

NHD-C12864CZ-FSW-GBW

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

| | |
|---------|---------------------------|
| NHD- | Newhaven Display |
| C12864- | 128 x 64 pixels |
| CZ- | Model |
| F- | Transflective |
| SW- | Side White LED backlight |
| G- | STN - Gray |
| B- | 6:00 view |
| W- | Wide Temp (-20°C ~ +70°C) |

RoHS Compliant

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Document Revision History

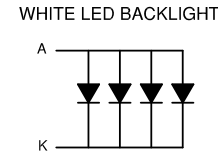
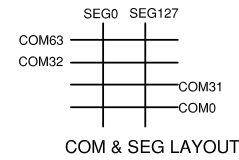
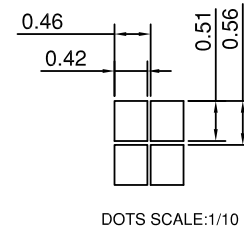
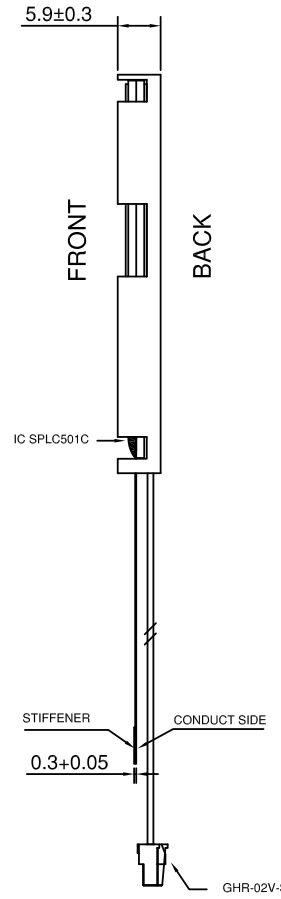
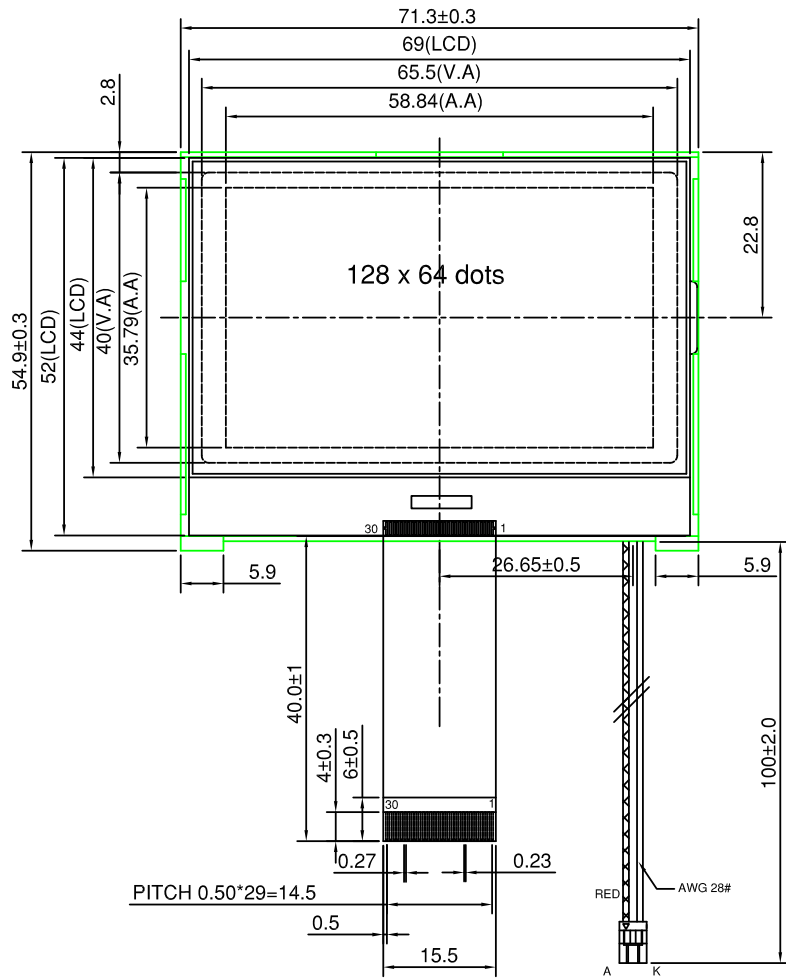
| Revision | Date | Description | Changed by |
|----------|------------|--|------------|
| 0 | 5/20/2008 | Initial Release | - |
| 1 | 9/25/2009 | User guide reformat | BE |
| 2 | 10/14/2009 | Updated Electrical Characteristic | MC |
| 3 | 11/20/2009 | Added backlight supply current maximum | MC |
| 4 | 9/22/2011 | Pin description & Wiring diagram updated | AK |

Functions and Features

- 128 x 64 pixels
- Built-in SPLC501C controller
- Parallel/Serial mode
- +5.0V power supply
- 1/65 duty cycle; 1/9 bias
- RoHS Compliant

Mechanical Drawing

| REV | DESCRIPTION: | DATE |
|-----|--|------------|
| | Increase the ribbon cable from 40mm to 42mm. | |
| 1.1 | B/L connector is reversed. | 2006.09.18 |
| 1.2 | B/L connector line spec | 2008.07.09 |



PIN ASSIGNMENT

| NO | SYMBOL |
|----|---------|
| 1 | /CS1 |
| 2 | /RES |
| 3 | AO |
| 4 | /R/W/WR |
| 5 | EP/RD |
| 6 | DB0 |
| 7 | DB1 |
| 8 | DB2 |
| 9 | DB3 |
| 10 | DB4 |
| 11 | DB5 |
| 12 | DB6;SCL |
| 13 | DB7;SI |
| 14 | VDD |
| 15 | VSS |
| 16 | VOUT |
| 17 | CAP3- |
| 18 | CAP1+ |
| 19 | CAP1- |
| 20 | CAP2- |
| 21 | CAP2+ |
| 22 | V1 |
| 23 | V2 |
| 24 | V3 |
| 25 | V4 |
| 26 | V5 |
| 27 | VR |
| 28 | C86 |
| 29 | PS |
| 30 | IRS |

Specification:

- 1). Driving: 1/65 Duty, 1/9 Bias, Vlcd: 9.5V
- 2). Viewing Direction: 6 O'clock
- 3). Display mode: STN/Positive/Transflective/Gray mode
- 4). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
- 5). Driver : SPLC501C Vdd:5V
- 6). Edge Backlight: White Color, 3~3.3V, Current: 60~75mA
- 7). RoHS Compliant

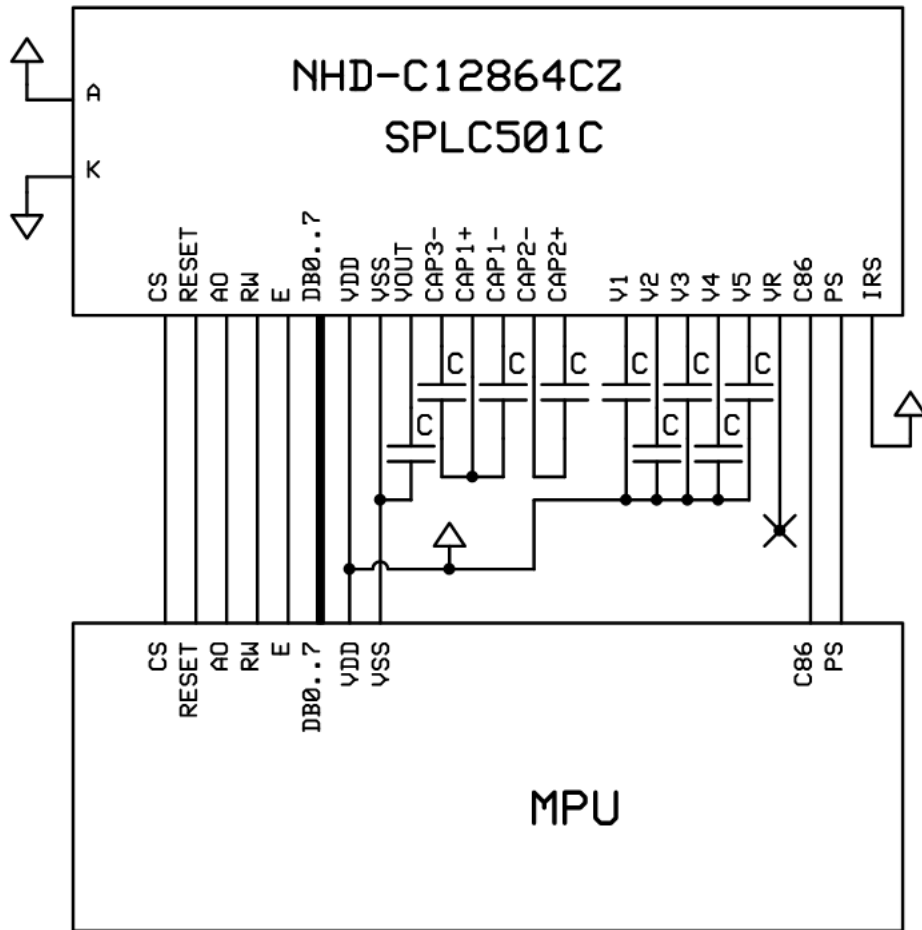
| | | | |
|-------------------------------------|--------------|-------------------------|--------|
| Model Name: NHD-C12864CZ-FSW-GBW | | Newhaven Display | |
| GENERAL TOL: ± 0.2 | | | |
| APPROVALS | DATE | DRAWN NO. | SCALE: |
| DWN: Qiwei Qiu | July 9, 2008 | | 1:1 |
| CHK: | | SIZE: | UNIT: |
| APP: Guoxiang Ye | | A4 | mm |
| | | | Page: |
| | | | 1-1 |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description | |
|---------|--------|---------------------|--|---|
| 1 | /CS | MPU | Active LOW chip select | |
| 2 | /RESET | MPU | Active LOW Reset signal | |
| 3 | A0 | MPU | Register select signal. 0: instruction; 1: data | |
| 4 | R/W | 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 | VDD | Power Supply | | Power supply for LCD and logic (+5.0V) |
| 15 | VSS | Power Supply | | Ground |
| 16 | VOUT | Power Supply | | Connect to 1uF cap to VSS |
| 17 | CAP3- | Power Supply | | Connect to 1uF cap to CAP1+ (PIN-18) |
| 18 | CAP1+ | Power Supply | | Connect to 1uF cap to CAP3-(PIN17) and CAP1-(PIN19) |
| 19 | CAP1- | Power Supply | Connect to 1uF cap to CAP1+ (PIN-18) | |
| 20 | CAP2- | Power Supply | Connect to 1uF cap to CAP2+ (PIN-21) | |
| 21 | CAP2+ | Power Supply | Connect to 1uF cap to CAP2- (PIN-20) | |
| 22 | V1 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 23 | V2 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 24 | V3 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 25 | V4 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 26 | V5 | Power Supply | 1.0uF-2.2uF cap to VDD | |
| 27 | VR | - | No Connect | |
| 28 | C86 | MPU | Select MPU interface pin. C86=H: 6800; C86=L: 8080 | |
| 29 | PS | MPU | Parallel/Serial select. PS= H: Parallel; PS=L: Serial | |
| 30 | IRS | MPU | Internal resistor select (high to use internal resistors) | |
| 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: JST p/n: GHR-02V-S **Mates with:** JST p/n: BM02B-GHS-TBT



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 | | 4.7 | 5.0 | 5.5 | V |
| Supply Current | IDD | Ta=25°C, VDD=5.0V | - | 1.5 | 2.5 | mA |
| Supply for LCD (contrast) | VDD-V0 | Ta=25°C | - | 9.5 | - | V |
| "H" Level input | Vih | | 2.2 | - | VDD | V |
| "L" Level input | Vil | | 0 | - | 0.6 | V |
| "H" Level output | Voh | | 2.4 | - | - | V |
| "L" Level output | Vol | | - | 3.0 | - | V |
| Backlight Supply Voltage | VLED | | - | 3.0 | - | V |
| Backlight Supply Current | ILED | VLED=3.0V | - | 60 | 75 | mA |

Optical Characteristics

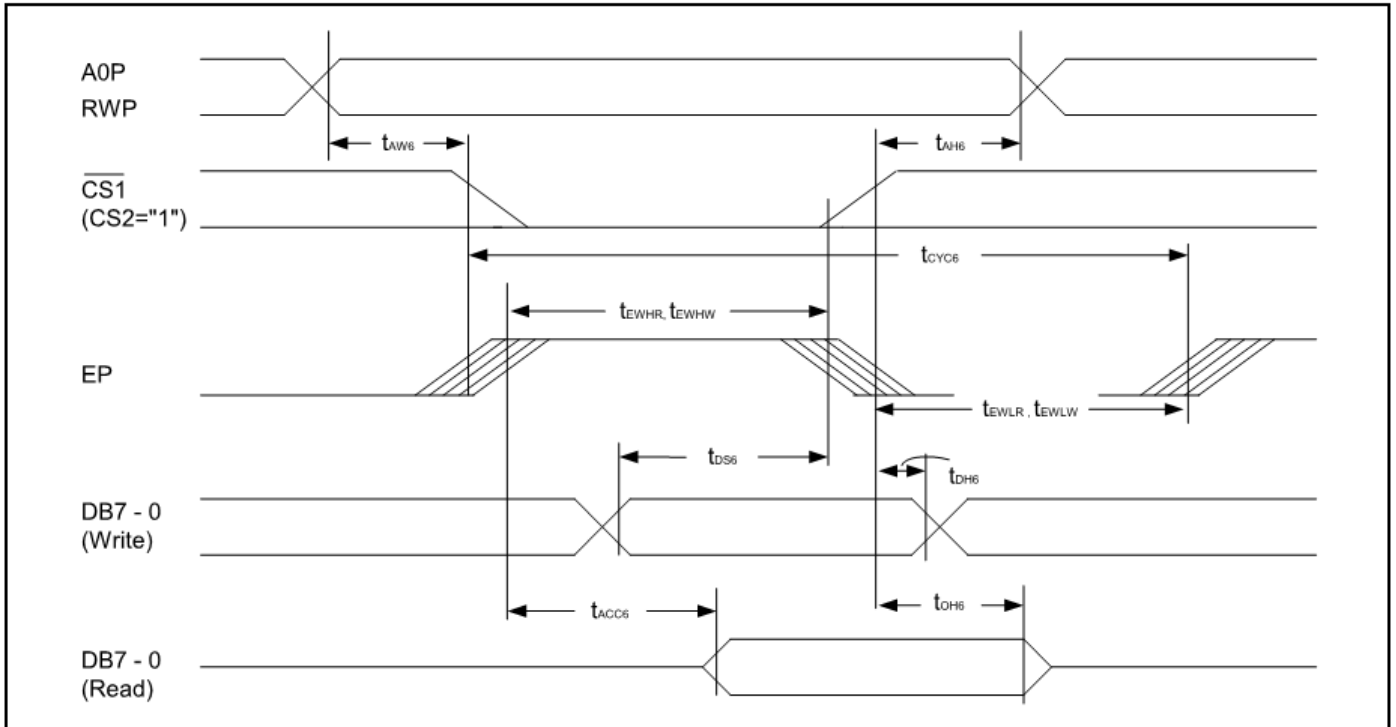
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Vertical | K | CR ≥ 2 | -60 | - | +35 | ° |
| Viewing Angle - Horizontal | Φ | CR ≥ 2 | -40 | - | +40 | ° |
| Contrast Ratio | CR | | - | 6 | - | - |
| 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

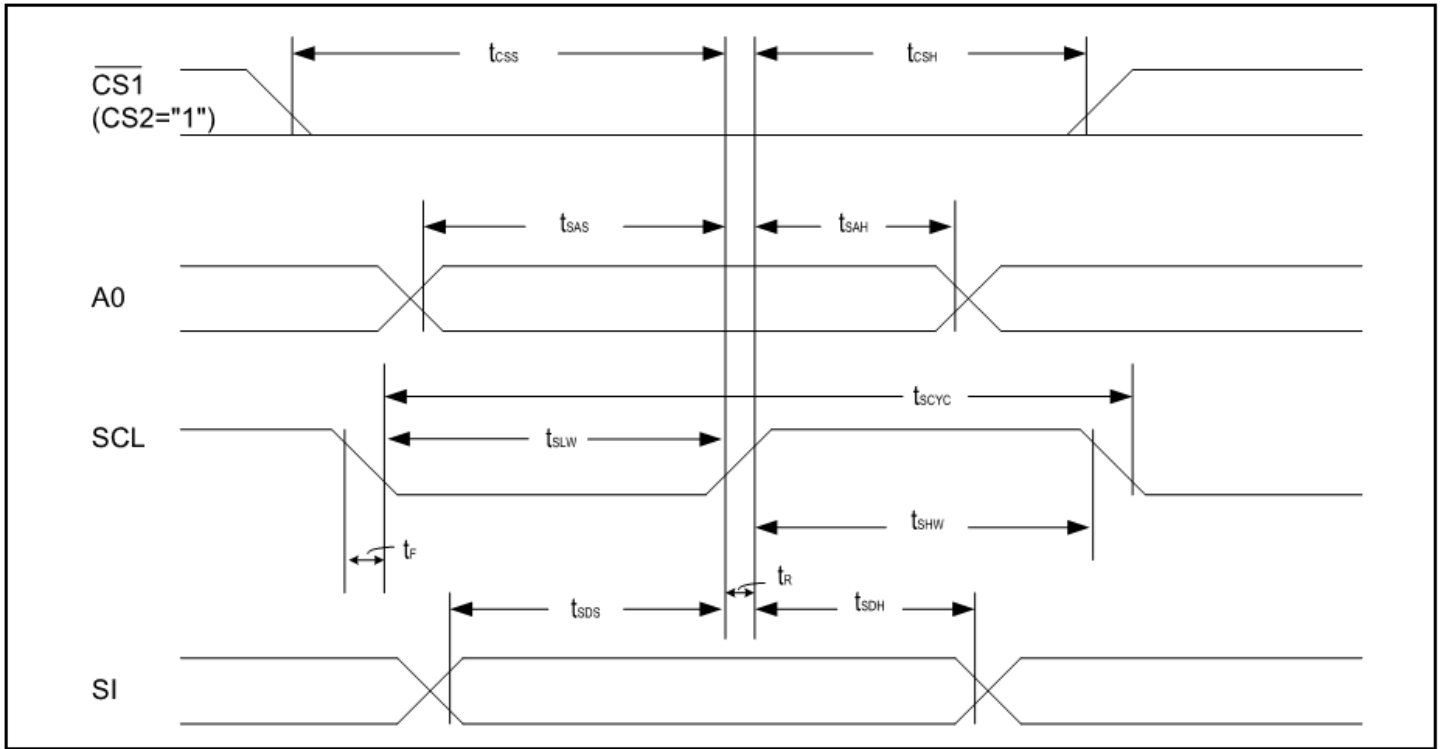
Timing Characteristics

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} | - | 200 | - | ns |
| SCL 'H' pulse width | SCL | t_{SHW} | - | 75 | - | ns |
| SCL 'L' pulse width | | t_{SLW} | - | 75 | - | ns |
| Address setup time | A0P | t_{SAS} | - | 50 | - | ns |
| Address hold time | | t_{SAH} | - | 100 | - | ns |
| Data setup time | SI | t_{SDS} | - | 50 | - | ns |
| Data hold time | | t_{SDH} | - | 50 | - | ns |
| CS-SCL time | CS | t_{CSS} | - | 100 | - | ns |
| | | t_{CSH} | - | 100 | - | 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 | | | | Sets the display RAM page address |
| 4). Column address set upper bit | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Most significant column address | | | | 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 | | | | Set 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 | 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 | RD | 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 | 1 | 0: OFF, 1: ON Set the flashing mode |
| 20). Page Blink Page selection | 0 | 1 | 0 | 1 | 1 | 0 | 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 | 0 | 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  
Set P3.0  
Set P3.1  
Reset P3.4  
Set P3.3          'reset  
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 = &H13          'ELECTRONIC VOLUME  
Call Writecom  
A = &H2F          'POWER CONTROLLER SET  
Call Writecom  
A = &HAF          'DISPLAY ON  
Call Writecom  
End Sub
```

```
.....  
Sub Writecom  
Reset P3.2        'A0  
Reset P3.1        'R/W  
Reset P3.4        'CS1  
Set P3.0          'E  
P1 = A  
Reset P3.0  
Set P3.4  
End Sub
```

```
.....  
Sub Writedata  
Set P3.2  
Reset P3.1  
Reset P3.4  
Set P3.0  
P1 = A  
Reset P3.0  
Set P3.4  
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