

NHD-C0216CU-FN-GBW-3V

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

| | |
|--------|------------------------------|
| NHD- | Newhaven Display |
| C0216- | COG, 2 Lines x 16 Characters |
| CU- | Model |
| F- | Transflective |
| N- | No LED Backlight |
| G- | STN Positive Gray |
| B- | 6:00 View Angle |
| W- | Wide Temp |
| 3V- | 3V _{DD} |
| | 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

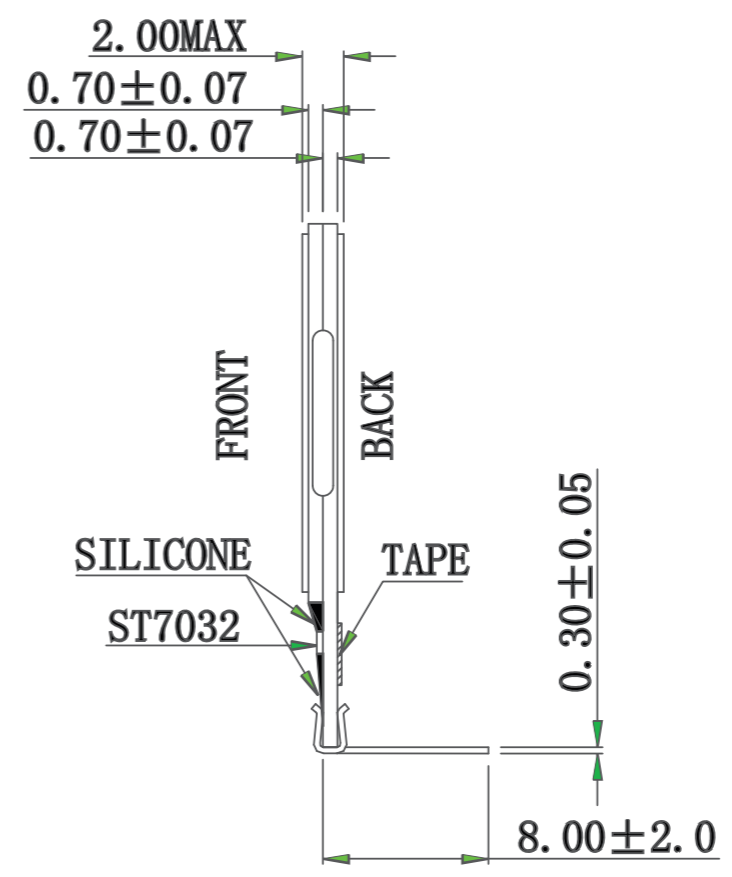
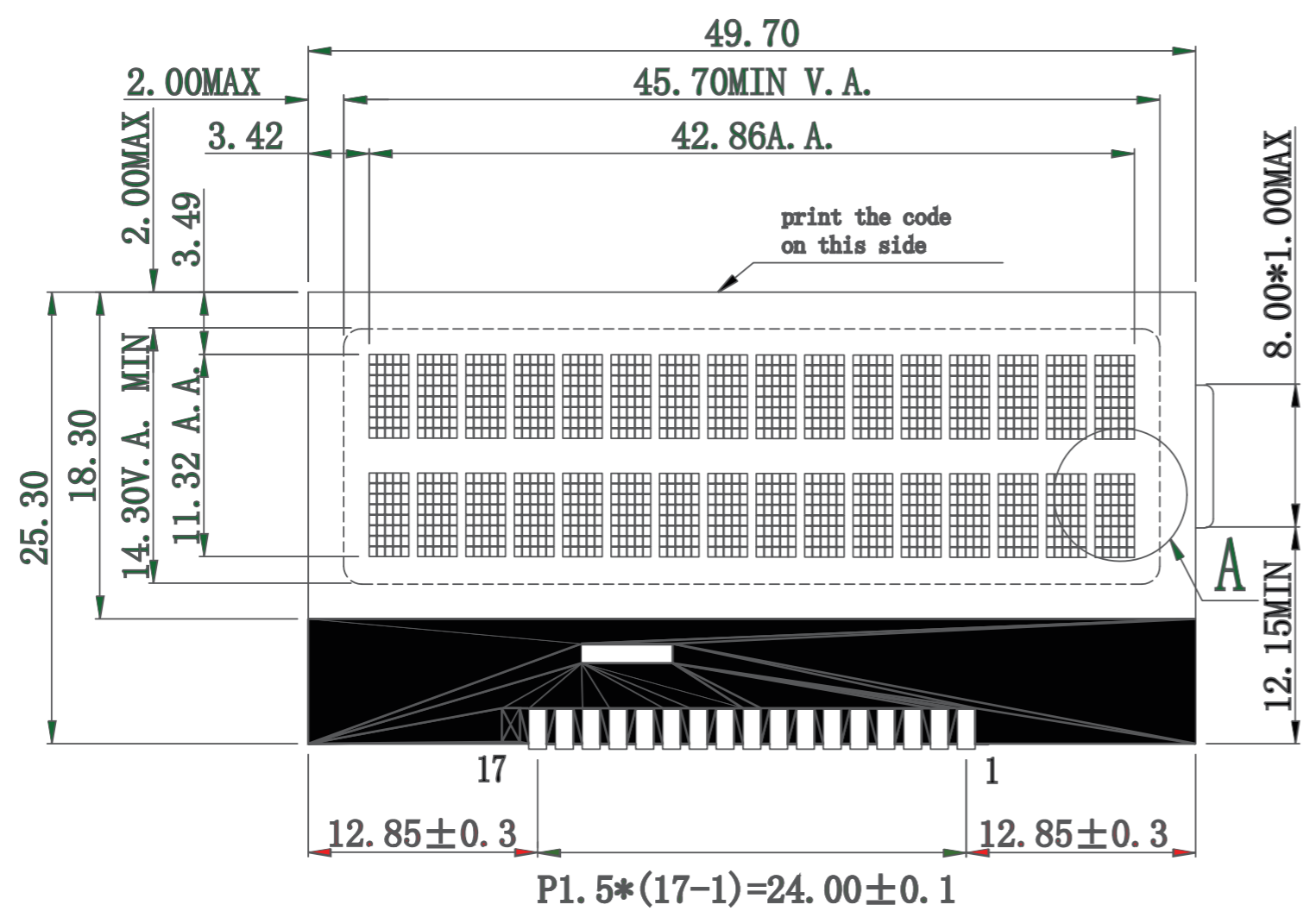
Document Revision History

| Revision | Date | Description | Changed by |
|----------|-----------|------------------------------------|------------|
| 0 | 9/18/2007 | Initial Release | - |
| 1 | 4/27/2009 | User guide reformat | BE |
| 2 | 10/9/2009 | Updated Electrical Characteristics | MC |
| 3 | 3/3/2010 | Updated Pin 16 and Pin 17 | MC |
| 4 | 8/5/2010 | Electrical Characteristics Update | MP |
| 5 | 7/5/2019 | Added PCB Footprint Drawing | AS |
| 6 | 8/8/19 | Datasheet Reformat | SB |

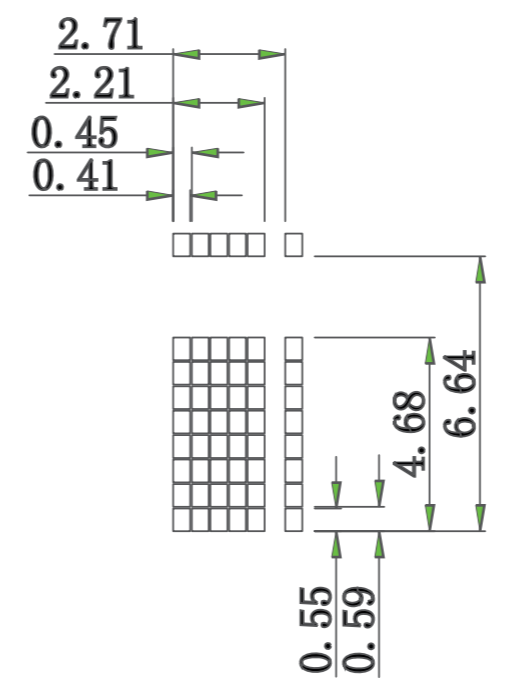
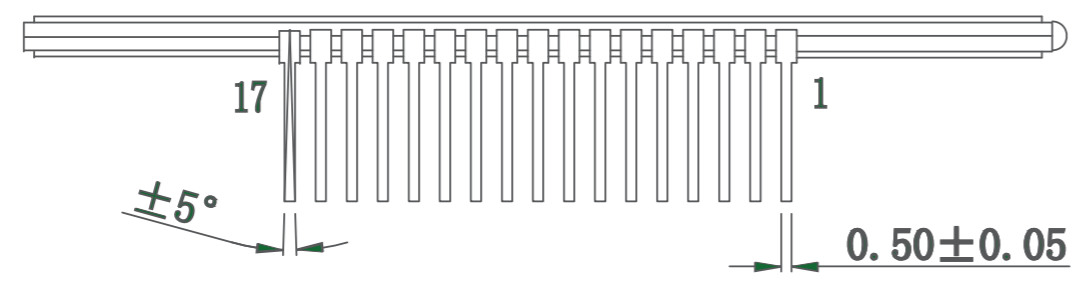
Functions and Features

- 2 lines x 16 characters
- Built-in ST7032 controller
- 3V power supply
- 8-bit parallel data input from MPU
- 1/16 duty, 1/5 bias
- RoHS Compliant
- No CGRAM available

| | | |
|--------|----------|------|
| SYMBOL | REVISION | DATE |
| | | |
| | | |



| NO. | SYMBOL |
|-----|--------|
| 17 | CAP1N |
| 16 | CAP1P |
| 15 | VOUT |
| 14 | VDD |
| 13 | VSS |
| 12 | DB7 |
| 11 | DB6 |
| 10 | DB5 |
| 9 | DB4 |
| 8 | DB3 |
| 7 | DB2 |
| 6 | DB1 |
| 5 | DB0 |
| 4 | E |
| 3 | R/W |
| 2 | RS |
| 1 | XRESET |

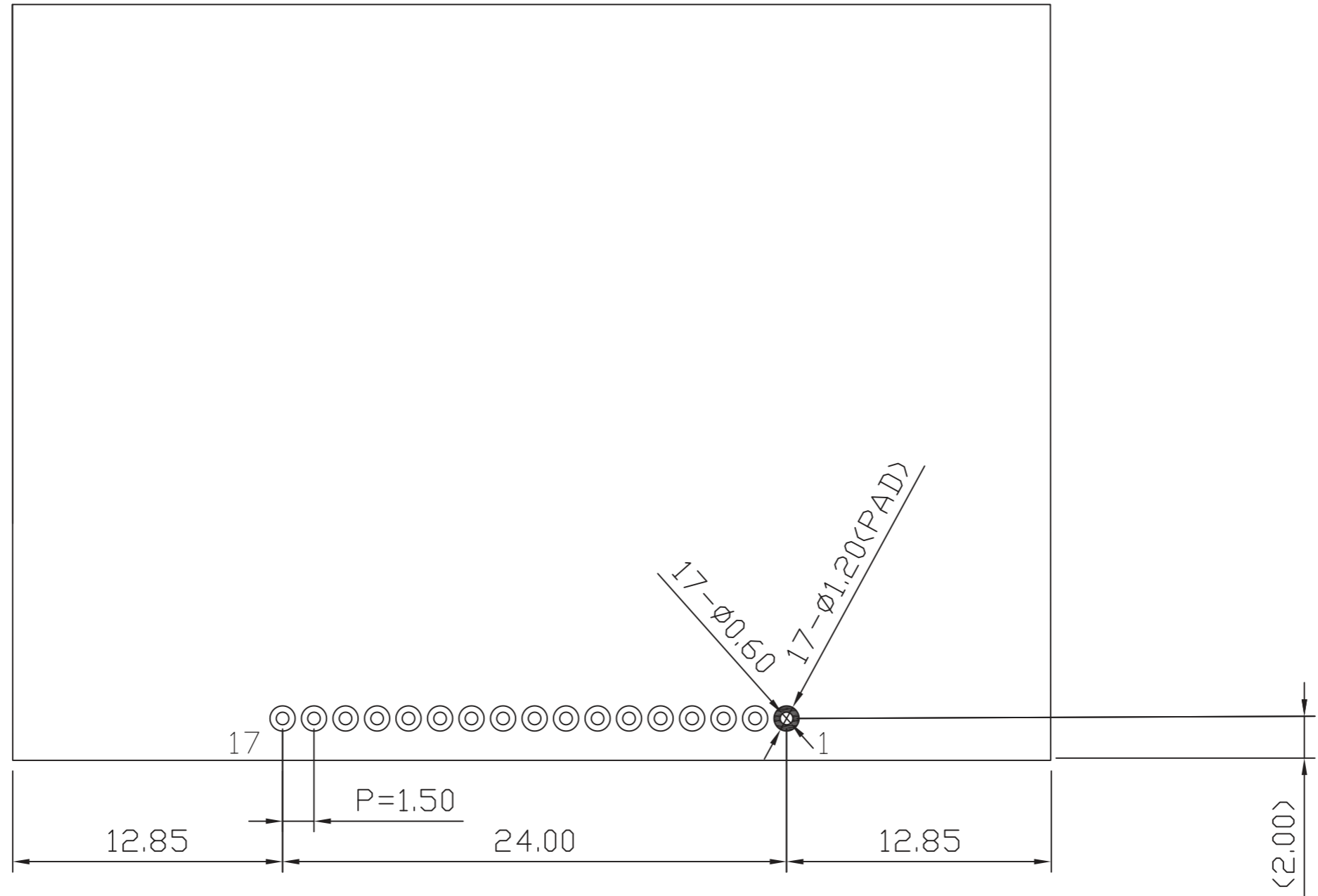


- Notes:
- 1. Driver: 1/16 Duty, 1/5 Bias
 - 2. Voltage: 3V V_{DD}
 - 3. Display Mode: STN Positive / Gray / Transflective
 - 4. Optimal View: 6:00
 - 5. Driver IC: ST7032i-0D - 8/4 Bit Parallel Interface



| | | | |
|---|--|--|---|
| STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) | | | |
| LINEAR: ±0.3mm | | | |
| UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION | | DRAWING/PART NUMBER: NHD-C0216CU-FN-GBW | REVISION: 1.0 SIZE: A3 SCALE: NS |
| | | DRAWN BY: A. Shah APPROVED BY: A. Khan DRAWN DATE: 7/5/19 APPROVED DATE: 7/5/19 | DO NOT SCALE DRAWING SHEET 1 OF 1 |
| THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC. THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY. | | | |

Recommended PCB Footprint

| SYMBOL | REVISION | DATE |
|--------|----------|------|
| | | |
| | | |



Applicable Displays:
1) NHD-C0216CU-FN-GBW-3V

| | | |
|---|---|---|
| STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) |  | |
| | LINEAR: $\pm 0.3\text{mm}$ | DRAWING/PART NUMBER: NHD-C0216CU-FN-Footprint |
| UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION  | DRAWN BY: A. Shah | APPROVED BY: A. Khan |
| | DRAWN DATE: 7/2/19 | APPROVED DATE: 7/2/19 |
| DO NOT SCALE DRAWING | | SHEET 1 OF 1 |
| THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC. THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY. | | |

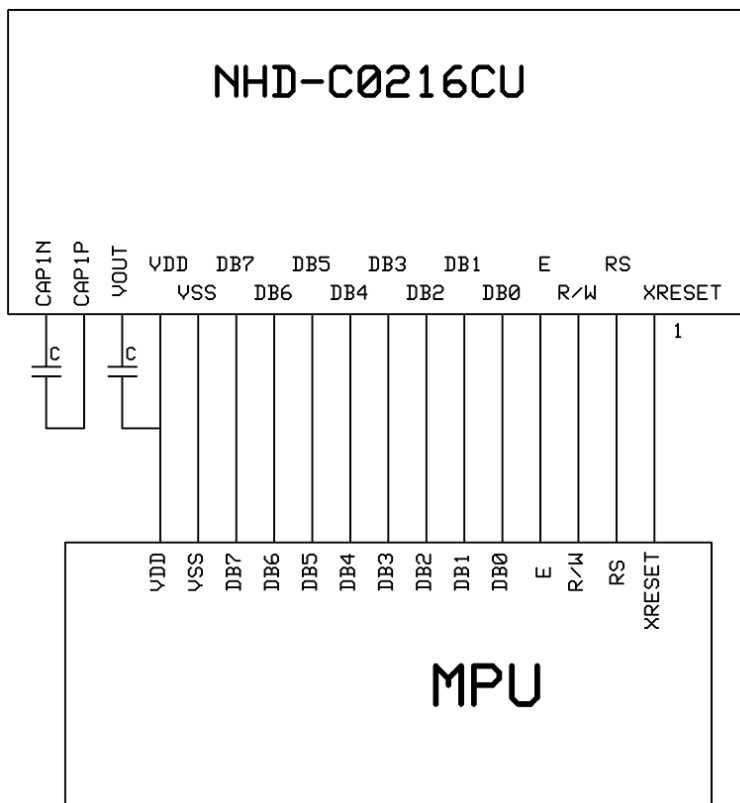
Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|------------------|---------------------|--|
| 1 | XRESET | MPU | Active LOW Reset Signal |
| 2 | RS | MPU | Register Select signal. RS=0: instruction; RS=1: data |
| 3 | R/W | MPU | Read/Write select signal, R/W=1: Read; R/W: =0: Write |
| 4 | E | MPU | Operation enable signal. Falling edge triggered. |
| 5-12 | DB0-DB7 | MPU | 8-bit bi-directional data bus lines |
| 13 | V _{SS} | Power Supply | Ground |
| 14 | V _{DD} | | Power supply for logic for LCD (3.0V) |
| 15 | V _{OUT} | | DC/DC voltage converter. Connect to 1uF capacitor to VDD |
| 16 | CAP1P | | Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN17. |
| 17 | CAP1N | | Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN16. |

Recommended LCD connector: 1.5mm pitch pins

Backlight connector: --- Mates with: - - -

Recommended Breakout Board: [NHD-PCB40](#)



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------------------|------------------------|-----------------------|-------|-----------------------|------|
| Operating Temperature Range | T _{OP} | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | T _{ST} | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | V _{DD} | - | 2.7 | 3.0 | 3.5 | V |
| Supply Current | I _{DD} | - | - | 0.295 | 1.0 | mA |
| Supply for LCD (contrast) | V _{DD-Vo} | T _{OP} = 25°C | 4.8 | 5.0 | 5.2 | V |
| "H" Level input | V _{IH} | | 0.7 * V _{DD} | - | V _{DD} | V |
| "L" Level input | V _{IL} | - | - | - | 0.2 * V _{DD} | V |

Optical Characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|--------|----------------|------------------------|------|------|------|------|
| Optimal Viewing Angles | Top | φY+ | CR ≥ 2 | - | 25 | - | ° |
| | Bottom | φY- | | - | 45 | - | ° |
| | Left | θX- | | - | 35 | - | ° |
| | Right | θX+ | | - | 35 | - | ° |
| Contrast Ratio | | CR | - | 3 | - | - | - |
| Response Time | Rise | T _R | T _{OP} = 25°C | - | 150 | 250 | ms |
| | Fall | T _F | | - | 200 | 300 | ms |

Controller Information

Built-in ST7032 Controller.

Please download specification at http://www.newhavendisplay.com/app_notes/ST7032.pdf

DDRAM Address

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

Table of Commands

| 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 | 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 | I/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"

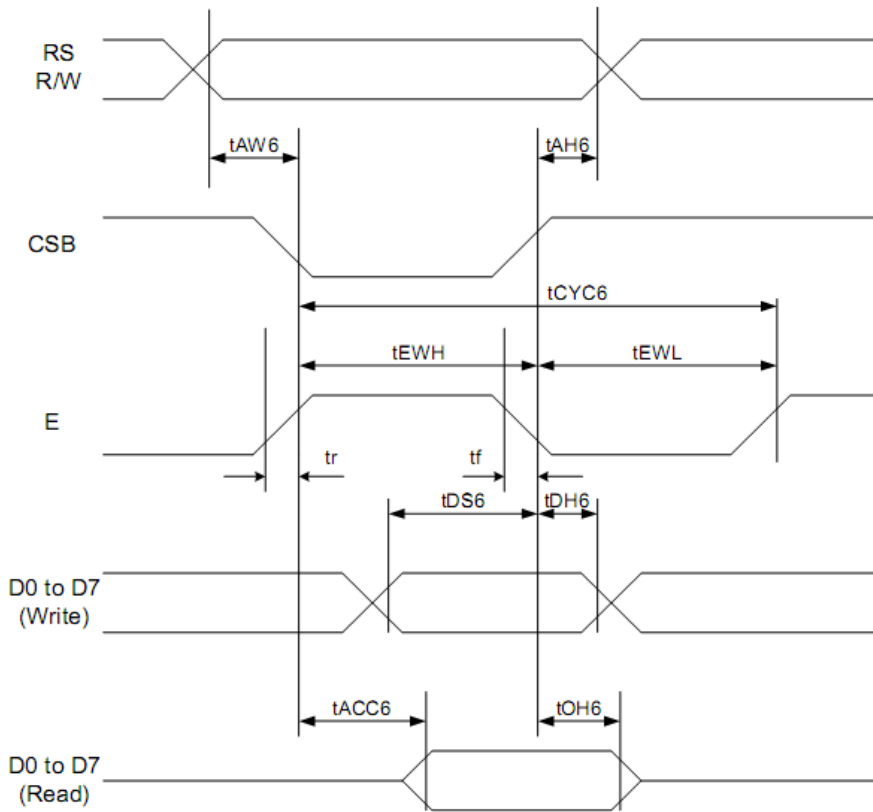
| Instruction table 0 (IS=0) | | | | | | | | | | | | | | |
|----------------------------|---|---|---|---|-----|-----|-----|-----|-----|-----|--|---------|---------|---------|
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | x | x | S/C and R/L: Set cursor moving and display shift control 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 |

| 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 |

Figure 10. 2-Line Display

Timing Characteristics



| Item | Signal | Symbol | Condition | VDD=2.7 to 4.5V Rating | | VDD=4.5 to 5.5V Rating | | Units |
|-----------------------|----------|------------|-------------|------------------------|------|------------------------|------|-------|
| | | | | Min. | Max. | Min. | Max. | |
| Address hold time | RS | t_{AH6} | — | 20 | - | 20 | - | ns |
| Address setup time | RS | t_{AW6} | | 20 | - | 20 | - | |
| System cycle time | RS | t_{CYC6} | — | 400 | - | 280 | - | ns |
| Data setup time | D0 to D7 | t_{DS6} | — | 100 | - | 80 | - | ns |
| Data hold time | D0 to D7 | t_{DH6} | | 40 | - | 20 | - | |
| Access time | D0 to D7 | t_{ACC6} | CL = 100 pF | - | 500 | - | 400 | ns |
| Output disable time | D0 to D7 | t_{OH6} | | 300 | - | 150 | - | |
| Enable Rise/Fall time | E | t_r, t_f | — | - | 20 | - | 20 | ns |
| Enable H pulse time | E | t_{EWH} | — | 200 | - | 120 | - | ns |
| Enable L pulse time | E | t_{EWL} | — | 150 | - | 130 | - | ns |

Built-in Font Table

ST7032-0D (ITO option OPR1=1, OPR2=1)

| b7-b4 b3-b0 | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 | |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|
| 0000 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F | |
| 0001 | J | T | L | I | A | Q | a | q | 0 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | |
| 0010 | 0 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 9 | 8 | 7 | 6 | 5 | |
| 0011 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 |
| 0100 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 0101 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0110 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 0111 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| 1000 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| 1001 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 |
| 1010 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 |
| 1011 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1100 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1101 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| 1110 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1111 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Example Initialization Program

```

/*****
/*****
void init()                //initialize the LCD
{

P3 = 1;
P1 = 1;
RST = 0;                  //RESET
delay(2);
RST = 1;                  //end reset
delay(20);
Writecom(0x30);          //wake up
delay(2);
Call writecom(0x30);      //wake up
Call writecom(0x30);      //wake up
Call writecom(0x39);      //function set
Call writecom(0x14);      //internal osc frequency
Call writecom(0x56);      //power control
Call writecom(0x6D);      //follower control

Call writecom(0x70);      //contrast
Call writecom(0x0C);      //display on
Call writecom(0x06);      //entry mode
Call writecom(0x01);      //clear
delay(10);
}
/*****
/*****
void writecom(int c)
{
CS = 0;                  //CS
RS = 0;                  //A0 = Command
P1 = d;
CS = 1;
}
/*****
/*****
void writedata(int d)
{
CS = 0;                  //CS
RS = 1;                  //A0 = Data
P1 = d;
CS = 1;
}
/*****
/*****

```

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, 96hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C, 96hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C, 96hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C, 96hrs | 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, 96hrs | 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 , 1.5mm 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