

NHD-C0216CiZ-FSW-FBW-3V3

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

| | |
|--------|------------------------------|
| NHD- | Newhaven Display |
| C0216- | COG, 2 lines x 16 characters |
| CiZ- | Model |
| F- | Transflective |
| SW- | Side White LED Backlight |
| F- | FSTN (+) |
| B- | 6:00 View Angle |
| W- | Wide Temp (-20 c ~ +70 c) |
| 3V3- | 3Vdd, 3V Backlight |
| | RoHS Compliant |

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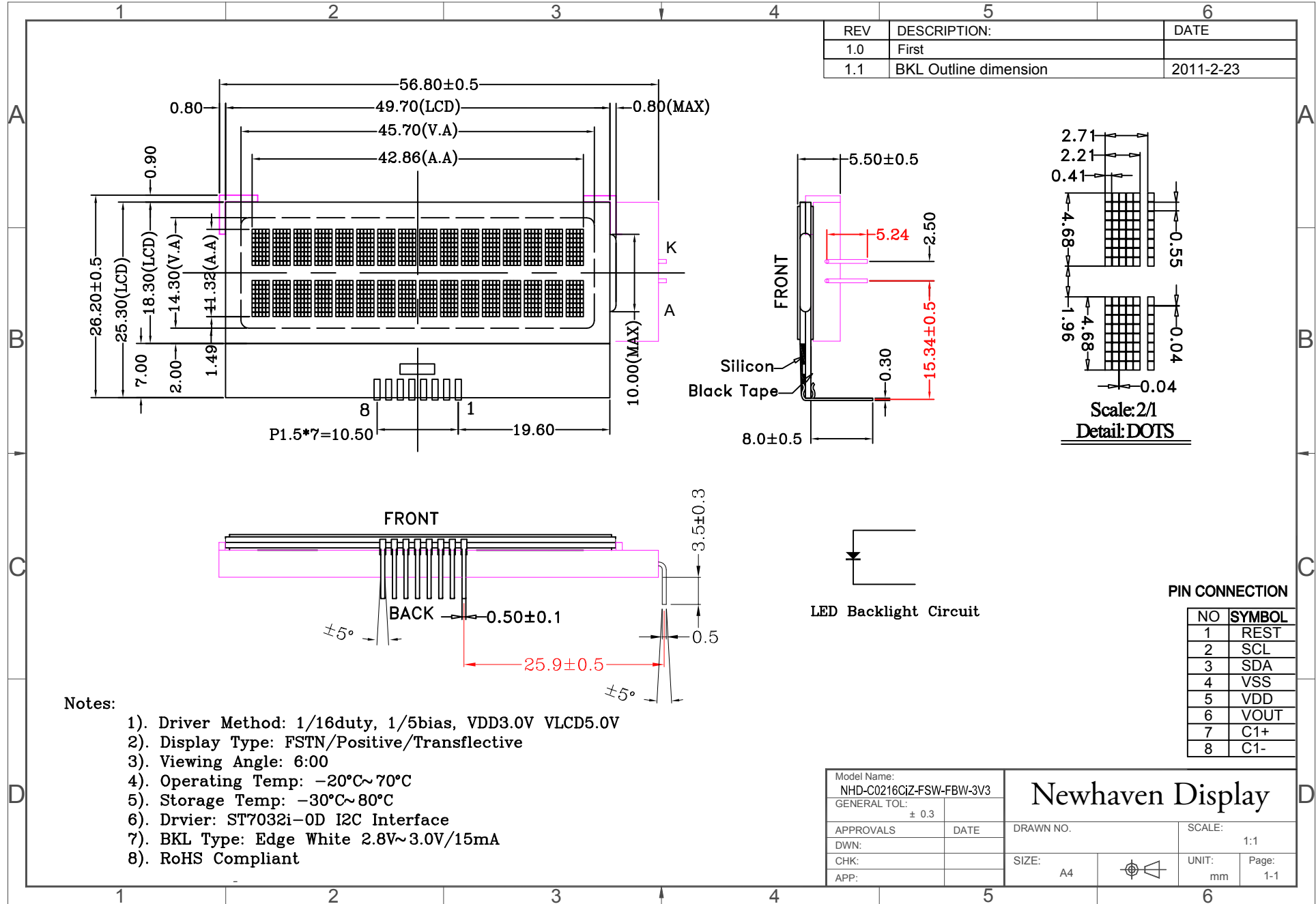
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|---|------------|
| 0 | 3/10/2000 | Initial Release | |
| 1 | 5/14/2009 | User guide reformat | BE |
| 2 | 10/9/2009 | Updated Electrical Characteristic Information | MC |
| 3 | 11/5/2009 | Block Diagram Update | BE |
| 4 | 11/19/2009 | Updated backlight current | MC |
| 5 | 2/12/2010 | Updated Font table | MC |
| 6 | 4/18/2011 | Mechanical drawing updated | AK |
| 7 | 8/26/2011 | Mechanical drawing updated | TJ |
| 8 | 11/29/2011 | Mechanical drawing updated | AK |
| 9 | 3/30/2012 | Example initialization program updated | AK |

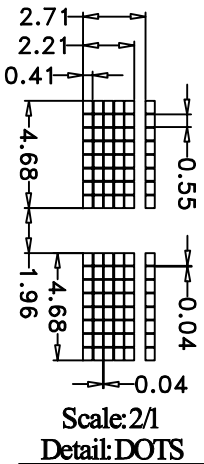
Functions and Features

- 2 lines x 16 characters
- Built-in ST7032i-oD with I²C interface
- 5x8 pixels with cursor
- 3V power supply
- 1/16 duty, 1/5 bias
- RoHS Compliant

Mechanical Drawing



| REV | DESCRIPTION: | DATE |
|-----|-----------------------|-----------|
| 1.0 | First | |
| 1.1 | BKL Outline dimension | 2011-2-23 |



PIN CONNECTION

| NO | SYMBOL |
|----|--------|
| 1 | REST |
| 2 | SCL |
| 3 | SDA |
| 4 | VSS |
| 5 | VDD |
| 6 | VOUT |
| 7 | C1+ |
| 8 | C1- |

Notes:

- 1). Driver Method: 1/16duty, 1/5bias, VDD3.0V VLCD5.0V
- 2). Display Type: FSTN/Positive/Transflective
- 3). Viewing Angle: 6:00
- 4). Operating Temp: -20°C~70°C
- 5). Storage Temp: -30°C~80°C
- 6). Driver: ST7032i-0D I2C Interface
- 7). BKL Type: Edge White 2.8V~3.0V/15mA
- 8). RoHS Compliant

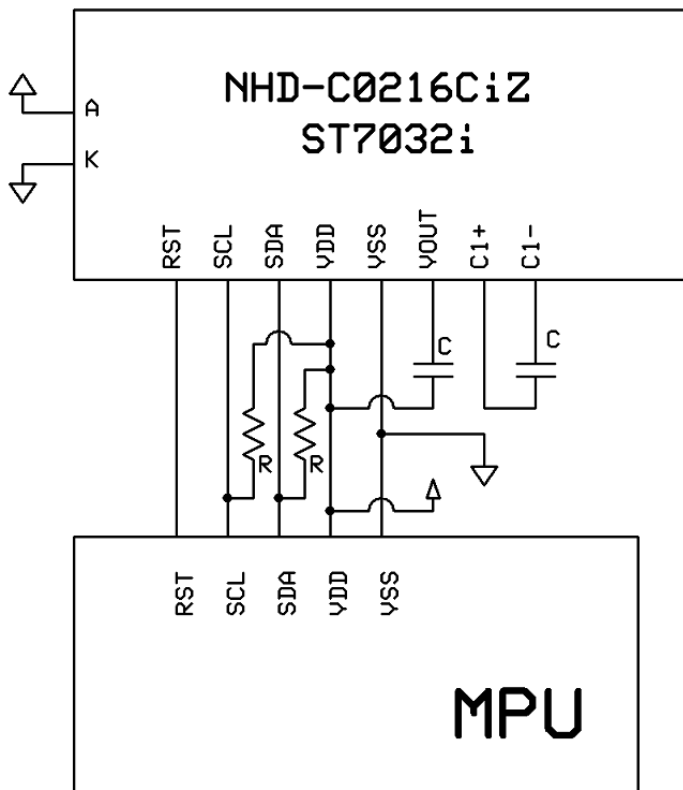
| | | | |
|---|------|---------------------------|-----------|
| Model Name: NHD-C0216CiZ-FSW-FBW-3V3 | | <h2>Newhaven Display</h2> | |
| GENERAL TOL: ± 0.3 | | | |
| APPROVALS | DATE | DRAWN NO. | SCALE: |
| DWN: | | | 1:1 |
| CHK: | | SIZE: A4 | UNIT: mm |
| APP: | | | Page: 1-1 |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|--------|---------------------|--|
| 1 | RST | MPU | Active LOW Reset Signal |
| 2 | SCL | MPU | Serial clock |
| 3 | SDA | MPU | Input Data |
| 4 | Vss | Power Supply | Ground |
| 5 | VDD | Power Supply | Power supply for logic for LCD (3.0V) |
| 6 | VOUT | Power Supply | DC/DC voltage converter. Connect to 1uF capacitor to VDD |
| 7 | C1+ | CAP | Voltage booster circuit. Connect to 1uF cap to PIN8 |
| 8 | C1- | CAP | Voltage booster circuit. Connect to 1uF cap to PIN7 |
| A | LED+ | Power Supply | Power supply for Backlight(3.0V) |
| K | LED- | Power Supply | Backlight Ground |

Recommended LCD connector: 1.5mm pitch pins

Backlight connector: A and K pins **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 | | 2.7 | 3.0 | 3.3 | V |
| Supply Current | IDD | Ta=25°C, VDD=3.0V | - | 0.3 | 0.5 | mA |
| Supply for LCD (contrast) | VDD-Vo | Ta=25°C | - | 5.0 | - | 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 | - | 15 | 20 | mA |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|--------|-----------|------|------|------|------|
| Viewing Angle – Vertical | AV | Cr ≥ 2 | -60 | - | +35 | ° |
| Viewing Angle - Horizontal | AH | Cr ≥ 2 | -40 | - | +40 | ° |
| Contrast Ratio | Cr | | - | 6 | - | - |
| Response Time (rise) | Tr | - | - | 150 | 250 | ms |
| Response Time (fall) | Tr | - | - | 150 | 250 | ms |

Slave Address = 0x7C

Write mode

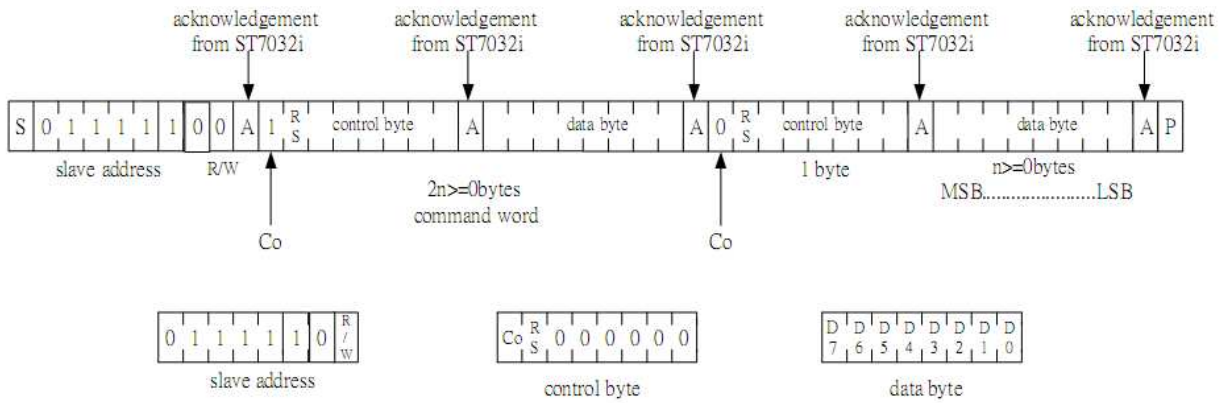
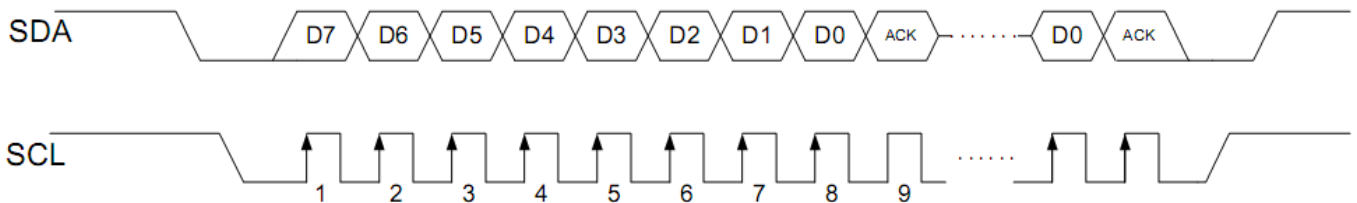


Figure 5. 2-line Interface protocol

| | | |
|----|---|---|
| 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 condition. |
| | 1 | Another control byte will follow the data byte unless a STOP condition is received. |



| Display Position | 1 | 2 | 3 | 4 | 5 | 6 | | 38 | 39 | 40 |
|-----------------------------|----|----|----|----|----|----|-------|----|----|----|
| DDRAM Address (hexadecimal) | 00 | 01 | 02 | 03 | 04 | 05 | | 25 | 26 | 27 |
| | 40 | 41 | 42 | 43 | 44 | 45 | | 65 | 66 | 67 |

Controller Information

Built-in ST7032i-oD. Download specification at http://www.newhavendisplay.com/app_notes/ST7032.pdf

➤ instruction table at "Extension mode"

(when "EXT" option pin connect to VSS, the instruction set follow below table)

| Instruction | Instruction Code | | | | | | | | | | Description | Instruction Execution Time | | |
|----------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|----------------------------|------------|------------|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | OSC=380KHz | OSC=540kHz | OSC=700KHz |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM, and set DDRAM address to "00H" from AC | 1.08 ms | 0.76 ms | 0.59 ms |
| Return Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 x | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.08 ms | 0.76 ms | 0.59 ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | /D | S | Sets cursor move direction and specifies display shift. These operations are performed during data write and read. | 26.3 us | 18.5 us | 14.3 us |
| Display ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | D=1:entire display on C=1:cursor on B=1:cursor position on | 26.3 us | 18.5 us | 14.3 us |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | DH | *0 | IS | DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select | 26.3 us | 18.5 us | 14.3 us |
| Set DDRAM address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter | 26.3 us | 18.5 us | 14.3 us |
| Read Busy flag and address | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read. | 0 | 0 | 0 |
| Write data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM/ICONRAM) | 26.3 us | 18.5 us | 14.3 us |
| Read data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM/ICONRAM) | 26.3 us | 18.5 us | 14.3 us |

Note *: this bit is for test command, and must always set to "0"

Instruction table 0 (IS=0)

| | | | | | | | | | | | | | | |
|-------------------------|---|---|---|---|-----|-----|-----|-----|-----|-----|--|---------|---------|---------|
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | x | x | S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data. | 26.3 us | 18.5 us | 14.3 us |
| Set CGRAM | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter | 26.3 us | 18.5 us | 14.3 us |

Instruction table 1 (IS=1)

| | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|-----|------|------|------|--|---------|---------|---------|
| Internal OSC frequency | 0 | 0 | 0 | 0 | 0 | 1 | BS | F2 | F1 | F0 | BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency. | 26.3 us | 18.5 us | 14.3 us |
| Set ICON address | 0 | 0 | 0 | 1 | 0 | 0 | AC3 | AC2 | AC1 | AC0 | Set ICON address in address counter. | 26.3 us | 18.5 us | 14.3 us |
| Power/ICON control/Contrast set | 0 | 0 | 0 | 1 | 0 | 1 | Ion | Bon | C5 | C4 | Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode. | 26.3 us | 18.5 us | 14.3 us |
| Follower control | 0 | 0 | 0 | 1 | 1 | 0 | Fon | Rab2 | Rab1 | Rab0 | Fon: set follower circuit on/off Rab2~0: select follower amplified ratio. | 26.3 us | 18.5 us | 14.3 us |
| Contrast set | 0 | 0 | 0 | 1 | 1 | 1 | C3 | C2 | C1 | C0 | Contrast set for internal follower mode. | 26.3 us | 18.5 us | 14.3 us |

Example Initialization Program

```
/******  
void I2C_out(unsigned char j)                //I2C Output  
{  
    int n;  
    unsigned char d;  
    d=j;  
    for(n=0;n<8;n++){  
        if((d&0x80)==0x80)  
            SDA=1;  
        else  
            SDA=0;  
        d=(d<<1);  
        SCL = 0;  
        SCL = 1;  
        SCL = 0;  
    }  
    SCL = 1;  
    while(SDA==1){  
        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;  
    I2C_Start();  
    I2C_out(Slave);  
    I2C_out(Datasend);  
    for(n=0;n<16;n++){  
        I2C_out(*text);  
        ++text;  
    }  
    I2C_Stop();  
}  
/******
```

```
*      Initialization For ST7032i      *
*****/
void init_LCD()
{
I2C_Start();
I2C_out(0x7C);
I2C_out(0x00);
I2C_out(0x38);
delay(10);
I2C_out(0x39);
delay(10);
I2C_out(0x14);
I2C_out(0x78);
I2C_out(0x5E);
I2C_out(0x6D);
I2C_out(0x0C);
I2C_out(0x01);
I2C_out(0x06);
delay(10);
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



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