

NHD-C0220BiZ-FSW-FBW-3V3M

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

NHD- Newhaven Display
C0220- COG 2 lines x 20 characters
BiZ- Model, with I2C interface
F- Transflective
SW- Side White LED backlight
F- FSTN (+)
B- 6:00 view
W- Wide Temp (-20°C ~ +70°C)
3V3- 3.3V power supply
M- with Mounting holes
RoHS Compliant

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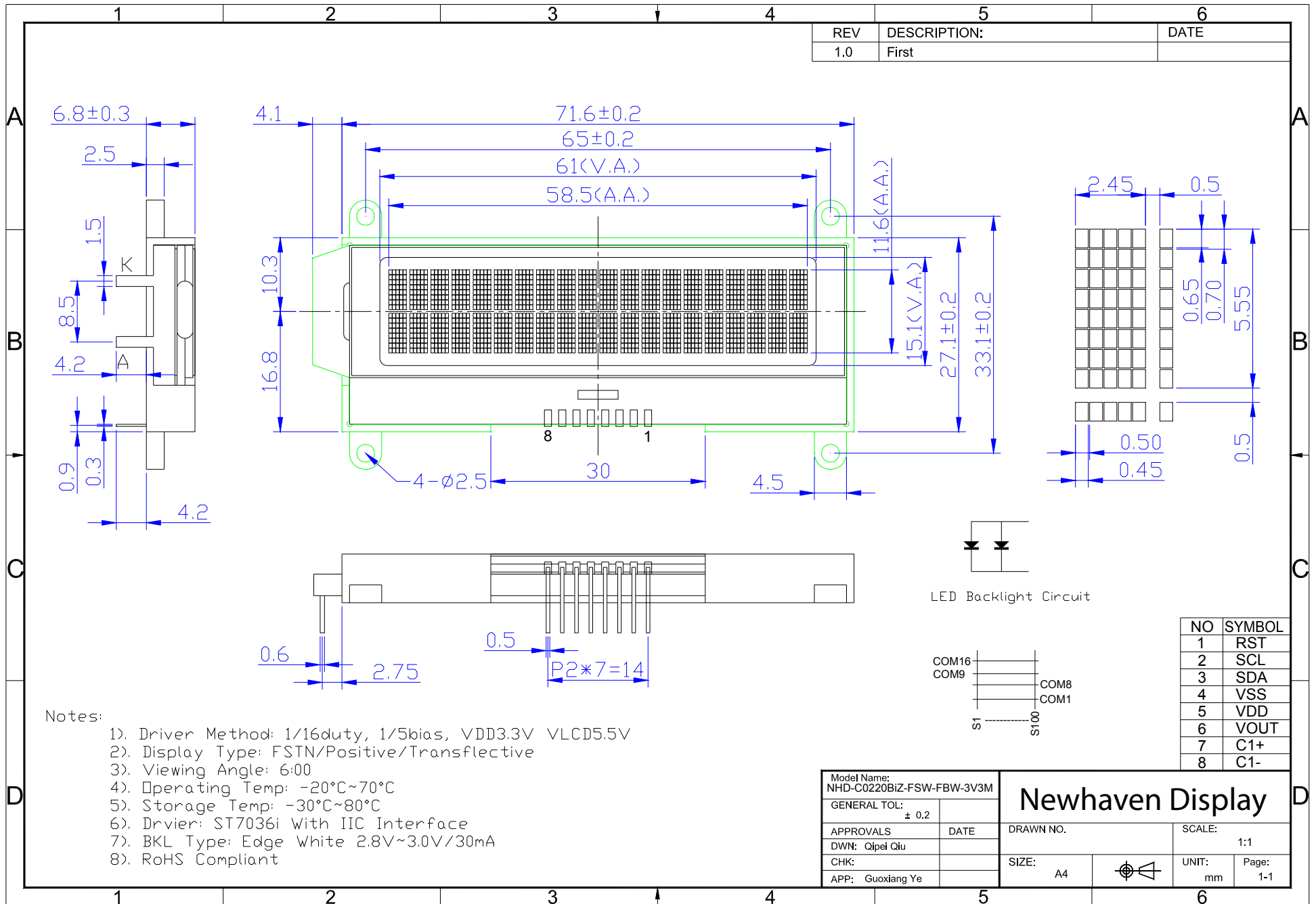
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|--|------------|
| 0 | 7/8/2009 | Initial Release | |
| 1 | 10/9/2009 | Updated Electrical Characteristic | MC |
| 2 | 11/20/2009 | Updated backlight supply current | MC |
| 3 | 5/27/2011 | Display character address code updated | AK |

Functions and Features

- 2 lines x 20 characters
- Built-in ST7036i controller with I2C interface
- 3.3V power supply
- 1/16 duty, 1/5 bias
- Built-in DC supply for VLCD (requires 2 external capacitors)

Mechanical Drawing

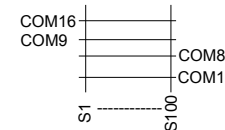


| | | |
|-----|--------------|------|
| REV | DESCRIPTION: | DATE |
| 1.0 | First | |

Notes:

- 1). Driver Method: 1/16duty, 1/5bias, VDD3.3V VLCD5.5V
- 2). Display Type: FSTN/Positive/Transflective
- 3). Viewing Angle: 6:00
- 4). Operating Temp: $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$
- 5). Storage Temp: $-30^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- 6). Driver: ST7036i With IIC Interface
- 7). BKL Type: Edge White 2.8V~3.0V/30mA
- 8). RoHS Compliant

LED Backlight Circuit



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

| | |
|--|-----------|
| Model Name: NHD-C0220BiZ-FSW-FBW-3V3M | |
| GENERAL TOL: | ± 0.2 |
| APPROVALS | DATE |
| DWN: Qipei Qiu | |
| CHK: | |
| APP: Guoxiang Ye | |

Newhaven Display

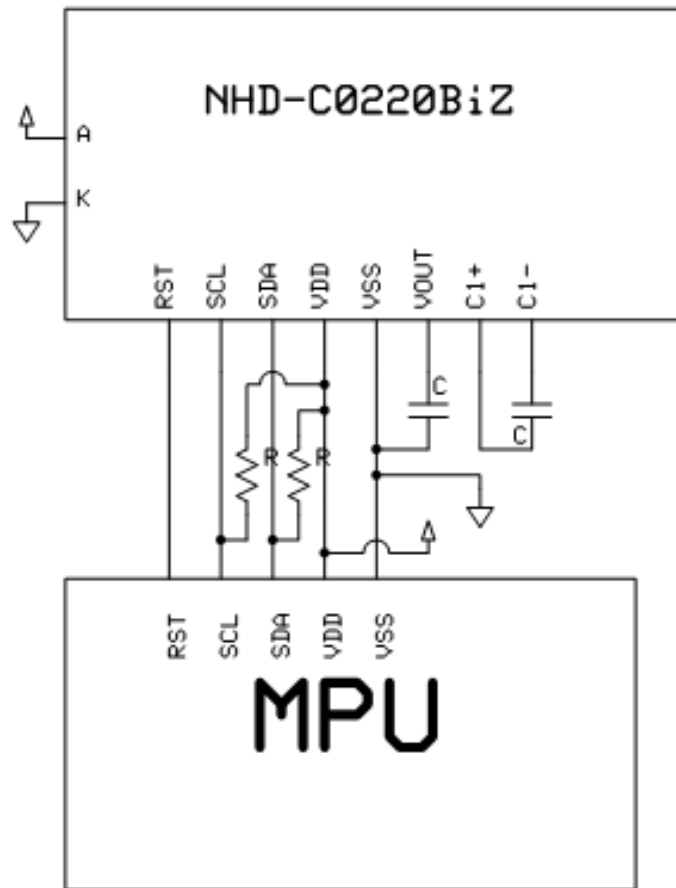
| | |
|-----------|-----------|
| DRAWN NO. | SCALE: |
| SIZE: A4 | 1:1 |
| UNIT: mm | Page: 1-1 |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|--------|---------------------|--|
| 1 | RST | MPU | Active LOW Reset |
| 2 | SCL | MPU | Serial Clock (requires pull-up resistor) |
| 3 | SDA | MPU | Serial Data (requires pull-up resistor) |
| 4 | VSS | Power Supply | GND |
| 5 | VDD | Power Supply | +3.3V |
| 6 | VOUT | CAP | Voltage booster circuit – connect to 1uF cap to VSS or VDD |
| 7 | C1+ | CAP | Connect to 1uF cap to PIN8 |
| 8 | C1- | CAP | Connect to 1uF cap to PIN7 |

Recommended LCD connector: 2.0mm pitch pins, solder directly into PCB

Backlight connector: 8.5mm pitch pins, solder directly into PCB **Mates with:** ---



Capacitance 0.47uF~2.2uF

Recommended value = 1uF

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 | 3.3 | 3.5 | V |
| Supply Current | IDD | VDD=3.3V | | 1 | | mA |
| Supply for LCD (contrast) | VDD-V0 | VLCD=VDD-V0 | 2.7 | | 7.0 | 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 |
| | | | | | | |
| Backlight Supply Voltage – White | VLED | - | 2.8 | 3.0 | 3.0 | V |
| Backlight Supply Current – White | Iled | - | - | 30 | 45 | 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 | 200 | ms |
| Response Time (fall) | Tr | - | - | 150 | 200 | ms |

Controller Information

Built-in ST7036i. Download specification at http://www.newhavendisplay.com/app_notes/ST7036.pdf

Slave Address = 0x78

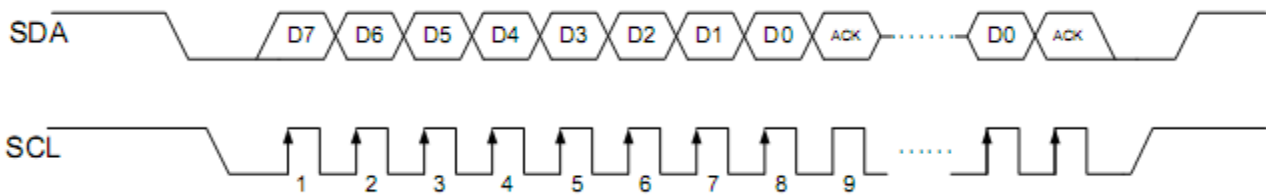
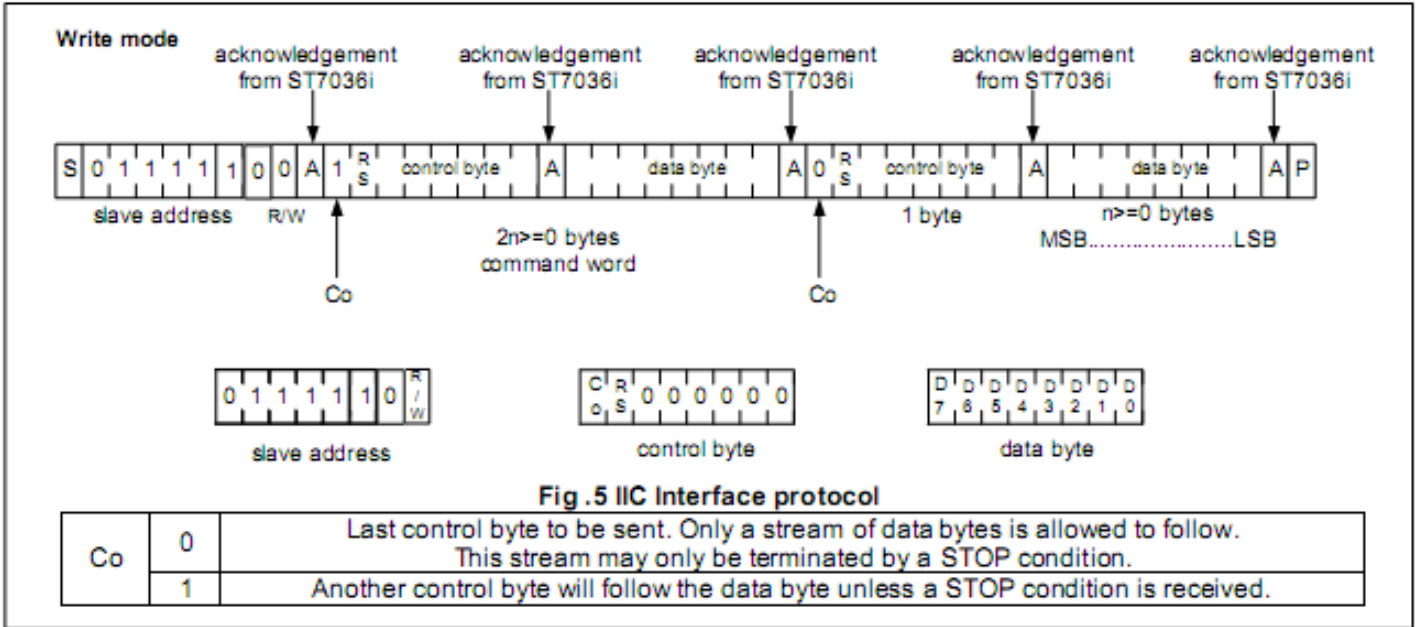


Table of Commands

| Instruction | Instruction Code | | | | | | | | | | Description | |
|----------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM. and set DDRAM address to "00H" from AC | |
| 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. |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Sets cursor move direction and specifies display shift. These operations are performed during data write and read. |
| 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 |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | DH | IS2 | IS1 | | DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS[2:1]: instruction table select |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | | Set DDRAM address in address counter |
| 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. |
| Write Data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | Write data into internal RAM (DDRAM/CGRAM/ICONRAM) |
| Read Data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | Read data from internal RAM (DDRAM/CGRAM/ICONRAM) |

| Instruction table 0(IS[2:1]=[0,0]) | | | | | | | | | | | |
|------------------------------------|---|---|---|---|-----|-----|-----|-----|-----|-----|--|
| 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. |
| Set CGRAM | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter |

| Instruction table 1(IS[2:1]=[0,1]) | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|-----|------|------|------|---|
| Bias Set | 0 | 0 | 0 | 0 | 0 | 1 | BS | 1 | 0 | FX | BS=1:1/4 bias BS=0:1/5 bias FX: fixed on high in 3-line application and fixed on low in other applications. |
| Set ICON Address | 0 | 0 | 0 | 1 | 0 | 0 | AC3 | AC2 | AC1 | AC0 | Set ICON address in address counter. |
| 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. |
| Follower Control | 0 | 0 | 0 | 1 | 1 | 0 | Fon | Rab2 | Rab1 | Rab0 | Fon: set follower circuit on/off Rab2~0: select follower amplified ratio. |
| Contrast Set | 0 | 0 | 0 | 1 | 1 | 1 | C3 | C2 | C1 | C0 | Contrast set for internal follower mode. |

| Instruction table 2(IS[2:1]=[1,0]) | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|----|---|---|---|-----------------------------------|
| Double Height Position Select | 0 | 0 | 0 | 0 | 0 | 1 | UD | X | x | x | UD: Double height position select |
| Reserved | 0 | 0 | 0 | 1 | X | X | X | X | X | X | Do not use (reserved for test) |

Display Character Address Code

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F | 50 | 51 | 52 | 53 |

Built-in Font Table (OPR1 = 0, OPR2 = 0)

| b7-b4 b3-b0 | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000 | | | | | | | | | | | | | | | | |
| 0001 | | | | | | | | | | | | | | | | |
| 0010 | | | | | | | | | | | | | | | | |
| 0011 | | | | | | | | | | | | | | | | |
| 0100 | | | | | | | | | | | | | | | | |
| 0101 | | | | | | | | | | | | | | | | |
| 0110 | | | | | | | | | | | | | | | | |
| 0111 | | | | | | | | | | | | | | | | |
| 1000 | | | | | | | | | | | | | | | | |
| 1001 | | | | | | | | | | | | | | | | |
| 1010 | | | | | | | | | | | | | | | | |
| 1011 | | | | | | | | | | | | | | | | |
| 1100 | | | | | | | | | | | | | | | | |
| 1101 | | | | | | | | | | | | | | | | |
| 1110 | | | | | | | | | | | | | | | | |
| 1111 | | | | | | | | | | | | | | | | |

Example Initialization Program

```

/*****
*           Initialization For ST7036i           *
*****/
void init_LCD()
{
I2C_Start();
I2C_out(Slave);//Slave=0x78
I2C_out(Comsend);//Comsend = 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();
}
/*****/

/*****
*           Output command or data via I2C           *
*****/
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;
}
/*****/

/*****
*           I2C Start           *
*****/
```

```

*****/
void I2C_Start(void)
{
    SCL=1;
    SDA=1;
    SDA=0;
    SCL=0;
}
/*****/

/*****
*           I2C Stop           *
*****/
void I2C_Stop(void)
{
    SDA=0;
    SCL=0;
    SCL=1;
    SDA=1;
}
/*****/

/*****
*           Send string of ASCII data to LCD           *
*****/
void Show(unsigned char *text)
{
    int n,d;
    d=0x00;
    I2C_Start();
    I2C_out(Slave); //Slave=0x78
    I2C_out(Datasend); //Datasend=0x40
    for(n=0;n<20;n++){
        I2C_out(*text);
        ++text;
    }
    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 , 200hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C , 200hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C 200hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C , 200hrs | 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. | +60°C , 90% RH , 96hrs | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -20°C,30min -> 25°C,5min -> 70°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