

NHD-C12864B2Z-RN-FBW

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

| | |
|---------|---------------------------|
| NHD- | Newhaven Display |
| C12864- | 128 x 64 Pixels |
| B2Z- | Model |
| R- | Reflective |
| N- | No Backlight |
| F- | FSTN (+) |
| B- | 6:00 view |
| W- | Wide Temp (-20°C ~ +70°C) |

RoHS Compliant

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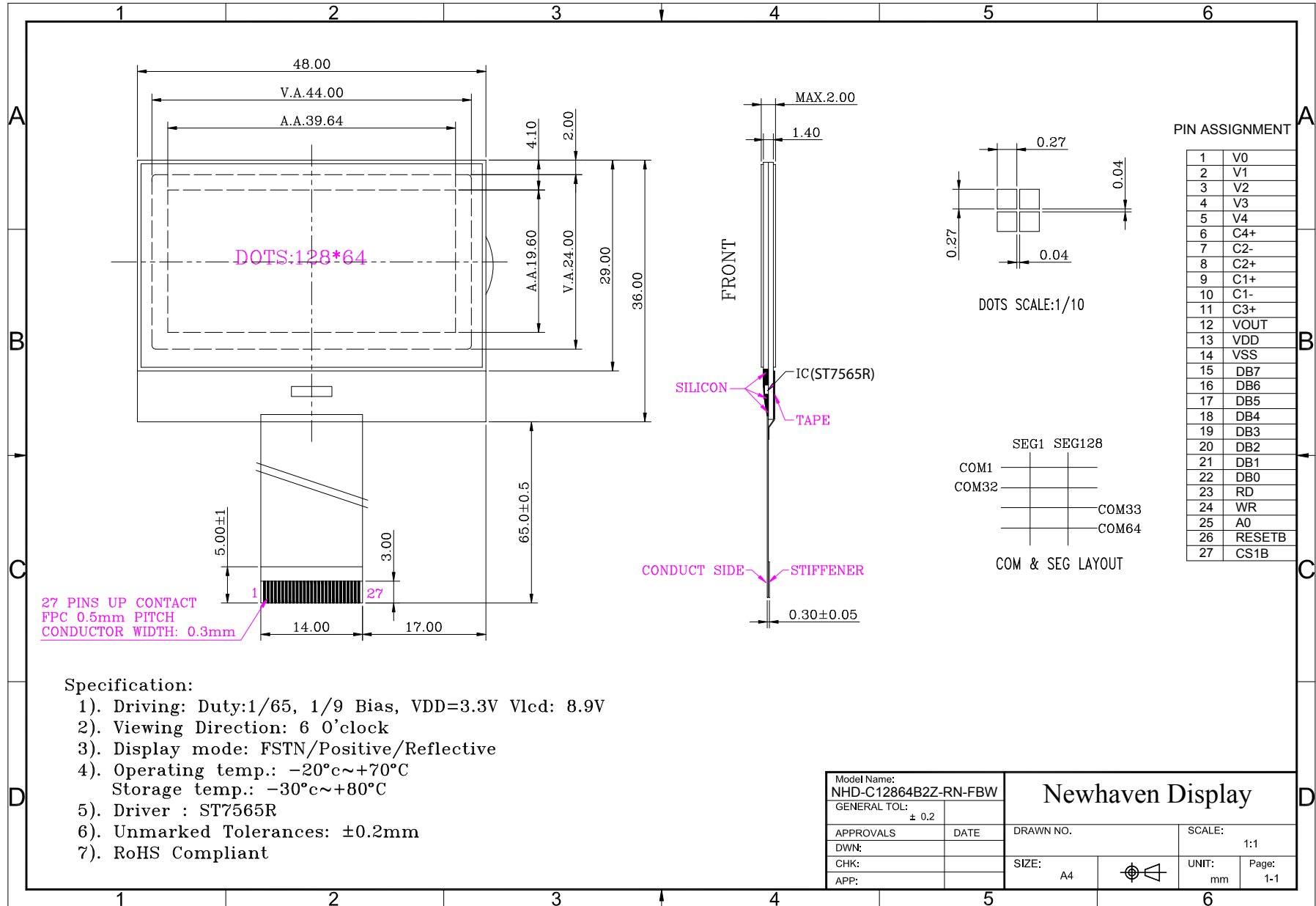
Document Revision History

| Revision | Date | Description | Changed by |
|----------|-----------|-------------------------|------------|
| 0 | 5/12/2008 | Initial Release | - |
| 1 | 3/18/2009 | User guide reformat | - |
| 2 | 7/14/2009 | User guide reformat | BE |
| 3 | 5/10/2011 | Code Update | JT |
| 4 | 11/7/2011 | Example program updated | AK |

Functions and Features

- 128 x 64 Pixels
- Built-in ST7565R controller
- 8080 MPU interfaces
- RoHS Compliant

Mechanical Drawing



PIN ASSIGNMENT

| | |
|----|--------|
| 1 | V0 |
| 2 | V1 |
| 3 | V2 |
| 4 | V3 |
| 5 | V4 |
| 6 | C4+ |
| 7 | C2- |
| 8 | C2+ |
| 9 | C1+ |
| 10 | C1- |
| 11 | C3+ |
| 12 | VOUT |
| 13 | VDD |
| 14 | VSS |
| 15 | DB7 |
| 16 | DB6 |
| 17 | DB5 |
| 18 | DB4 |
| 19 | DB3 |
| 20 | DB2 |
| 21 | DB1 |
| 22 | DB0 |
| 23 | RD |
| 24 | WR |
| 25 | A0 |
| 26 | RESETB |
| 27 | CS1B |

27 PINS UP CONTACT
FPC 0.5mm PITCH
CONDUCTOR WIDTH: 0.3mm

- Specification:**
- 1). Driving: Duty:1/65, 1/9 Bias, VDD=3.3V Vled: 8.9V
 - 2). Viewing Direction: 6 O'clock
 - 3). Display mode: FSTN/Positive/Reflective
 - 4). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
 - 5). Driver : ST7565R
 - 6). Unmarked Tolerances: ±0.2mm
 - 7). RoHS Compliant

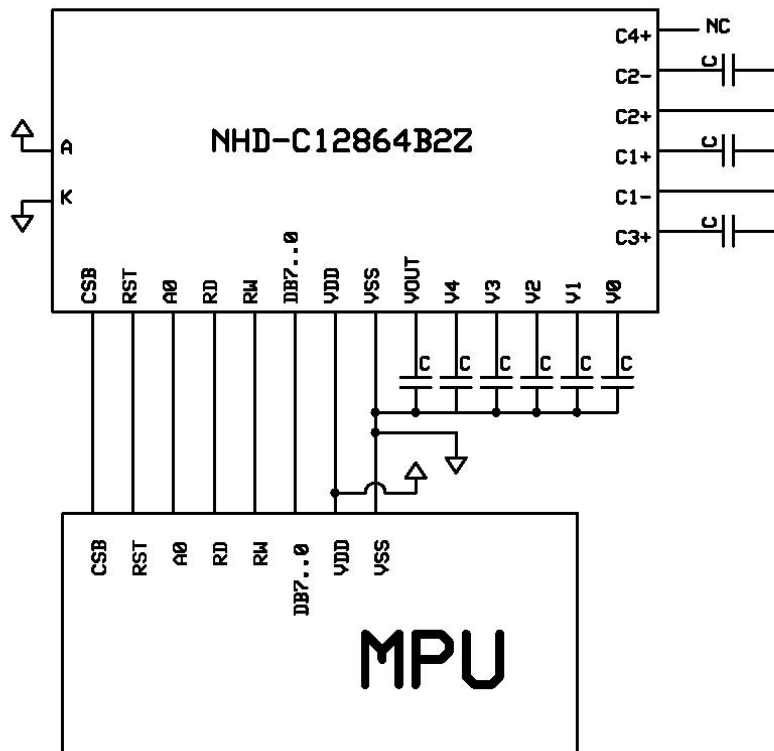
| | | | |
|-------------------------------------|------|---------------------------|---------------|
| Model Name: NHD-C12864B2Z-RN-FBW | | <h2>Newhaven Display</h2> | |
| GENERAL TOL: ± 0.2 | | | |
| APPROVALS | DATE | DRAWN NO. | SCALE: 1:1 |
| DWN: | | SIZE: A4 | UNIT: mm |
| CHK: | | | Page: 1-1 |
| APP: | | | |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|------------------|---------------------|---|
| 1 | V0 | Power Supply | CAP to VSS (0.1~1Uf) |
| 2 | V1 | Power supply | CAP to VSS (0.1~1Uf) |
| 3 | V2 | Power Supply | CAP to VSS (0.1~1Uf) |
| 4 | V3 | Power Supply | CAP to VSS (0.1~1Uf) |
| 5 | V4 | Power Supply | CAP to VSS (0.1~1Uf) |
| 6 | C4+ | Power Supply | No Connect |
| 7 | C2- | Power Supply | CAP to PIN8 (1~2.2uF) |
| 8 | C2+ | Power Supply | CAP to PIN7 (1~2.2uF) |
| 9 | C1+ | Power Supply | CAP to PIN10(1~2.2uF) |
| 10 | C1- | Power Supply | CAP to PIN9 (1~2.2uF) |
| 11 | C3+ | Power Supply | CAP to PIN10 (1~2.2uF) |
| 12 | V _{OUT} | Power Supply | CAP to VSS (1~2.2uF) |
| 13 | V _{DD} | Power Supply | Power Supply for logic |
| 14 | V _{SS} | Power Supply | Ground |
| 15~22 | DB7~DB0 | MPU | This is an 8-bit-directional data bus. |
| 23 | /RD | MPU | Active low Read signal |
| 24 | /WR | MPU | Active low Write signal |
| 25 | A0 | MPU | Register Select. 0: instruction; 1: data register |
| 26 | RESTB | MPU | Active low Reset signal. (May tie to VDD) |
| 27 | CS1B | MPU | Active low Chip Select. (May tie to VSS) |

Recommended LCD connector: 27 pins, 0.5mm Pitch FFC

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



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|-----------------------|--------|------|------|------|
| Operating Temperature Range | Top | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | Tst | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | VDD | | - | 3.3 | - | V |
| Supply Current | IDD | Ta=25III, VDD=3.3V | - | 0.5 | - | mA |
| Supply for LCD (contrast) | VDD-V0 | Ta =25III | - | 8.9 | - | V |
| "H" Level input | Vih | | 0.7VDD | - | VDD | V |
| "L" Level input | Vil | | 0 | - | 0.8 | V |
| "H" Level output | Voh | | 0.7VDD | - | VDD | V |
| "L" Level output | Vol | | - | - | 0.8 | V |
| | | | | | | |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|---------|-----------|------|-----------------|------|------|
| Viewing Angle - Vertical | K2- K 1 | CR = 2.0 | 70 | - | - | ° |
| Viewing Angle - Horizontal | Φ | CR = 2.0 | - | ² 30 | - | ° |
| Contrast Ratio | CR | Φ=0, θ=25 | 3 | 5 | - | - |
| Response Time (rise) | Tr | Φ=0, θ=25 | - | 150 | 250 | ms |
| Response Time (fall) | Tf | Φ=0, θ=25 | - | 200 | 300 | ms |

Controller Information

Built-in ST7565R. Download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

Timing Characteristics

System bus read/write characteristics 1 (for the 8080 series MPU)

(Ta=25°C, VDD=3.0V)

| Item | Signal | Symbol | condition | Min. | Max. | Unit |
|-----------------------------|---------|--------|-----------|------|------|------|
| Address hold time | A0 | tAH8 | | 0 | - | ns |
| Address setup time | | tAW8 | | 0 | - | |
| Address cycle time | | tCYC8 | | 240 | - | |
| Enable L pulse width(write) | WR | tCCLW | | 80 | - | |
| Enable H pulse width(write) | | tCCHW | | 80 | - | |
| Enable L pulse width(read) | RD | tCCLR | | 140 | - | |
| Enable H pulse width(read) | | tCCHR | | 80 | - | |
| Write data setup time | DB0~DB7 | tDS8 | | 40 | - | |
| Write address hold time | | tDH8 | | 0 | - | |
| Read access time | | tACC8 | CL=100Pf | - | 70 | |
| Read output disable time | | tOH8 | CL=100Pf | 5 | 50 | |

| Item | Signal | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------|--------|--------|------|------|------|------|
| Reset time | | tR | - | - | 1.0 | us |
| Reset 'L' pulse width | /RES | tRW | 1.0 | - | - | |

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)

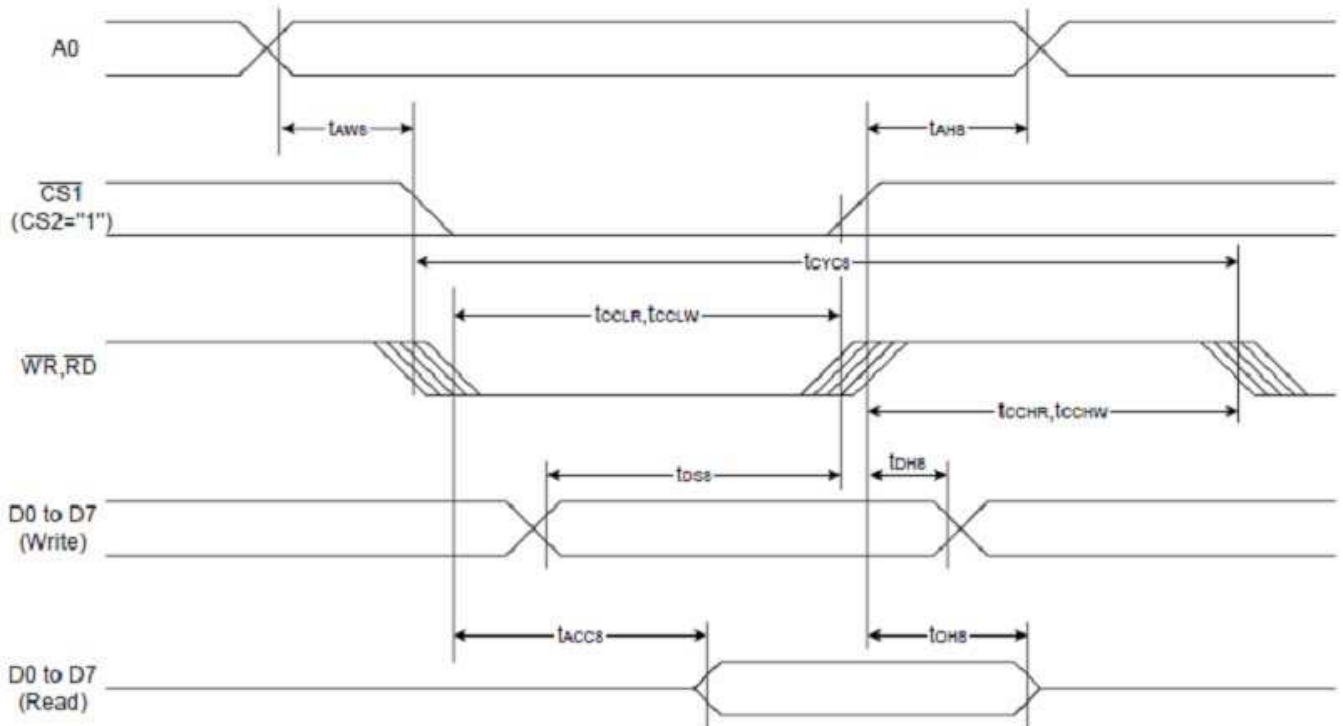


Table of Commands

Table 16: Table of ST7565R Commands

(Note) *: ignored data

| 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 | | | | | 0 | Sets the display RAM display start line address | |
| (3) Page address set | 0 | 1 | 0 | 1 | 0 | 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 | 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 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 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 0: normal display 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 0: 1/9 bias, 1: 1/7 bias (ST7565R) |
| (12) Read-modify-write | 0 | 1 | 0 | 1 | 1 | 1 | 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 | 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 | * | * | * | 1 | 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 | | 0 | 0 | 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 | | 0 | 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 V ₀ output voltage electronic volume register |
| Electronic volume register set | | | | 0 | 0 | Electronic volume value | | | | | 0 | 0 | |
| (19) Sleep mode set | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0: Sleep mode, 1: Normal mode |
| (20) Booster ratio set | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x |
| (21) NOP | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 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 |

Example Initialization Program

```
'-----  
Sub Init  
Reset P3.7          'set Read/write to '0' for write  
Reset P3.0          'RS  
Set P3.1            'reset  
Reset P3.4 'E  
'Set P3.3  
'Reset P3.3  
Waitms 2  
'Set P3.3  
Waitms 20  
A = &HA2            '1/9 BIAS  
Call Writecom  
A = &HA0            'ADC SELECT , NORMAL  
Call Writecom  
A = &HC8            'COM OUTPUT REVERSE  
Call Writecom  
A = &HA4            'DISPLAY ALL POINTS NORMAL  
Call Writecom  
A = &H40            'DISPLAY START LINE SET  
Call Writecom  
A = &H25            'INTERNAL RESISTOR RATIO  
Call Writecom  
A = &H81            'ELECTRONIC VOLUME MODE SET  
Call Writecom  
A = &H10            'ELECTRONIC VOLUME  
Call Writecom  
A = &H2F            'POWER CONTROLLER SET  
Call Writecom  
A = &HAF            'DISPLAY ON  
Call Writecom  
End Sub
```

```
'-----  
Sub Writecom  
Reset P3.0          'A0 low  
Reset P3.7          'R/W low  
Set P3.6            'CS2  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
End Sub
```

```
Sub Writedata  
Set P3.0            'A0 high  
Reset P3.7          'R/W low  
Set P3.6            'CS2  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
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 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