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NHD-C160100DiZ-FSW-FBW

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

| | |
|----------|---------------------------|
| NHD- | Newhaven Display |
| C160100- | 160 x 100 pixels |
| DiZ- | Model (I2C) |
| F- | Transflective |
| SW- | Side White LED backlight |
| F- | FSTN (+) |
| B- | 6:00 view |
| W- | Wide Temp (-20°C ~ +70°C) |
| | RoHS Compliant |

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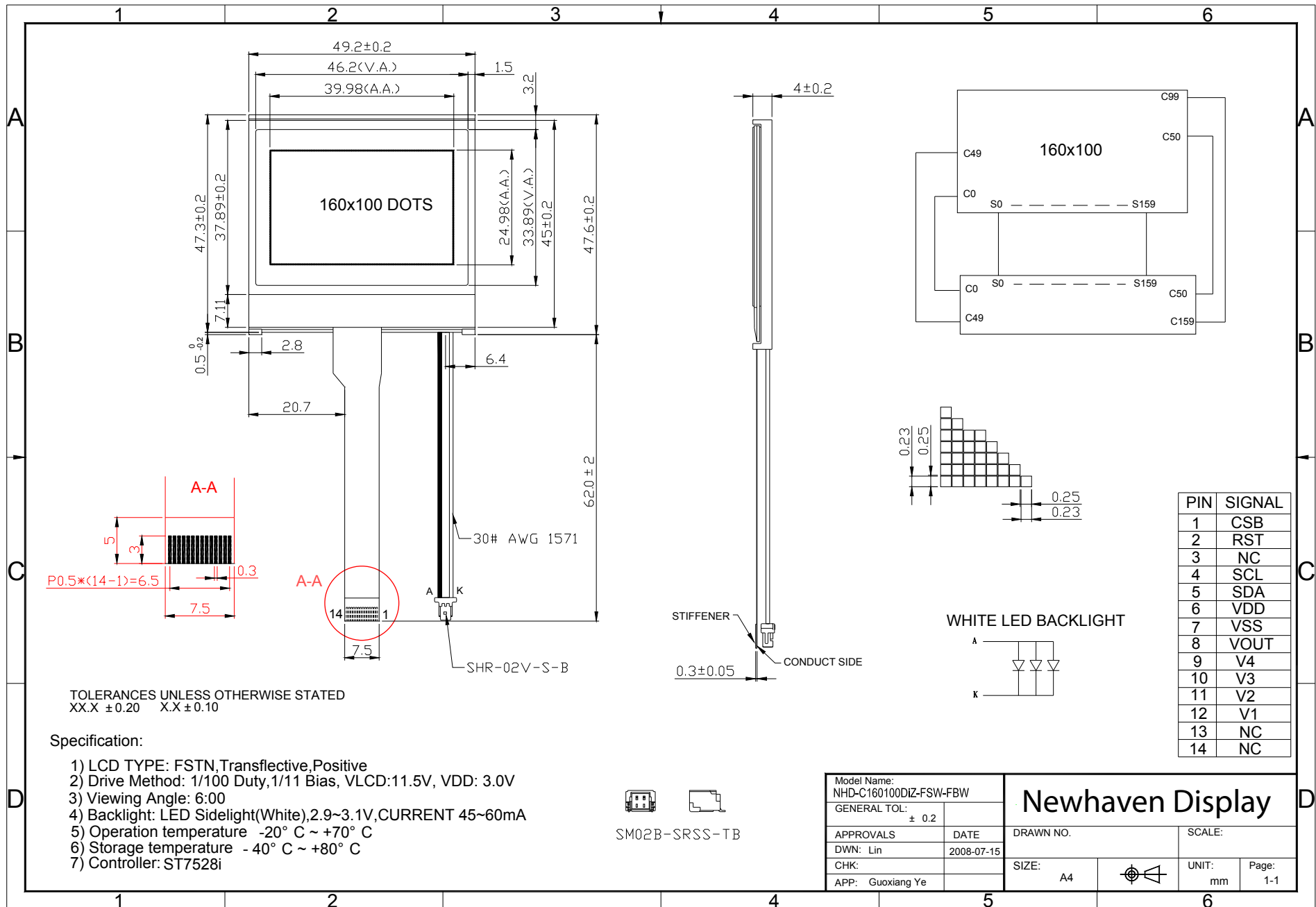
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|--|------------|
| 0 | 1/06/2008 | Initial Release | - |
| 1 | 9/18/2009 | User guide reformat | BE |
| 2 | 10/14/2009 | Updated Electrical Characteristic | MC |
| 3 | 11/9/2009 | Slave Address Updated | BE |
| 4 | 11/17/2009 | Slave Address Updated | MC |
| 5 | 11/20/2009 | Updated backlight supply current max / Updated Table of Commands | MC |
| 6 | 12/14/2010 | Updated backlight cable length | CL |

Functions and Features

- 160 x 100 pixels
- Built-in ST7528i (I2C) controller
- +3.0V power supply
- 1/100 duty cycle; 1/11 bias
- RoHS Compliant

Mechanical Drawing



TOLERANCES UNLESS OTHERWISE STATED
 XX.X ± 0.20 X.X ± 0.10

Specification:

- 1) LCD TYPE: FSTN, Transflective, Positive
- 2) Drive Method: 1/100 Duty, 1/11 Bias, VLCD: 11.5V, VDD: 3.0V
- 3) Viewing Angle: 6:00
- 4) Backlight: LED Sidelight(White), 2.9~3.1V, CURRENT 45~60mA
- 5) Operation temperature -20° C ~ +70° C
- 6) Storage temperature -40° C ~ +80° C
- 7) Controller: ST7528i



| | |
|---------------------------------------|------------|
| Model Name: NHD-C160100DIZ-FSW-FBW | |
| GENERAL TOL: ± 0.2 | |
| APPROVALS | DATE |
| DWN: Lin | 2008-07-15 |
| CHK: | |
| APP: Guoxiang Ye | |

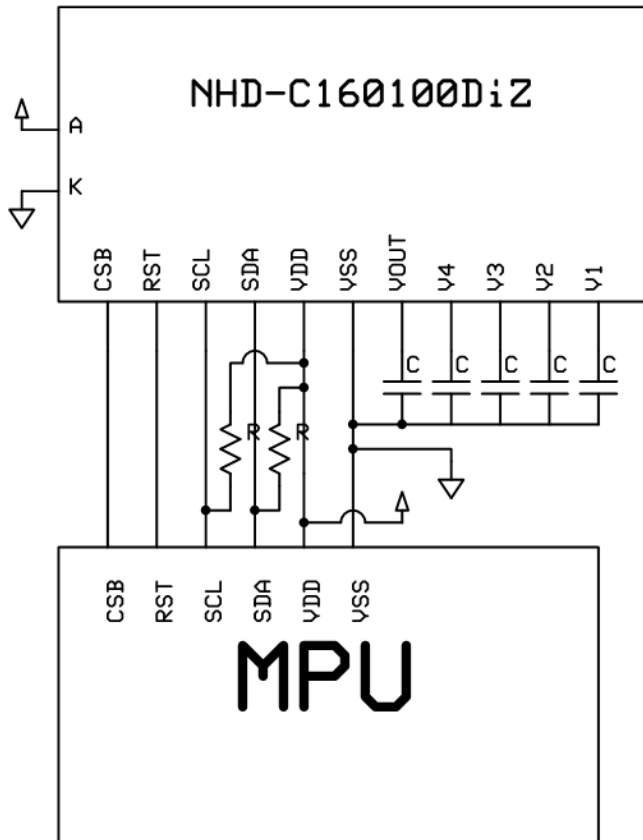
| | | | | | |
|------------------|--|-----------|--|--------------------|--|
| Newhaven Display | | DRAWN NO. | | SCALE: | |
| | | SIZE: A4 | | UNIT: mm Page: 1-1 | |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|--------|---------------------|--|
| 1 | CSB | MPU | Active Low chip select |
| 2 | RST | MPU | Active Low Reset signal |
| 3 | NC | - | No Connect |
| 4 | SCL | MPU | Serial clock input (requires pull-up) |
| 5 | SDA | MPU | Serial data input (requires pull-up) |
| 6 | VDD | Power Supply | Power supply for LCD and logic (+3.0V) |
| 7 | Vss | Power Supply | Ground |
| 8 | VOOUT | Power Supply | Connect to 1uF cap to VSS or VDD |
| 9 | V4 | Power Supply | 1.0uF-2.2uF cap to Vss |
| 10 | V3 | Power Supply | 1.0uF-2.2uF cap to Vss |
| 11 | V2 | Power Supply | 1.0uF-2.2uF cap to Vss |
| 12 | V1 | Power Supply | 1.0uF-2.2uF cap to Vss |
| 13 | NC | - | No Connect |
| 14 | NC | - | No Connect |

Recommended LCD connector: 0.5mm pitch pins. Molex p/n: 52892-1495

Backlight connector: SHR-02V-S-B **Mates with:** SM02B-SRSS-TB



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|----------------------|------|------|------|------|
| Operating Temperature Range | Top | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | Tst | Absolute Max | -40 | - | +80 | °C |
| Supply Voltage | VDD | | 2.4 | 3.0 | 3.3 | V |
| Supply Current | IDD | Ta=25°C, VDD=3.0V | - | 500 | - | uA |
| Supply for LCD (contrast) | VDD-V0 | Ta=25°C | - | 11.5 | - | 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 | | - | - | 0.4 | V |
| | | | | | | |
| Backlight Supply Voltage | VLED | | - | 3.0 | - | V |
| Backlight Supply current | ILED | VLED=3.0V | - | 45 | 60 | mA |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-----------|------|------|------|------|
| Viewing Angle - Vertical | θ | Cr≥3 | -20 | - | +40 | ° |
| Viewing Angle - Horizontal | Φ | | -35 | - | +35 | ° |
| Contrast Ratio | CR | | - | 10 | - | - |
| Response Time (rise) | Tr | - | - | 200 | 250 | ms |
| Response Time (fall) | Tf | - | - | 300 | 350 | ms |

Controller Information

Built-in ST7528. Download specification at http://www.newhavendisplay.com/app_notes/ST7528.pdf

I2C Interface:

I2C interface requires 2 lines, Serial Data and Serial Clock. Both lines must be connected to the positive supply via a pull-up resistor. Data transfer may be initiated only when the bus is not busy.

Bit transfer:

One data bit is transferred during each clock pulse. The data on the SDA line must remain stable during the HIGH period of the clock pulse, changes in the data line at this time will be interpreted as a control signal.

Start and Stop conditions:

Both data and clock lines remain HIGH when the bus is not busy. A HIGH-to-LOW transition of the data line while the clock is HIGH is define as the START condition. A LOW-to-HIGH transition of the data line while the clock is HIGH is defined as the STOP condition.

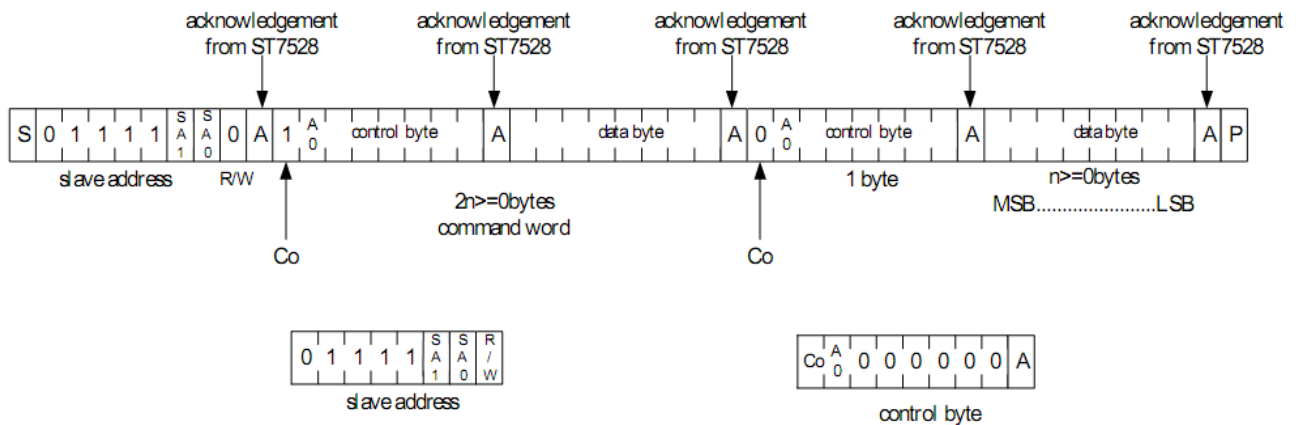
Acknowledge:

Each byte of eight bits is followed by an acknowledge bit. The ACK bit is a HIGH signal put on the bus by the transmitter, during which time the master generates an extra ACK related clock pulse. The LCD generates an ACK after the reception of each byte. The LCD will pull-down the SDA line during the ACK clock pulse, so that the SDA line is stable LOW during the HIGH period of the ACK clock pulse.

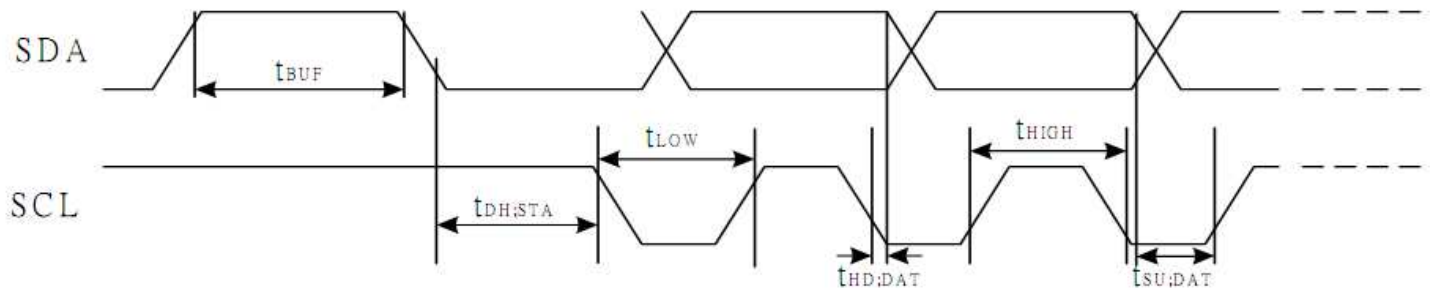
Slave Address = 0x3F

Timing Characteristics

Write mode



| | | |
|----|---|---|
| Co | 0 | Last control byte to be sent. Only a stream of data bytes is allowed to follow. This stream may only be terminated by a STOP or RE-START condition. |
| | 1 | Another control byte will follow the data byte unless a STOP or RE-START condition is received. |



($V_{DD}=3.3V, T_a=25^{\circ}C$)

| Item | Signal | Symbol | Condition | Rating | | Units |
|--|--------|----------|-----------|-------------|------|-------|
| | | | | Min. | Max. | |
| SCL clock frequency | SCL | FCLK | | - | 400 | kHZ |
| SCL clock low period | SCL | TLOW | | 1.3 | - | us |
| SCL clock high period | SCL | THIGH | | 0.6 | - | us |
| Data set-up time | SI | TSU;Data | | 100 | - | ns |
| Data hold time | SI | THD;Data | | 0 | 0.9 | us |
| SCL,SDA rise time | SCL | TR | | $20+0.1C_b$ | 300 | ns |
| SCL,SDA fall time | SCL | TF | | $20+0.1C_b$ | 300 | ns |
| Capacitive load represented by each bus line | | C_b | | - | 400 | pF |
| Setup time for a repeated START condition | SI | TSU;SUA | | 0.6 | - | us |
| Start condition hold time | SI | THD;STA | | 0.6 | - | us |
| Setup time for STOP ondition | | TSU;STO | | 0.6 | - | us |
| Tolerable spike width on bus | | TSW | | - | 50 | ns |
| BUS free time between a STOP and StART condition | SCL | TBUF | | 1.3 | | us |

Table of Commands

| Instruction | A0 | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description |
|-----------------------------------|----|----|------------|-----|-----|-----|-----|-----|-----|------|---|
| EXT=0 or 1 | | | | | | | | | | | |
| Mode Set | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 2-byte instruction to set Mode and FR(Frame frequency control) BE(Booster efficiency control) |
| | 0 | 0 | FR3 | FR2 | FR1 | FR0 | 0 | BE | x' | EXT | |
| EXT=0 | | | | | | | | | | | |
| Read display data | 1 | 1 | Read data | | | | | | | | Read data into DDRAM |
| Write display data | 1 | 0 | Write data | | | | | | | | Write data into DDRAM |
| Read status | 0 | 1 | BUSY | ON | RES | MF2 | MF1 | MF0 | DS1 | DS0 | Read the internal status |
| ICON control register ON/OFF | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | ICON | ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16 |
| Set page address | 0 | 0 | 1 | 0 | 1 | 1 | P3 | P2 | P1 | P0 | Set page address |
| Set column address MSB | 0 | 0 | 0 | 0 | 0 | 1 | Y9 | Y8 | Y7 | Y6 | Set column address MSB |
| Set column address LSB | 0 | 0 | 0 | 0 | 0 | 0 | Y5 | Y4 | Y3 | Y2 | Set column address LSB |
| Set modify-read | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Set modify-read mode |
| Reset modify-read | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | release modify-read mode |
| Display ON/OFF | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | D | D=0: Display OFF D=1: Display ON |
| Set initial display line register | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | x' | x' | 2-byte instruction to specify the initial display line to realize vertical scrolling |
| | 0 | 0 | x' | S6 | S5 | S4 | S3 | S2 | S1 | S0 | |
| Set initial COM0 register | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | x' | x' | 2-byte instruction to specify the initial COM0 to realize window scrolling |
| | 0 | 0 | x' | C6 | C5 | C4 | C3 | C2 | C1 | C0 | |
| Set partial display duty ration | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | x' | x' | 2-byte instruction to set partial display duty ratio |
| | 0 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| Set N-line inversion | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | x' | x' | 2-byte instruction to set N-line inversion register |
| | 0 | 0 | x' | x' | x' | N4 | N3 | N2 | N1 | N0 | |
| Release N-line inversion | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Release N-line inversion mode |
| Reverse display ON/OFF | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | REV | REV=0: normal display REV=1: reverse display |
| Entire display ON/OFF | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | EON | EON=0: normal display EON=1: entire display ON |

ST7528

| Instruction | A0 | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description |
|---|----|----|-----|-----|-----|-----|-----|-----|------|------|---|
| Ext=0 | | | | | | | | | | | |
| Power control | 0 | 0 | 0 | 0 | 1 | 0 | 1 | VC | VR | VF | Control power circuit operation |
| Select DC-DC step-up | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | DC1 | DC0 | Select the step-up of internal voltage converter |
| Select regulator register | 0 | 0 | 0 | 0 | 1 | 0 | 0 | R2 | R1 | R0 | Select the internal resistance ratio of the regulator resistor |
| Select electronic volumn register | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2-byte instruction to specify the reference voltage |
| | 0 | 0 | x' | x' | EV5 | EV4 | EV3 | EV2 | EV1 | EV0 | |
| Select LCD bias | 0 | 0 | 0 | 1 | 0 | 1 | 0 | B2 | B1 | B0 | Select LCD bias |
| Bias Power Save | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | Bias Power save Save the Bias current consumption |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| SHL select | 0 | 0 | 1 | 1 | 0 | 0 | SHL | x' | x' | x' | COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction |
| ADC select | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | ADC | SEG bi-direction selection ADC=0: normal direction ADC=1: reverse direction |
| Oscillator on start | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Start the built-in oscillator |
| Set power save mode | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | P | P=0: normal mode P=1: sleep mode |
| Release power save mode | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | release power save mode |
| Reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | initial the internal function |
| Set data direction & display data length(DDL) | x | x' | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 2-byte instruction to specify the number of data bytes. (SPI mode) |
| | x | x' | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| Select FRC and PWM mode | 0 | 0 | 1 | 0 | 0 | 1 | 0 | FRC | PWM1 | PWM0 | FRC(1:3FRC, 0:4FRC) PWM1 PWM0 0 0 45PWM 0 1 45 PWM 1 0 60PWM 1 1 --- |
| NOP | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | <u>No operation</u> |
| Test Instruction | 0 | 0 | 1 | 1 | 1 | 1 | x' | x' | x' | x' | <u>Don't use this instruction</u> |

| Instruction | A0 | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description |
|--|----|----|-------------------|-----|------|------|------|------|------|------|---|
| EXT=1 | | | | | | | | | | | |
| Set white mode and 1 st frame, set pulse width | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Set white mode and 1st frame |
| | 0 | 0 | X' | X' | GA05 | GA04 | GA03 | GA02 | GA01 | GA00 | |
| Set white mode and 2 nd frame, set pulse width | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set white mode and 2nd frame |
| | 0 | 0 | X' | X' | GA05 | GA04 | GA03 | GA02 | GA01 | GA00 | |
| Set white mode and 3 rd frame, set pulse width | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | Set white mode and 3rd frame |
| | 0 | 0 | X' | X' | GA05 | GA04 | GA03 | GA02 | GA01 | GA00 | |
| Set white mode and 4 th frame, set pulse width | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Set white mode and 4th frame |
| | 0 | 0 | X' | X' | GA05 | GA04 | GA03 | GA02 | GA01 | GA00 | |
| Set gray level 1 mode | 0 | 0 | 84H~87H (4 bytes) | | | | | | | | Set gray level1 |
| Set gray level 2 mode | 0 | 0 | 88H~8BH (4 bytes) | | | | | | | | Set gray level2 |
| Set gray level 3 mode | 0 | 0 | 8CH~8FH (4bytes) | | | | | | | | Set gray level3 |
| Set gray level 4 mode | 0 | 0 | 90H~93H (4bytes) | | | | | | | | Set gray level4 |
| Set gray level 5 mode | 0 | 0 | 94H~97H (4bytes) | | | | | | | | Set gray level5 |
| Set gray level 6 mode | 0 | 0 | 98H~9BH (4 bytes) | | | | | | | | Set gray level6 |
| Set gray level 7 mode | 0 | 0 | 9CH~9FH (4 bytes) | | | | | | | | Set gray level7 |
| Set gray level 8 mode | 0 | 0 | A0H~A3H (4 bytes) | | | | | | | | Set gray level8 |
| Set gray level 9 mode | 0 | 0 | A4H~A7H (4 bytes) | | | | | | | | Set gray level9 |
| Set gray level 10 mode | 0 | 0 | A8H~ABH (4 bytes) | | | | | | | | Set gray level10 |
| Set gray level 11mode | 0 | 0 | ACH~AFH (4 bytes) | | | | | | | | Set gray level11 |
| Set gray level 12 mode | 0 | 0 | B0H~B3H (4 bytes) | | | | | | | | Set gray level12 |
| Set gray level 13 mode | 0 | 0 | B4H~B7H (4 bytes) | | | | | | | | Set gray level13 |
| Set gray level 14 mode | 0 | 0 | B8H~BBH (4 bytes) | | | | | | | | Set gray level14 |
| Set Dark mode and 1st frame, set pulse width | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Set Dark mode and 1st frame, set pulse width |
| | 0 | 0 | X' | X' | GAF5 | GAF4 | GAF3 | GAF2 | GAF1 | GAF0 | |
| Set Dark mode and 2nd frame, set pulse width | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | Set Dark mode and 2nd frame, set pulse width |
| | 0 | 0 | X' | X' | GAF5 | GAF4 | GAF3 | GAF2 | GAF1 | GAF0 | |
| Set Dark mode and 3rd frame, set pulse width | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | Set Dark mode and 3rd frame, set pulse width |
| | 0 | 0 | X' | X' | GAF5 | GAF4 | GAF3 | GAF2 | GAF1 | GAF0 | |
| Set Dark mode and 4th frame, set pulse width | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | Set Dark mode and 4th frame, set pulse width |
| | 0 | 0 | X' | X' | GAF5 | GAF4 | GAF3 | GAF2 | GAF1 | GAF0 | |

Example Initialization Program

Slave Address = 0x3F

```
/******  
const char Slave = 0x7E;                //slave address+Write bit  
  
const char Comsend = 0x00;  
  
const char Datasend = 0x40;  
  
/******  
void I2C_out(unsigned char j)           //I2C Output  
{  
    int n;  
    unsigned char d;  
    d=j;  
    for(n=0;n<8;n++){                  //send 8 bits  
        if((d&0x80)==0x80)             //get only the MSB  
            SDA=1;                       //if 1, then SDA=1  
        else  
            SDA=0;                       //if 0, then SDA=0  
        d=(d<<1);                       //shift data byte left  
        SCL = 0;  
        SCL = 1;                         //clock in data  
        SCL = 0;  
    }  
    SCL = 1;  
    while(SDA==1){                      //wait here until ACK  
        SCL=0;  
        SCL=1;  
    }  
    SCL=0;  
}  
/******  
void I2C_Start(void)  
{  
    SCL=1;  
    SDA=1;  
    SDA=0;  
    SCL=0;  
}  
/******  
void I2C_Stop(void)  
{  
    SDA=0;  
    SCL=0;  
    SCL=1;  
    SDA=1;  
}  
/******  
void Show(unsigned char *text)  
{  
    int n,i;  
    char page=0xB0;                     //first page  
    for(i=0;i<13;i++){                 //100 pixels = 12.5 pixels  
        I2C_Start();  
        I2C_out(Slave);  
        I2C_out(Comsend);  
    }  
}
```

```

        I2C_out(page);
        I2C_out(0x10);           //column address Y9:Y6
        I2C_out(0x01);         //column address Y5:Y2
        I2C_Stop();
        I2C_Start();
        I2C_out(Slave);
        I2C_out(Datasend);
        for(n=0;n<160;n++){
            I2C_out(*text);     //send data 4 times for grayscaling
            I2C_out(*text);
            I2C_out(*text);
            I2C_out(*text);
            ++text;             //point to next byte of data
            delay(10);
        }
        I2C_Stop();
        page++;                 //move to next page
    }
}
/*****
*      Initialization      *
*****/
void init_LCD()
{
    I2C_Start();
    I2C_out(Slave);
    I2C_out(Comsend);
    I2C_out(0x48);             //partial display duty ratio
    I2C_out(0x64);             // 1/100 duty
    I2C_out(0xA0);             //ADC select
    I2C_out(0xC8);             //SHL select
    I2C_out(0x44);             //initial Com0 register
    I2C_out(0x00);             //scan from Com0
    I2C_out(0xAB);             //OSC on
    I2C_out(0x26);             //
    I2C_out(0x81);             //set electronic volume
    I2C_out(0x15);             //vopcode=0x1C
    I2C_out(0x56);             //set 1/11 bias
    I2C_out(0x64);             //3x
    delay(2);
    I2C_out(0x2C);             //
    I2C_out(0x66);             //5x
    delay(2);
    I2C_out(0x2E);             //
    delay(2);
    I2C_out(0x2F);             //power control
    I2C_out(0xF3);             //bias save circuit
    I2C_out(0x00);             //
    I2C_out(0x96);             //frc and pwm
    I2C_out(0x38);             //external mode
    I2C_out(0x75);             //
    I2C_out(0x97);             //3frc, 45 pwm
    I2C_out(0x80);             //start 16-level grayscale settings
    I2C_out(0x00);             //
    I2C_out(0x81);             //
    I2C_out(0x00);             //
    I2C_out(0x82);             //
    I2C_out(0x00);             //
    I2C_out(0x83);             //
    I2C_out(0x00);             //
    I2C_out(0x84);             //
    I2C_out(0x06);             //
    I2C_out(0x85);             //

```

```
I2C_out(0x06); //
I2C_out(0x86); //
I2C_out(0x06); //
I2C_out(0x87); //
I2C_out(0x06); //
I2C_out(0x88); //
I2C_out(0x0B); //
I2C_out(0x89); //
I2C_out(0x0B); //
I2C_out(0x8A); //
I2C_out(0x0B); //
I2C_out(0x8B); //
I2C_out(0x0B); //
I2C_out(0x8C); //
I2C_out(0x10); //
I2C_out(0x8D); //
I2C_out(0x10); //
I2C_out(0x8E); //
I2C_out(0x10); //
I2C_out(0x8F); //
I2C_out(0x10); //
I2C_out(0x90); //
I2C_out(0x15); //
I2C_out(0x91); //
I2C_out(0x15); //
I2C_out(0x92); //
I2C_out(0x15); //
I2C_out(0x93); //
I2C_out(0x15); //
I2C_out(0x94); //
I2C_out(0x1A); //
I2C_out(0x95); //
I2C_out(0x1A); //
I2C_out(0x96); //
I2C_out(0x1A); //
I2C_out(0x97); //
I2C_out(0x1A); //
I2C_out(0x98); //
I2C_out(0x1E); //
I2C_out(0x99); //
I2C_out(0x1E); //
I2C_out(0x9A); //
I2C_out(0x1E); //
I2C_out(0x9B); //
I2C_out(0x1E); //
I2C_out(0x9C); //
I2C_out(0x23); //
I2C_out(0x9D); //
I2C_out(0x23); //
I2C_out(0x9E); //
I2C_out(0x23); //
I2C_out(0x9F); //
I2C_out(0x23); //
I2C_out(0xA0); //
I2C_out(0x27); //
I2C_out(0xA1); //
I2C_out(0x27); //
I2C_out(0xA2); //
I2C_out(0x27); //
I2C_out(0xA3); //
I2C_out(0x27); //
I2C_out(0xA4); //
I2C_out(0x2B); //
```

```
I2C_out(0xA5); //
I2C_out(0x2B); //
I2C_out(0xA6); //
I2C_out(0x2B); //
I2C_out(0xA7); //
I2C_out(0x2B); //
I2C_out(0xA8); //
I2C_out(0x2F); //
I2C_out(0xA9); //
I2C_out(0x2F); //
I2C_out(0xAA); //
I2C_out(0x2F); //
I2C_out(0xAB); //
I2C_out(0x2F); //
I2C_out(0xAC); //
I2C_out(0x32); //
I2C_out(0xAD); //
I2C_out(0x32); //
I2C_out(0xAE); //
I2C_out(0x32); //
I2C_out(0xAF); //
I2C_out(0x32); //
I2C_out(0xB0); //
I2C_out(0x35); //
I2C_out(0xB1); //
I2C_out(0x35); //
I2C_out(0xB2); //
I2C_out(0x35); //
I2C_out(0xB3); //
I2C_out(0x35); //
I2C_out(0xB4); //
I2C_out(0x38); //
I2C_out(0xB5); //
I2C_out(0x38); //
I2C_out(0xB6); //
I2C_out(0x38); //
I2C_out(0xB7); //
I2C_out(0x38); //
I2C_out(0xB8); //
I2C_out(0x3A); //
I2C_out(0xB9); //
I2C_out(0x3A); //
I2C_out(0xBA); //
I2C_out(0x3A); //
I2C_out(0xBB); //
I2C_out(0x3A); //
I2C_out(0xBC); //
I2C_out(0x3C); //
I2C_out(0xBD); //
I2C_out(0x3C); //
I2C_out(0xBF); //
I2C_out(0x3C); //
I2C_out(0xBF); //
I2C_out(0x3C); //end grayscale settings
I2C_out(0x38); //
I2C_out(0x74); //
I2C_out(0xAF); //display on
I2C_Stop();
}
```

/******

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