

NHD-C12864WM-09-FSW-FBW-3V3

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

| | |
|---------|---------------------------|
| NHD- | Newhaven Display |
| C12864- | 128 x 64 pixels |
| WM- | Model |
| F- | Transflective |
| SW- | Side White LED backlight |
| F- | FSTN (+) |
| B- | 6:00 view |
| W- | Wide Temp (-20°C ~ +70°C) |
| 3V3- | 3Vdd, 3Volt Backlight |
| | RoHS Compliant |

Newhaven Display International, Inc.

2511 Technology Drive, Suite 101

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

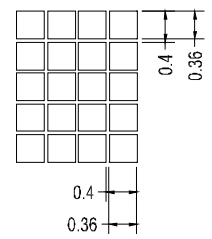
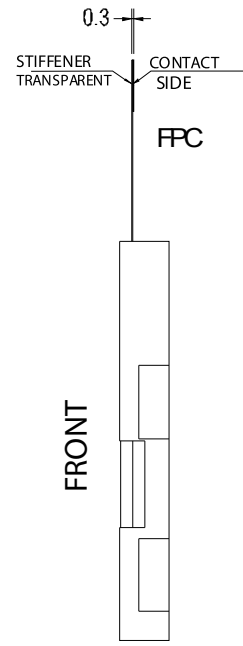
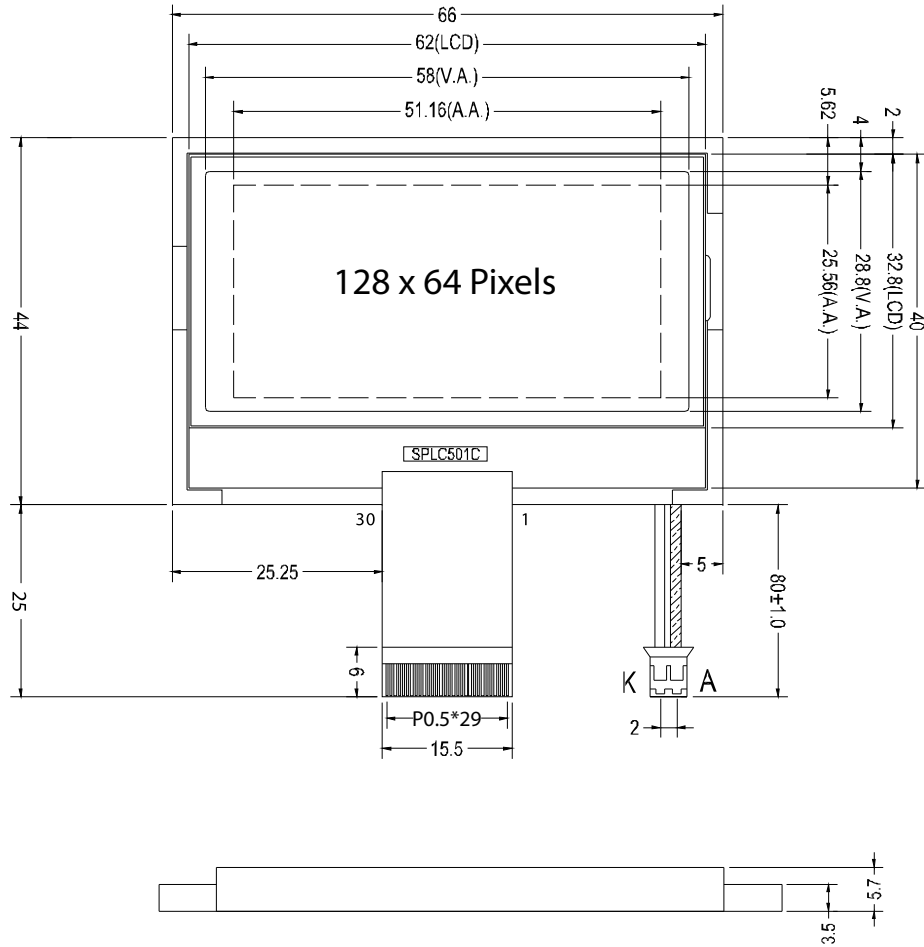
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|-----------------------------------|------------|
| 0 | 1/22/2007 | Initial Release | - |
| 1 | 9/23/2009 | User guide reformat | BE |
| 2 | 10/13/2009 | Updated Electrical Characteristic | MC |
| 3 | 4/22/2010 | Mechanical Drawing Update | MP |
| 4 | 7/9/2010 | Block diagram updated | BE |

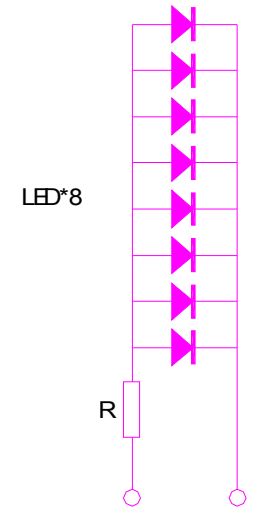
Functions and Features

- 128 x 64 pixels
- Built-in SPLC501C controller
- Parallel or Serial interface
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant

Mechanical Drawing



TOLERANCES UNLESS OTHERWISE STATED
 .X ±0.20
 ANGLES±1°
 ALL DIMENSIONS IN MM



Note:
 Lifetime>50'000hours

GENERAL SPECIFICATIONS

| | |
|-------------------|---|
| LCD TYPE | <input type="checkbox"/> TN <input type="checkbox"/> HTN <input type="checkbox"/> STN <input checked="" type="checkbox"/> FSTN |
| POLARIZER MODE | <input type="checkbox"/> REFLECTIVE |
| | <input checked="" type="checkbox"/> TRANSFLECTIVE |
| | <input type="checkbox"/> TRANSMISSIVE |
| DISPLAY COLOR | <input type="checkbox"/> YELLOW <input type="checkbox"/> GRAY <input type="checkbox"/> BLUE |
| VIEWING ANGLE | <input checked="" type="checkbox"/> 6 O'CLOCK <input type="checkbox"/> 12 O'CLOCK |
| BACKLIGHT | <input type="checkbox"/> BACK <input checked="" type="checkbox"/> SIDE <input type="checkbox"/> EL <input type="checkbox"/> CCFL |
| BACKLIGHT COLOR | <input type="checkbox"/> Y-G <input checked="" type="checkbox"/> WHT <input type="checkbox"/> GREEN <input type="checkbox"/> BLUE |
| TEMPERATURE RANGE | <input type="checkbox"/> STANDARD <input checked="" type="checkbox"/> WIDE |

ELECTRICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN. | MAX. | UNIT |
|-----------------|------------------|------------------------|------|------|------|
| Supply voltage | VDD | - | 2.4 | 5.5 | V |
| Supply current | IDD | VDD=3.3V | 0.6 | 1.0 | mA |
| Driving voltage | V _{LCD} | - | - | 9.5 | V |
| Driving current | IEE | V _{LCD} =9.5V | 8 | 20 | uA |
| LED BKL voltage | V _{LED} | - | 3.0 | 4.0 | V |
| LED BKL current | IF | V _{LED} =4.0 | 40 | 50 | mA |

PIN CONNECTIONS

| PIN | SIGNAL | PIN | SIGNAL | PIN | SIGNAL | PIN | SIGNAL |
|-----|--------|-----|--------|-----|--------|-----|--------|
| 1 | CS2 | 10 | DB4 | 19 | CAP2N | 28 | VR |
| 2 | RESETB | 11 | DB5 | 20 | CAP2P | 29 | C86 |
| 3 | RS | 12 | DB6 | 21 | VSS | 30 | PS |
| 4 | RW | 13 | DB7 | 22 | VDD | | |
| 5 | E | 14 | VSS2 | 23 | V1 | | |
| 6 | DB0 | 15 | VOUT | 24 | V2 | | |
| 7 | DB1 | 16 | CAP3N | 25 | V3 | | |
| 8 | DB2 | 17 | CAP1P | 26 | V4 | | |
| 9 | DB3 | 18 | CAP1N | 27 | V5 | | |

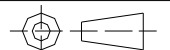
Newhaven Display

Model Name:

NHD-C12864WM-09-FSW-FBW-3V3

DATE 9/23/2009

SHEET: 1-1

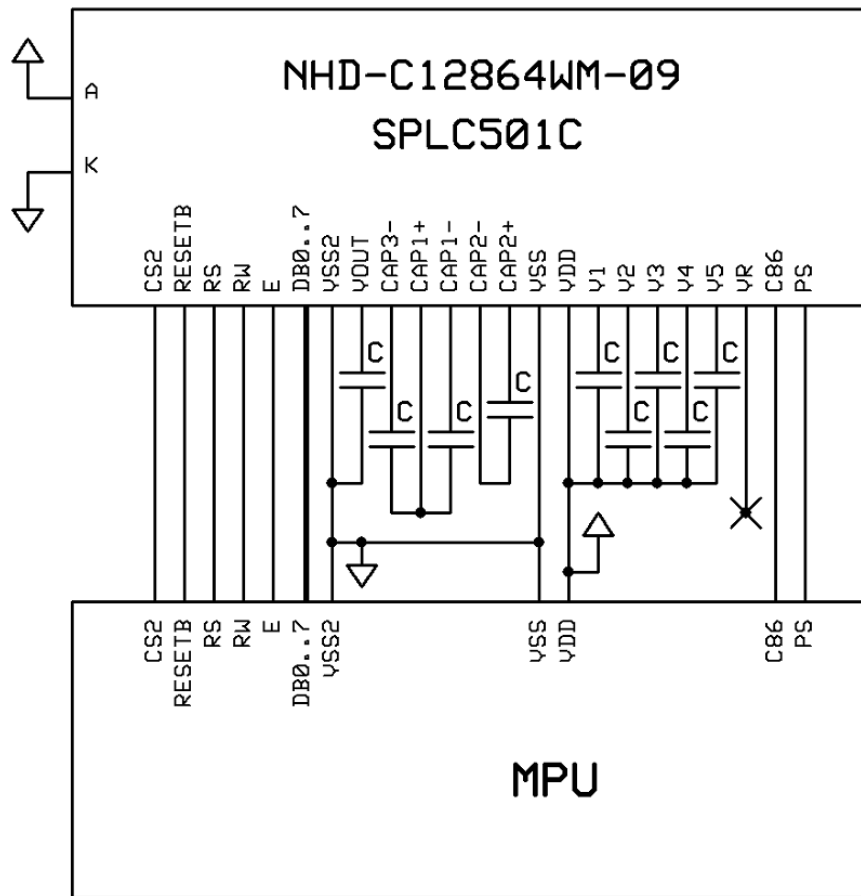


Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description | |
|---------|--------|---------------------|--|---|
| 1 | CS2 | MPU | Active HIGH chip select | |
| 2 | RESETB | MPU | Active LOW Reset signal | |
| 3 | RS | MPU | Register select signal. RS=0: Command, RS=1: Data | |
| 4 | RW | MPU | Read/write select signal. R/W=1: Read R/W=0: Write | |
| 5 | E | MPU | Operation enable signal. Falling edge triggered. | |
| 6 | DB0 | MPU | Parallel Interface DB0-DB7: Bi-directional 8-bit data bus Serial Interface: DB0-DB5: No connect in serial mode DB6= Serial clock (CLK) DB7= Serial data input (SDA) | |
| 7 | DB1 | MPU | | |
| 8 | DB2 | MPU | | |
| 9 | DB3 | MPU | | |
| 10 | DB4 | MPU | | |
| 11 | DB5 | MPU | | |
| 12 | DB6 | MPU | | |
| 13 | DB7 | MPU | | |
| 14 | VSS2 | Power Supply | | GND (reference for voltage step-up circuit) |
| 15 | VOUT | Power Supply | | Connect to 1uF cap to VSS2 (PIN-14) |
| 16 | CAP3- | Power Supply | | Connect to 1uF cap to CAP1+ (PIN-17) |
| 17 | CAP1+ | Power Supply | | Connect to 1uF cap to CAP3-(PIN16) and CAP1-(PIN18) |
| 18 | CAP1- | Power Supply | | Connect to 1uF cap to CAP1+ (PIN-17) |
| 19 | CAP2- | Power Supply | Connect to 1uF cap to CAP2+ (PIN-20) | |
| 20 | CAP2+ | Power Supply | Connect to 1uF cap to CAP2- (PIN-19) | |
| 21 | VSS | Power Supply | Ground | |
| 22 | VDD | Power Supply | Power supply for LCD and logic (3.0V) | |
| 23 | V1 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 24 | V2 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 25 | V3 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 26 | V4 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 27 | V5 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 28 | VR | - | No Connect | |
| 29 | C86 | MPU | Select MPU interface pin. C86=H: 6800; C86=L: 8080 | |
| 30 | PS | MPU | Parallel/Serial select. PS= H: Parallel; PS=L: Serial | |
| | | | | |
| A | | Power Supply | Power supply for LED Backlight (+3.0V) | |
| K | | Power Supply | Ground for Backlight | |

Recommended LCD connector: 0.5mm Pitch, 30 pin FFC. Molex p/n: 52892-3095

Backlight connector: A2001H-2P **Mates with:** A2001WR-S-2P



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 | | 2.4 | 3.3 | 5.5 | V |
| Supply Current | IDD | VDD=3.3v | 0.6 | - | 1.0 | mA |
| Supply for LCD (contrast) | VDD-V0 | - | - | - | 9.5 | V |
| "H" Level input | Vih | | 0.7VDD | - | VDD | V |
| "L" Level input | Vil | | Vss | - | 0.3VDD | V |
| "H" Level output | | | - | - | - | - |
| "L" Level output | | | - | - | - | - |
| LED BKL voltage | VLED | - | - | 3.0 | - | V |
| LED BKL current | ILED | VLED=3.0 | 40 | - | 50 | mA |

Optical Characteristics

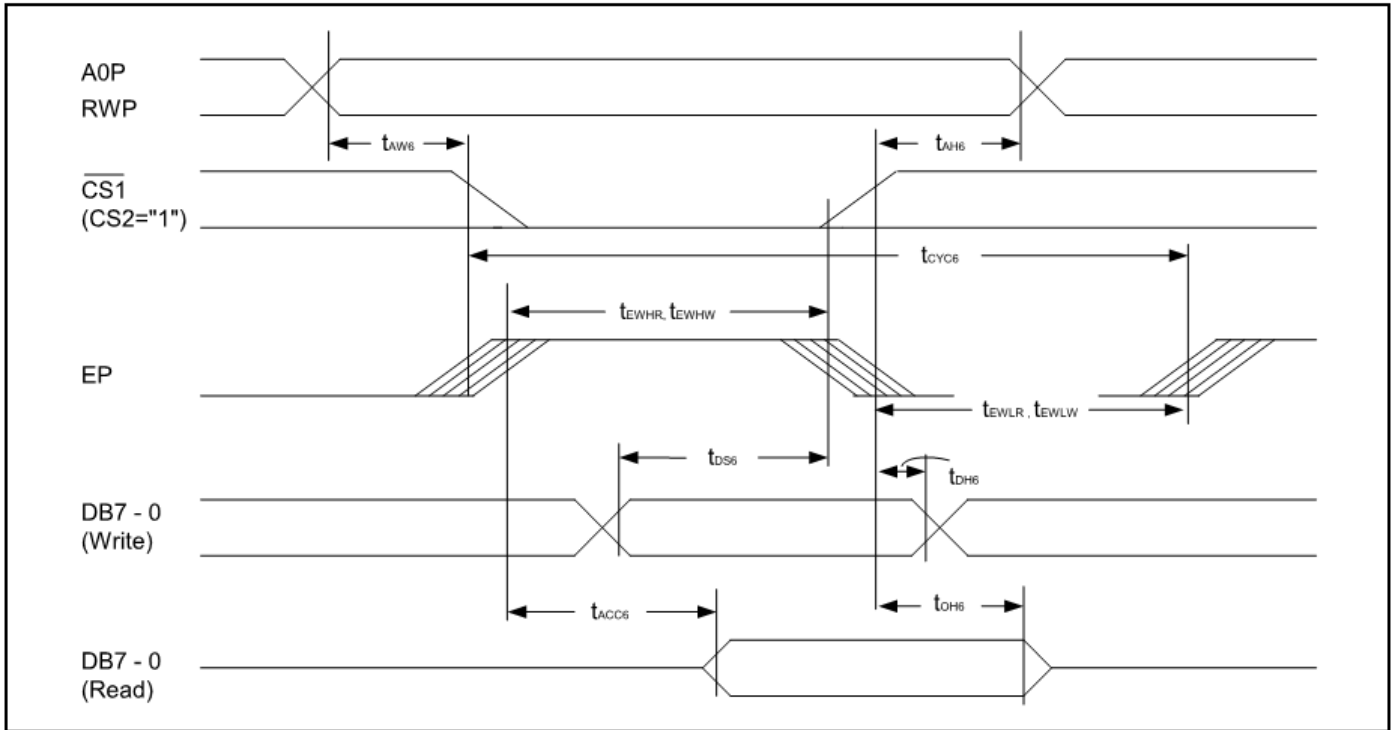
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-------------|------|------|------|------|
| Viewing Angle - Vertical | θ | CR \geq 2 | -60 | - | +35 | ° |
| Viewing Angle - Horizontal | Φ | CR \geq 2 | -40 | - | +40 | ° |
| Contrast Ratio | CR | | - | 6 | - | - |
| Response Time (rise) | Tr | | - | 150 | 250 | ms |
| Response Time (fall) | Tf | | - | 150 | 250 | ms |

Controller Information

Built-in SPLC501C. Download specification at http://www.newhavendisplay.com/app_notes/SPLC501C.pdf

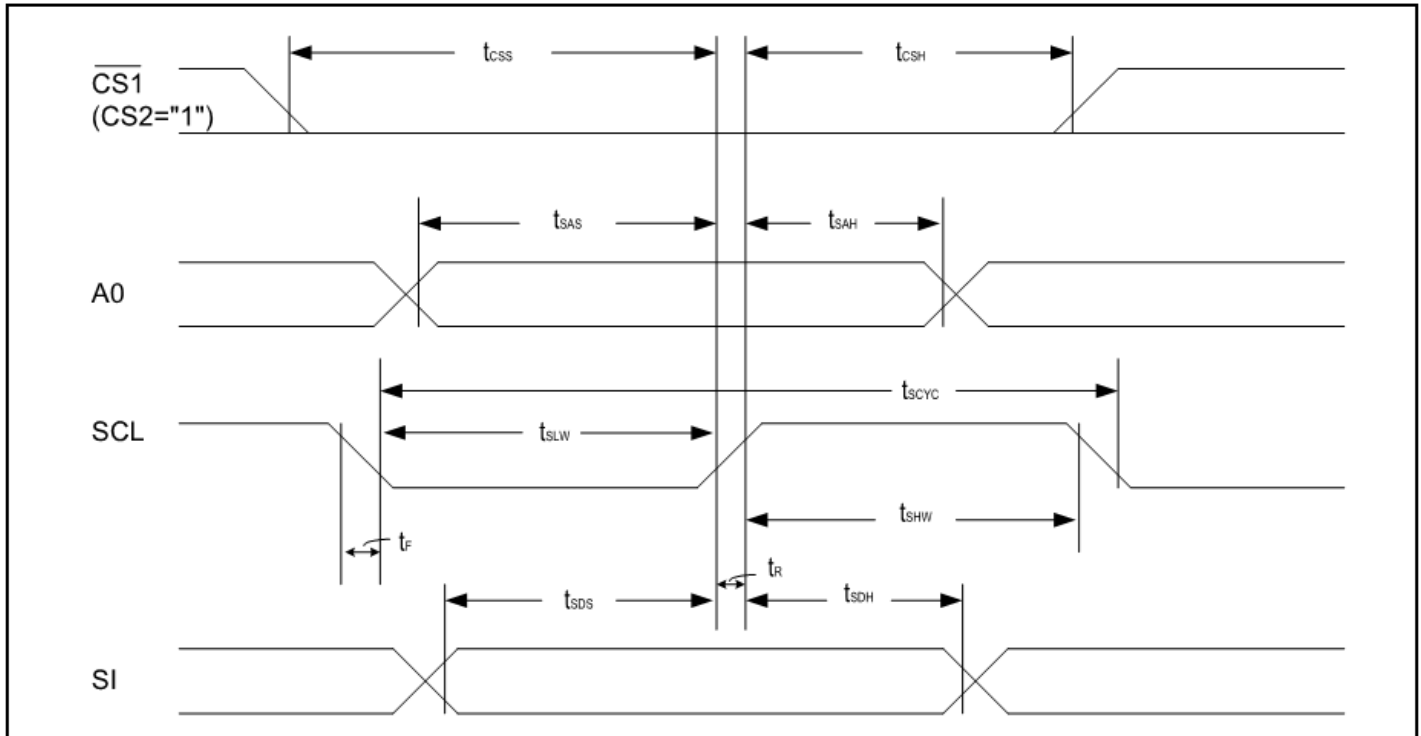
Timing Characteristics

8.6.2. System bus read/write characteristics 2 (6800 series MPU)



| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|---------|------------|---------------|--------|------|-------|
| | | | | Min. | Max. | |
| Address hold time | A0P | t_{AH6} | | 0 | - | ns |
| Address setup time | A0P | t_{AW6} | | 0 | - | ns |
| System cycle time | A0P | t_{CYC6} | | 166 | - | ns |
| Data setup time | DB7 - 0 | t_{DS6} | $C_L = 100pF$ | 30 | - | ns |
| Data hold time | | t_{DH6} | | 10 | - | ns |
| Access time | DB7 - 0 | t_{ACC6} | | - | 70 | ns |
| Output disable time | | t_{OH6} | | 10 | 50 | ns |
| Enable H pulse time | Read | EP | t_{EWHR} | 70 | - | ns |
| | Write | | t_{EWHW} | 30 | - | ns |
| Enable L pulse time | Read | EP | t_{EWLR} | 30 | - | ns |
| | Write | | t_{EWLW} | 30 | - | ns |

The serial interface



| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|--------|------------|-----------|--------|------|-------|
| | | | | Min. | Max. | |
| Serial Clock Period | | t_{SCYC} | - | 250 | - | ns |
| SCL 'H' pulse width | SCL | t_{SHW} | - | 100 | - | ns |
| SCL 'L' pulse width | | t_{SLW} | - | 100 | - | ns |
| Address setup time | A0P | t_{SAS} | - | 150 | - | ns |
| Address hold time | | t_{SAH} | - | 150 | - | ns |
| Data setup time | SI | t_{SDS} | - | 100 | - | ns |
| Data hold time | | t_{SDH} | - | 100 | - | ns |
| CS-SCL time | CS | t_{CSS} | - | 150 | - | ns |
| | | t_{CSH} | - | 150 | - | ns |

Table of Commands

| Command | Command Code | | | | | | | | | | | Function | |
|---|--------------|----|----|------------|-----|-------------------------|-----|----------------------------------|----------------|-----|-----|--|---|
| | A0P | RD | WR | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| 1). Display ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | LCD display ON/OFF 0: OFF, 1: ON | |
| 2). Display start line set | 0 | 1 | 0 | 0 | 1 | Display start address | | | | | 1 | Sets the display RAM display start line address | |
| 3). Page address set | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Page address | | | | 1 | Sets the display RAM page address |
| 4). Column address set upper bit | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Most significant column address | | | | 1 | Sets the most 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 | | | | 1 | Set the least significant 4 bits of the display RAM column address. |
| 5). Status read | 0 | 0 | 1 | Status | | | | 0 | 0 | 0 | 0 | 1 | Reads the status data |
| 6). Display data write | 1 | 1 | 0 | Write data | | | | | | | | 1 | Writes to the display RAM |
| 7). Display data read | 1 | 0 | 1 | Read data | | | | | | | | 1 | Reads from the display RAM |
| 8). ADC select | 0 | 1 | 0 | 1 | 0 | 1 | 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 | 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 | 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 | Sets the LCD driver voltage bias ratio SPLC501C.....0:1/9, 1:1/7 | |
| 12). Read/modify/write | 0 | 1 | 0 | 1 | 1 | 1 | 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 _S 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 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set the V _S output voltage electronic volume register | |
| Electronic volume register set | 0 | 1 | 0 | * | * | Electronic volume value | | | | | | | |

| Command | Command Code | | | | | | | | | | | Function |
|---|--------------|-----------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | A0P | \overline{RD} | \overline{WR} | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | |
| 19). Static indicator ON/OFF Static indicator Register set | | | | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0: OFF, 1: ON 1 Set the flashing mode |
| 20). Page Blink Page selection | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | P7 - 0: 1 - blinking page 0 - no blinking, normal display |
| 21). Driving Mode Set Mode selection | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | Set the driving mode register Driving capability (D1, D0): (1,1)>(0,0)>(0,1)>(1,0) |
| 22). Power saver | | | | | | | | | | | | Display OFF and display all points ON compound command |
| 23). NOP | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Command for non-operation |
| 24). 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