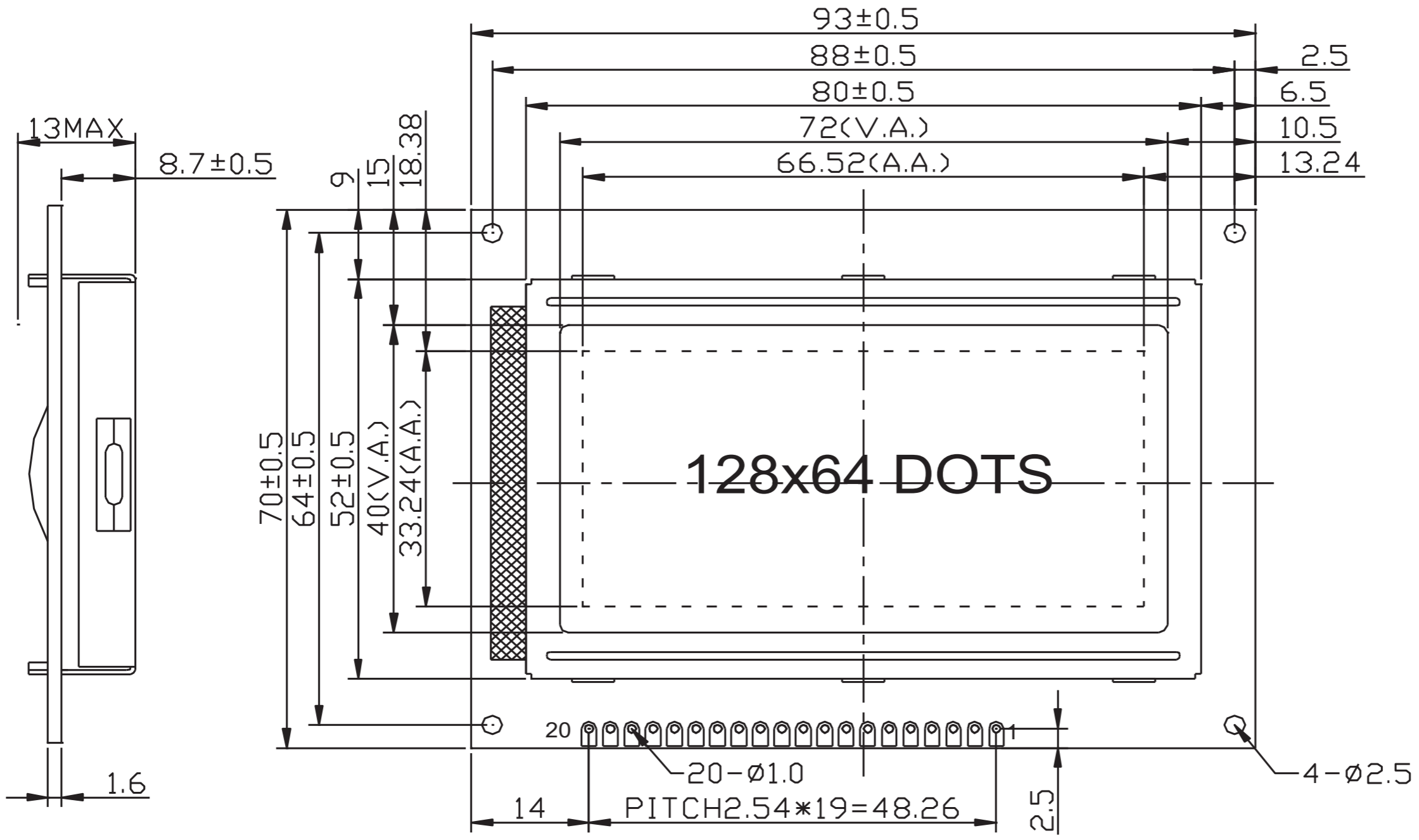
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|---|------------|
| 0 | 11/15/2008 | Initial Release | - |
| 1 | 8/25/2009 | User guide reformat | BE |
| 2 | 3/24/2010 | Mechanical Drawing/Pin Description updated | BE |
| 3 | 5/20/2010 | Updated Pin Description and Electrical Characteristics | MC |
| 4 | 12/14/2012 | Controller information updated | AK |
| 5 | 4/17/2013 | Temperature compensation circuit information removed | AK |
| 6 | 10/25/16 | Electrical & Optical Characteristics Updated | SB |
| 7 | 10/19/18 | Driver IC, Backlight Current, & Mechanical Drawing Updated | SB |
| 8 | 5/20/20 | Updated Supply Current for Display & Backlight & Logic Voltages Part Revision Updated to Rev1A | AS |

Functions and Features

- 128x64 pixels
- +5.0V power supply
- 1/64 duty, 1/9 bias
- Built-in Negative voltage

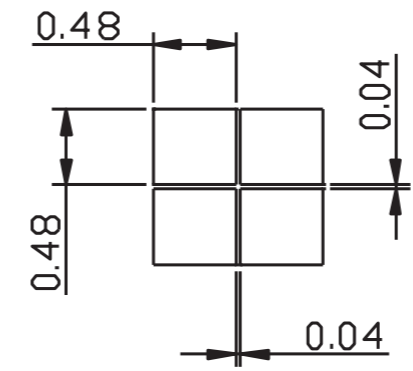
| SYMBOL | REVISION | DATE |
|--------|----------|------|
| | | |
| | | |



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- |

- Notes:**
1. Driver: 1/64 Duty, 1/9 Bias
 2. Display Mode: STN Negative / Blue / Transmissive
 3. Optimal View: 6:00
 4. Voltage: 5.0V VDD, 9.5V VLCD
 5. Backlight: White LED
 6. Driver IC: AiP31108U



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

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

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NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-12864AZ-NSW-BBW-TR

REVISION: 1A

SIZE: A3

SCALE: NS

DRAWN BY: A. Shah

APPROVED BY: A. Shah

DRAWN DATE: 5/18/20

APPROVED DATE: 5/18/20

SHEET 1 OF 1

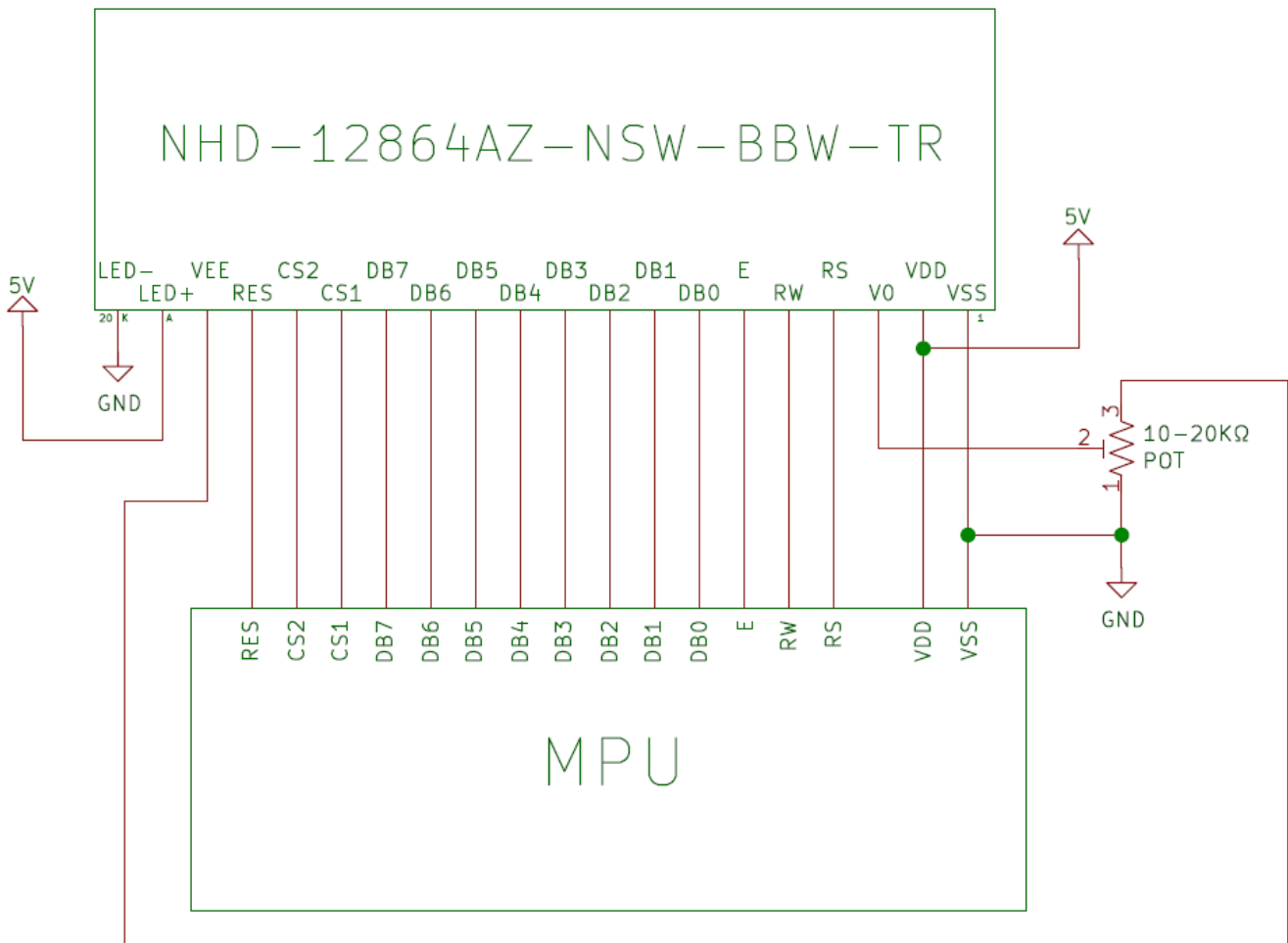
Pin Description

| 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 | 2.0 | 3.5 | 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 | CR ≥ 2 | - | 40 | - | ° |
| | Bottom | | - | 60 | - | ° |
| | Left | | - | 60 | - | ° |
| | Right | | - | 60 | - | ° |
| Contrast Ratio | CR | - | 2 | 5 | - | - |
| Response Time | Rise | T _{OP} = 25°C | - | 150 | 250 | ms |
| | Fall | | - | 200 | 300 | ms |

Controller Information

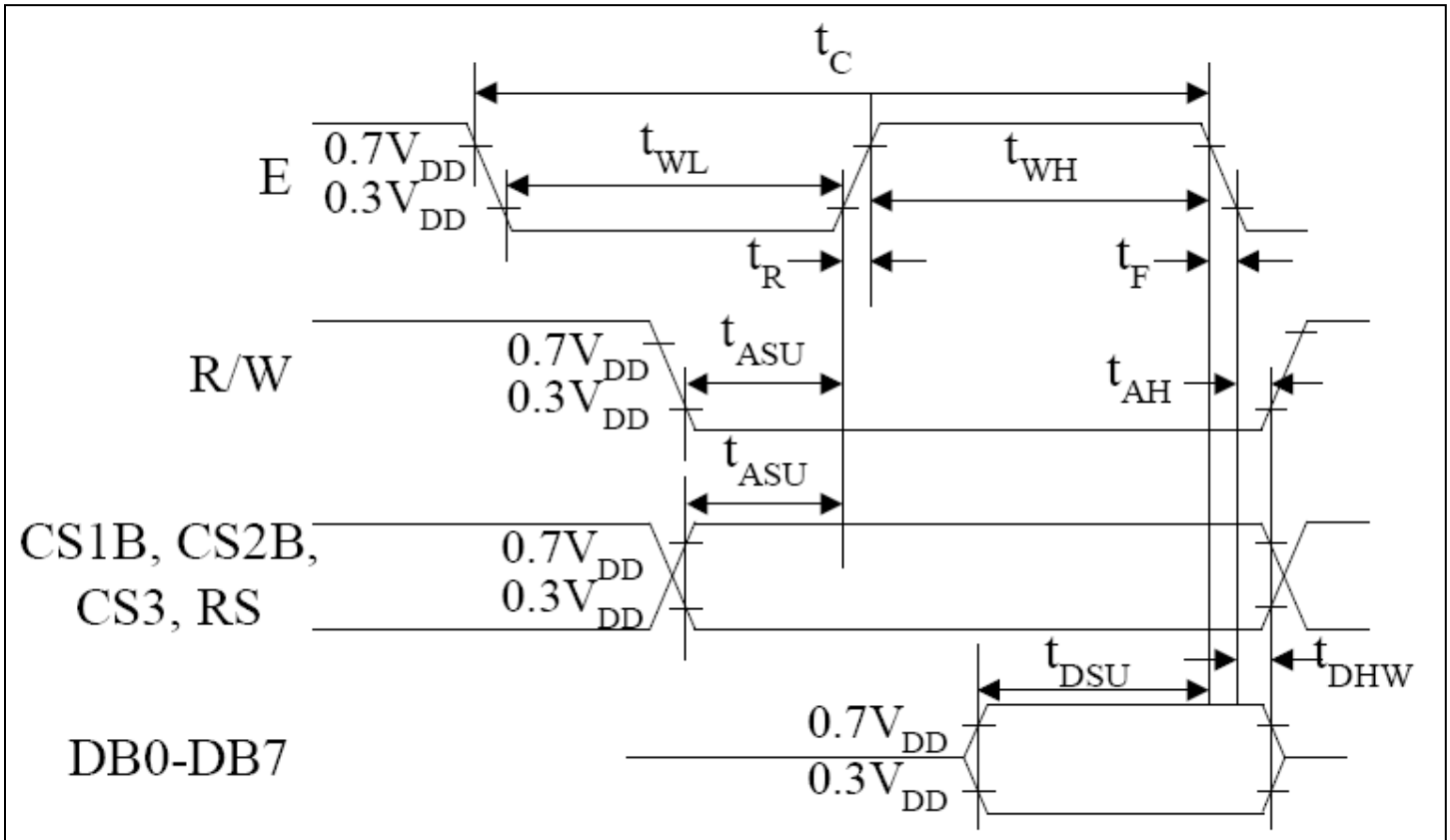
Built-in AiP31108U controller

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/AiP31108.pdf>

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 Writerright
  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.

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