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NHD-C0216AZ-FN-GBW

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

NHD- Newhaven Display
C0216- COG, 2 lines x 16 characters
AZ- Model
F- Transflective
N- No Backlight
G- STN- Gray
B- 6:00 View Angle
W- Wide Temp (-20° c ~ +70° c)
RoHS Compliant

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Document Revision History

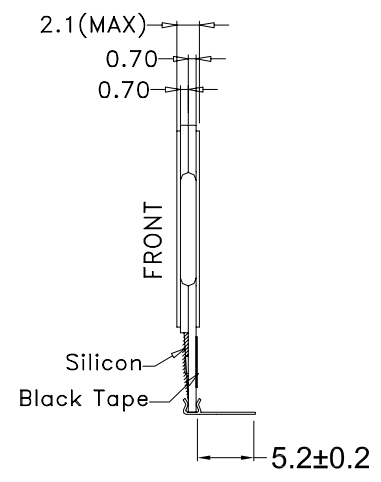
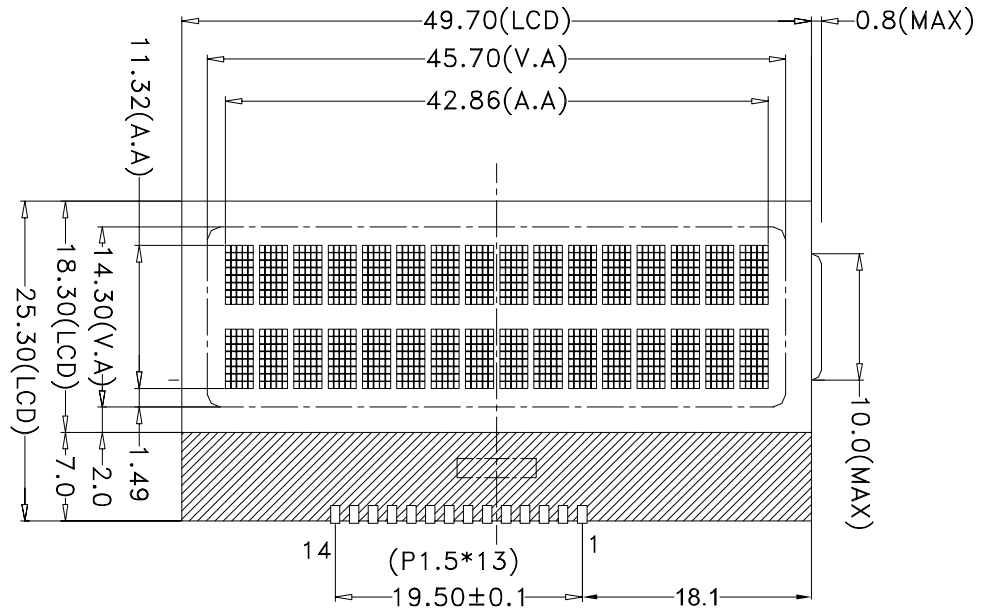
| Revision | Date | Description | Changed by |
|----------|------------|--|------------|
| 0 | 7/20/2007 | Initial Release | - |
| 1 | 8/1/2007 | Edit temp. range errors | CL |
| 2 | 6/4/2008 | Edit incorrect pinout | CL |
| 3 | 9/9/2009 | User guide reformat | BE |
| 4 | 10/9/2009 | Updated Electrical Characteristics information | MC |
| 5 | 10/15/2009 | Updated Block Diagram | MC |
| 6 | 6/2/2011 | Timing characteristics updated | AK |

Functions and Features

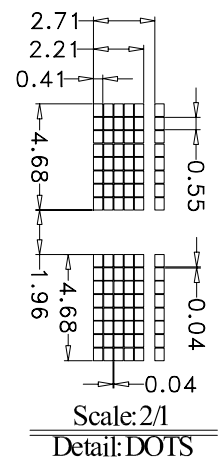
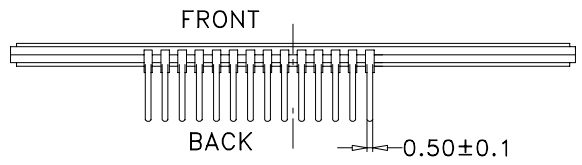
- 2 lines x 16 characters
- Built-in NT7605 controller
- 5x8 dots with cursor
- +5V power supply
- 1/16 duty, 1/5 bias
- RoHS Compliant

Mechanical Drawing

| REV | DESCRIPTION: | DATE |
|-----|--------------|---------|
| 1.0 | | 4/04/07 |



| | |
|----|-----|
| 1 | VSS |
| 2 | V0 |
| 3 | VDD |
| 4 | RS |
| 5 | R/W |
| 6 | E |
| 7 | D0 |
| 8 | D1 |
| 9 | D2 |
| 10 | D3 |
| 11 | D4 |
| 12 | D5 |
| 13 | D6 |
| 14 | D7 |



Display Type: STN GREY/TRANSFLECTIVE/POSITIVE
 Display Resolution: 16*2CHARACTER TYPE
 Viewing Angle: 6:00
 Max.Ratio and Bias Level: 1/16 DUTY,1/5 BIAS
 LCD Controller/Driver: NT7605(COG)
 Logic Voltage: 4.7±0.5V
 LCD Driving Voltage: TBD
 Operation Temperature: -20c To +70c
 Storage Temperature: -30c To +80c

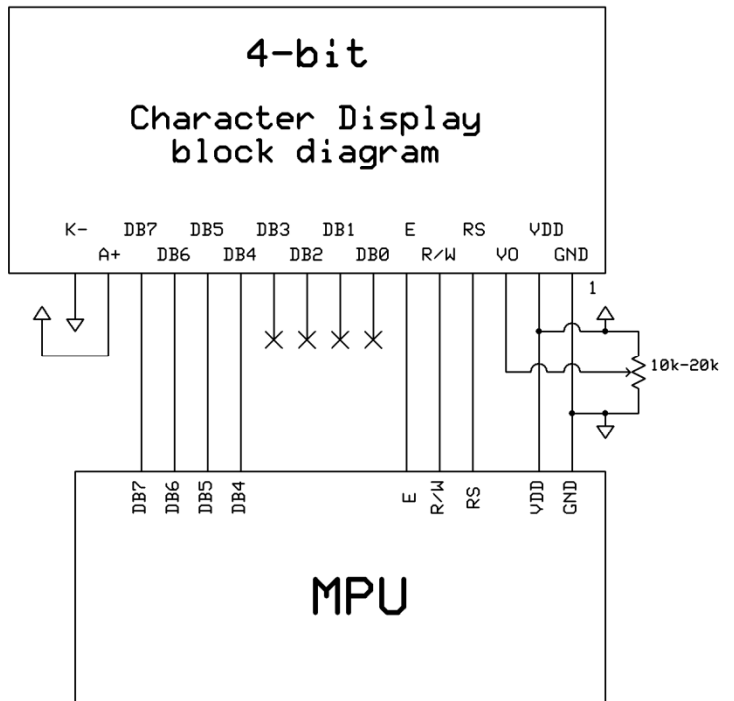
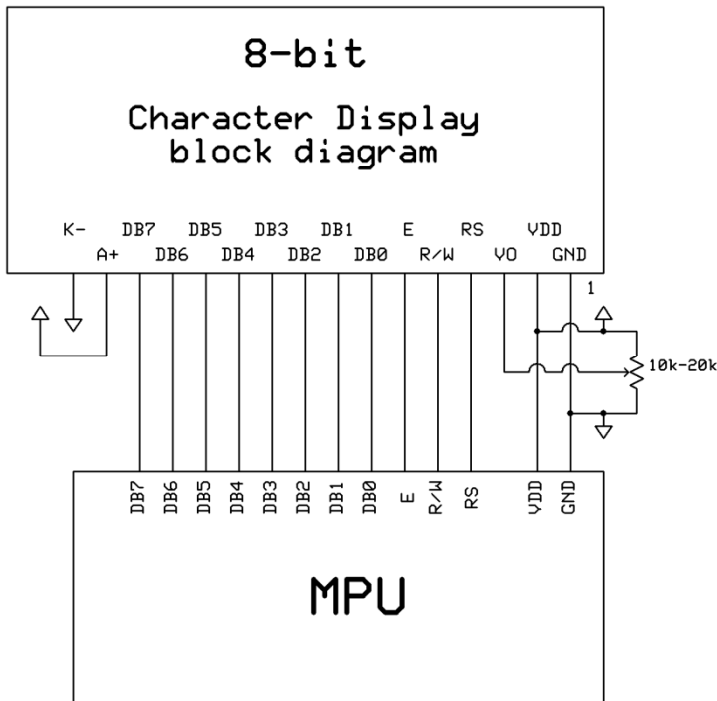
| | | | |
|-----------------------------------|------|---------------------------|--------------------|
| Model Name: NHD-C0216AZ-FN-GBW | | <h2>Newhaven Display</h2> | |
| GENERAL TOL: ± 0.2 | | | |
| APPROVALS | DATE | DRAWN NO. | SCALE: 1:1 |
| | | SIZE: A4 | UNIT: mm Page: 1-1 |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|-----------------|---------------------|---|
| 1 | V _{ss} | Power Supply | Ground |
| 2 | V _o | Adj. Power supply | Power supply for contrast (approx. 0.3V) |
| 3 | V _{DD} | Power Supply | Supply voltage for logic (5.0V) |
| 4 | R _s | MPU | Register select signal. RS=0: Command, RS=1: Data |
| 5 | R/W | MPU | Read/Write select signal, R/W=1: Read R/W=0: Write |
| 6 | E | MPU | Operation enable signal. Falling edge triggered. |
| 7-10 | DB0-DB3 | | Four low order bi-directional three state data bus lines. These four are not used during 4-bit operation. |
| 11-14 | DB4-DB7 | | Four high order bi-directional three state data bus lines. |

Recommended LCD connector: 1.5 mm pitch, 14 pins Soldered to PCB

Backlight connector: --- 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 | | 4.7 | 5.0 | 5.5 | V |
| Supply Current | IDD | Ta=25°C, VDD=5.0V | - | 1.0 | 1.5 | mA |
| Supply for LCD (contrast) | VDD-Vo | Ta=25°C | - | 4.7 | - | 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 |

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 |

Controller Information

Built-in NT7605. Download specification at http://www.newhavendisplay.com/app_notes/NT7605.pdf

Table of Commands

| Instruction | Code | | | | | | | | | | Function | Execution time (max) (f _{osc} = 250KHz) |
|--|------|----|------------|-----|-----|-----|-----|-----|-----|--|--|---|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Display Clear | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Clear entire display area, Restore display from shift, and load address counter with DD RAM address 00H. | 1.64ms |
| Display/ Cursor Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | * | Restore display from shift and load address counter with DD RAM address 00H. | 1.64ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write). | 40μs |
| Display ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Specify activation of display (D) cursor (C) and blinking of character at cursor position (B). | 40μs |
| Display/ Cursor Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * | Shift display or move cursor. | 40μs |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | * | * | Set interface data length (DL), number of display line (N), and character font (F). | 40μs |
| RAM Address Set | 0 | 0 | 0 | 1 | ACG | | | | | | Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data. | 40μs |
| DD RAM Address Set | 0 | 0 | 1 | ADD | | | | | | Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data. | 40μs | |
| Busy Flag/ Address Counter Read | 0 | 1 | BF | AC | | | | | | Read Busy Flag (BF) and contents of Address Counter (AC). | 1μs | |
| CG RAM/ DD RAM Data Write | 1 | 0 | Write data | | | | | | | | Write data to CG RAM or DD RAM. | 40μs |
| CG RAM/ DD RAM Data Read | 1 | 1 | Read data | | | | | | | | Read data from CG RAM or DD RAM. | 40μs |
| I/D = 1 : Increment I/D = 0 : Decrement S = 1 : Display Shift On D = 1 : Display On C = 1 : Cursor Display On B = 1 : Cursor Blink On S/C = 1 : Shift Display S/C = 0 : Move Cursor R/L = 1 : Shift Right R/L = 0 : Shift Left DL = 1 : 8-Bit DL = 0 : 4-Bit N = 1 : Dual Line N = 0 : Signal Line F = 1 : 5x10 dots F = 0 : 5x8 dots BF = 1 : Internal Operation BF = 0 : Ready for Instruction | | | | | | | | | | | DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter | |

DDRAM address location:

| 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 |

Timing Characteristics

Read Operation

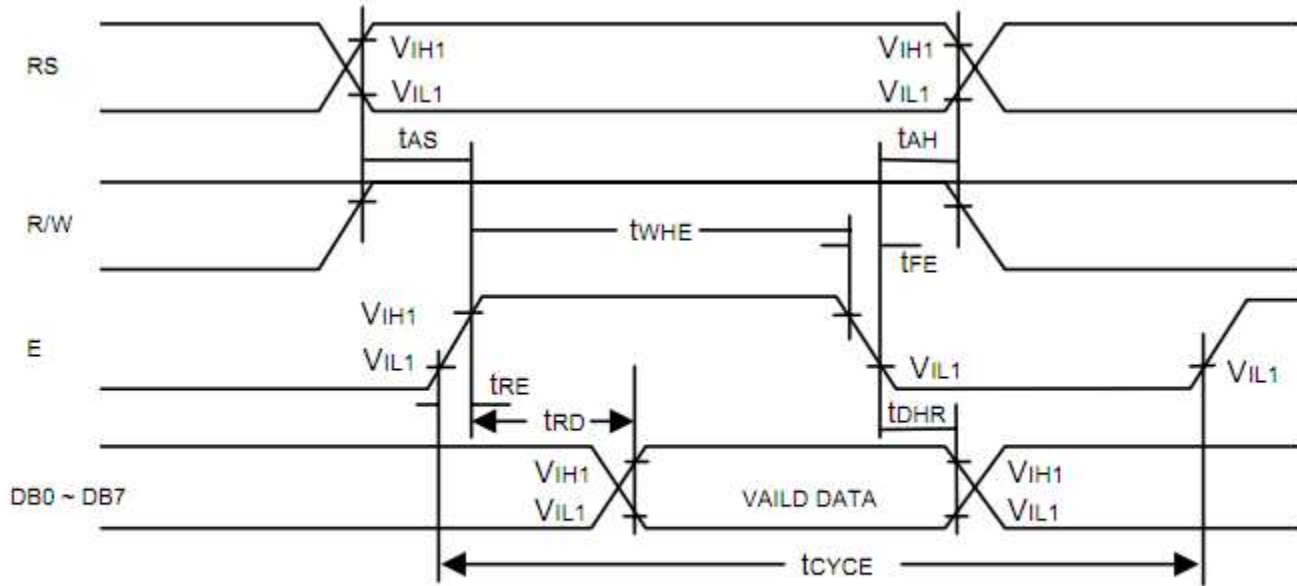


Figure 1. Bus Read Operation Sequence
(Reading out data from NT7605 to MPU)

Read Cycle ($V_{DD} = 5.0V$, $GND = 0V$, $T_A = 25^{\circ}C$)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Conditions |
|------------------|------------------------------|------------------|------|------|------|------------|
| t_{CYCE} | Enable Cycle Time | 500 | - | - | ns | Figure 1 |
| t_{WHE} | Enable "H" Level Pulse Width | 300 | - | - | ns | Figure 1 |
| t_{RE}, t_{FE} | Enable Rise/Fall Time | - | - | 25 | ns | Figure 1 |
| t_{AS} | RS, R/W Setup Time | 60 ¹ | - | - | ns | Figure 1 |
| | | 100 ² | | | | |
| t_{AH} | RS, R/W Address Hold Time | 10 | - | - | ns | Figure 1 |
| t_{RD} | Read Data Output Delay | - | - | 190 | ns | Figure 1 |
| t_{DHR} | Read Data Hold Time | 20 | - | - | ns | Figure 1 |

Notes: 1: 8-bit operation mode
2: 4-bit operation mode

Write Operation

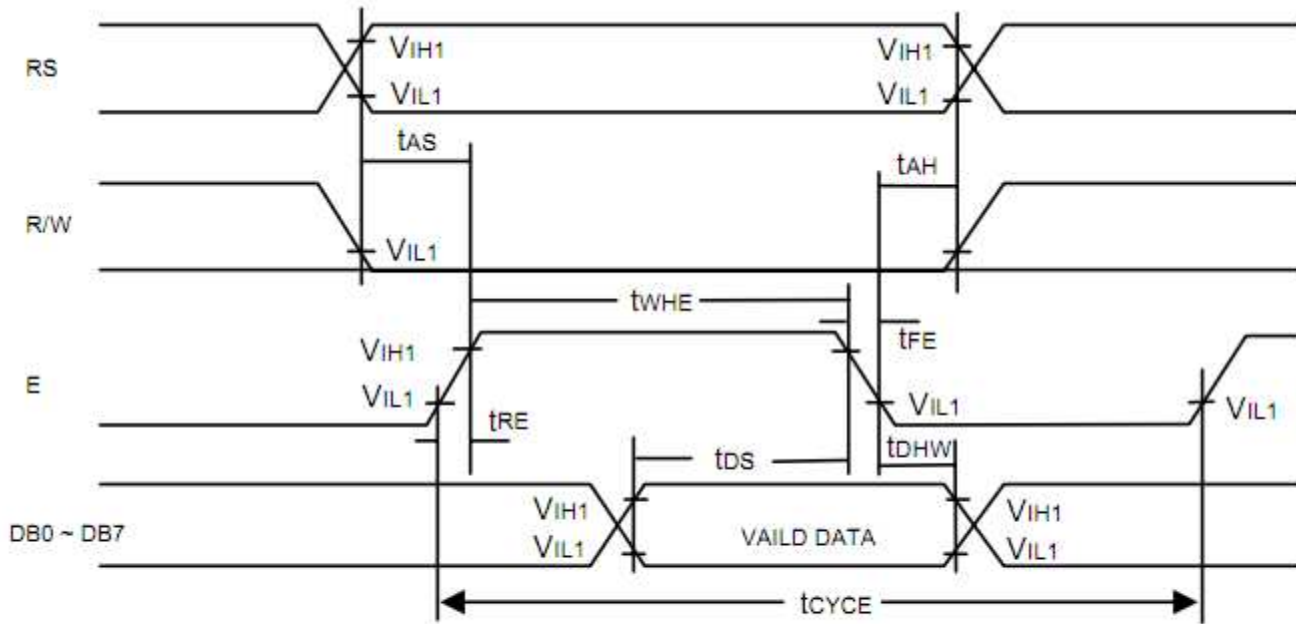


Figure 2. Bus Write Operation Sequence
(Writing data from MPU to NT7605)

Write Cycle ($V_{DD} = 5.0V$, $GND = 0V$, $T_A = 25^\circ C$)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Conditions |
|---------------------|------------------------------|---------|------|------|------|------------|
| t_{CYCE} | Enable Cycle Time | 500 | - | - | ns | Figure 2 |
| t_{WHE} | Enable "H" Level Pulse Width | 300 | - | - | ns | Figure 2 |
| t_{RE} , t_{FE} | Enable Rise/Fall Time | - | - | 25 | ns | Figure 2 |
| t_{AS} | RS, R/W Setup Time | 60^1 | - | - | ns | Figure 2 |
| | | 100^2 | | | | |
| t_{AH} | RS, R/W Address Hold Time | 10 | - | - | ns | Figure 2 |
| t_{DS} | Data Output Delay | 100 | - | - | ns | Figure 2 |
| t_{DHW} | Data Hold Time | 10 | - | - | ns | Figure 2 |

Notes: 1: 8-bit operation mode
2: 4-bit operation mode

Built-in Font Table

| Lower 4 Bits \ Upper 4 Bits | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|-----------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| xxxx0000 | CG RAM (1) | | | 0 | a | P | ` | P | | | | - | 夕 | ミ | α | ρ |
| xxxx0001 | (2) | | ! | 1 | A | Q | a | q | | | 。 | ア | チ | △ | ä | q |
| xxxx0010 | (3) | | " | 2 | B | R | b | r | | | 「 | イ | ツ | × | ß | θ |
| xxxx0011 | (4) | | # | 3 | C | S | c | s | | | 」 | ウ | テ | モ | ε | ∞ |
| xxxx0100 | (5) | | \$ | 4 | D | T | d | t | | | 、 | エ | ト | ト | μ | Ω |
| xxxx0101 | (6) | | % | 5 | E | U | e | u | | | ・ | オ | ナ | 1 | σ | ü |
| xxxx0110 | (7) | | & | 6 | F | V | f | v | | | ヲ | カ | ニ | ヨ | ρ | Σ |
| xxxx0111 | (8) | | ' | 7 | G | W | g | w | | | フ | キ | ヌ | ラ | g | π |
| xxxx1000 | (1) | | (| 8 | H | X | h | x | | | ィ | ク | ネ | リ | γ | ∞ |
| xxxx1001 | (2) | |) | 9 | I | Y | i | y | | | ウ | ケ | ル | ル | ´ | y |
| xxxx1010 | (3) | | * | : | J | Z | j | z | | | エ | コ | ハ | レ | j | ≠ |
| xxxx1011 | (4) | | + | ; | K | [| k | { | | | オ | サ | ヒ | ロ | * | ≠ |
| xxxx1100 | (5) | | , | < | L | ¥ | l | | | | カ | シ | フ | ク | φ | ≠ |
| xxxx1101 | (6) | | - | = | M |] | m | } | | | ユ | ス | ハ | ン | ≠ | ÷ |
| xxxx1110 | (7) | | . | > | N | ^ | n | → | | | ヨ | セ | ホ | ° | ñ | |
| xxxx1111 | (8) | | / | ? | O | _ | o | + | | | ッ | リ | マ | ° | ö | ■ |

Example Initialization Program

```
'INIT-----
A = &H30
Call Writecom                                     'wake up
Waitms 100
Call Writecom                                     'wake up
Waitms 10
Call Writecom                                     'wake up
Waitms 10
A = &H38
'function set
Call Writecom
A = &H10
'shift display=no
Call Writecom
A = &H0C
'display on
Call Writecom
A = &H06
'entry mode set
Call Writecom
'-----
Sub Writecom
P1 = A
Reset P3.0
'instruction
Reset P3.7
'RW
Waitms 1
Set P3.4
'E
Waitms 1
Reset P3.4                                     'E
End Sub
'-----
Sub Writedata
P1 = A
Set P3.0
'data
Reset P3.7
'RW
Waitms 1
Set P3.4
'E
Waitms 1
Reset P3.4                                     'E
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