NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-0208BZ-FL-YBW

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0208-	2 Lines x 8 Characters
BZ-	Model
F-	Transflective
L-	Yellow/Green LED Backlight
Y-	STN (+) Yellow/Green
B-	6:00 Optimal View
W-	Wide Temperature

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REACH Compliant

RoHS Compliant

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Additional Resources

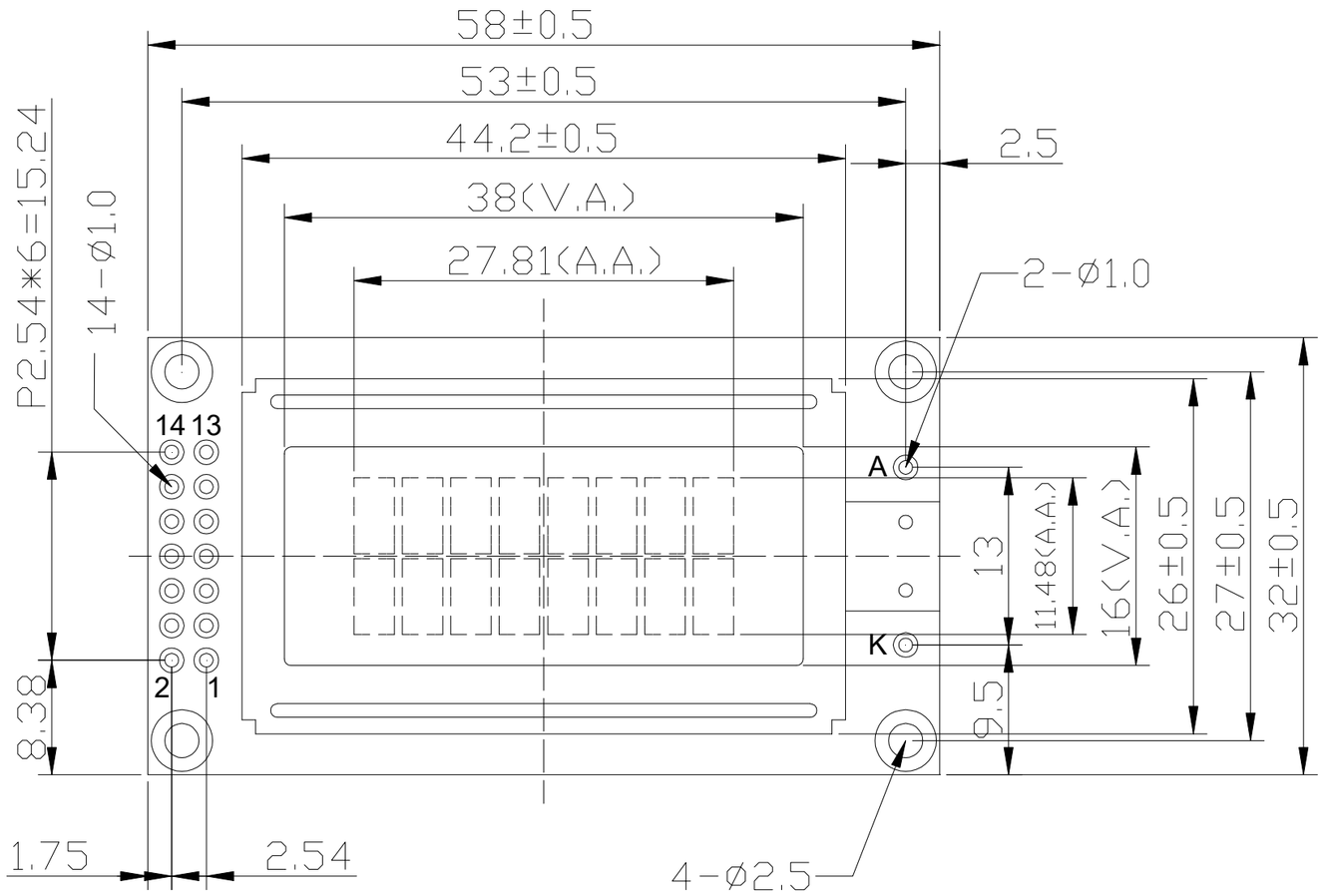
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** https://www.newhavendisplay.com/specs/precautions.pdf
- **Warranty / Terms & Conditions:** https://www.newhavendisplay.com/terms.html

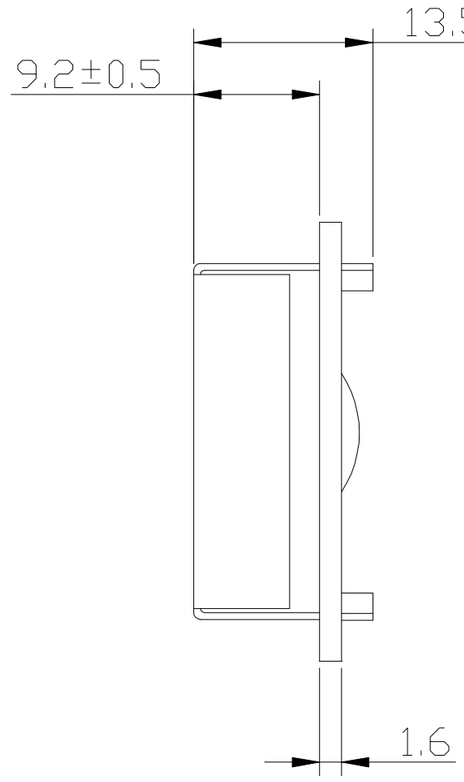
Document Revision History

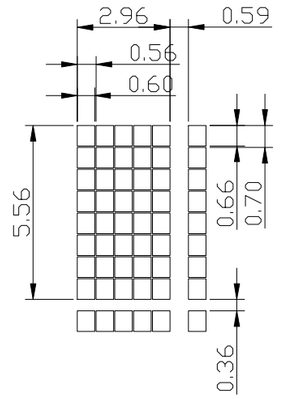
Revision	Date	Description	Changed By
0	10/30/2008	Initial Release	-
1	10/06/2009	User Guide Reformat	BE
2	11/02/2009	Block Diagram Revision	BE
3	11/25/2009	Optical/backlight revised	BE
4	12/29/2009	Optical revised	BE
5	01/05/2011	Alternate controller information updated	AK
6	04/19/2011	Electrical characteristics updated	AK
7	05/25/2011	Mechanical drawing updated	AK
8	11/02/2016	Mechanical Drawing, Electrical & Optical Char. Updated	SB
9	01/14/2019	Mechanical Drawing & Backlight Characteristics Updated	SB
10	09/03/2020	Updated Backlight Supply Voltage Range & Backlight Drive Conditions to indicate Current Driven Device	AS
11	10/03/2024	Updated AA size in Mechanical Drawing	KL

Mechanical Drawing

Newhaven Display
NHD-0208BZ-FL-YBW
Date Code
Part Label (type/format may vary)







PIN ASSIGNMENT

1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7~10	DB0~DB3
11~14	DB4~DB7
A	LED+
K	LED-

Product Description: 2x8 character LCD

1. Driver IC: ST7066U
2. Interface: 4/8 6800 Parallel
3. Power Requirement: 5.0V LCD, 4.1V/60mA Backlight
4. Optical Features: STN Yellow/Green, Transflective, 6:00 View,
5. Recommended Pin Header: 2x7pin 2.54mm pitch

Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-0208BZ-FL-YBW
Revision: -

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 10/03/2024
Approved Date: 10/03/2024

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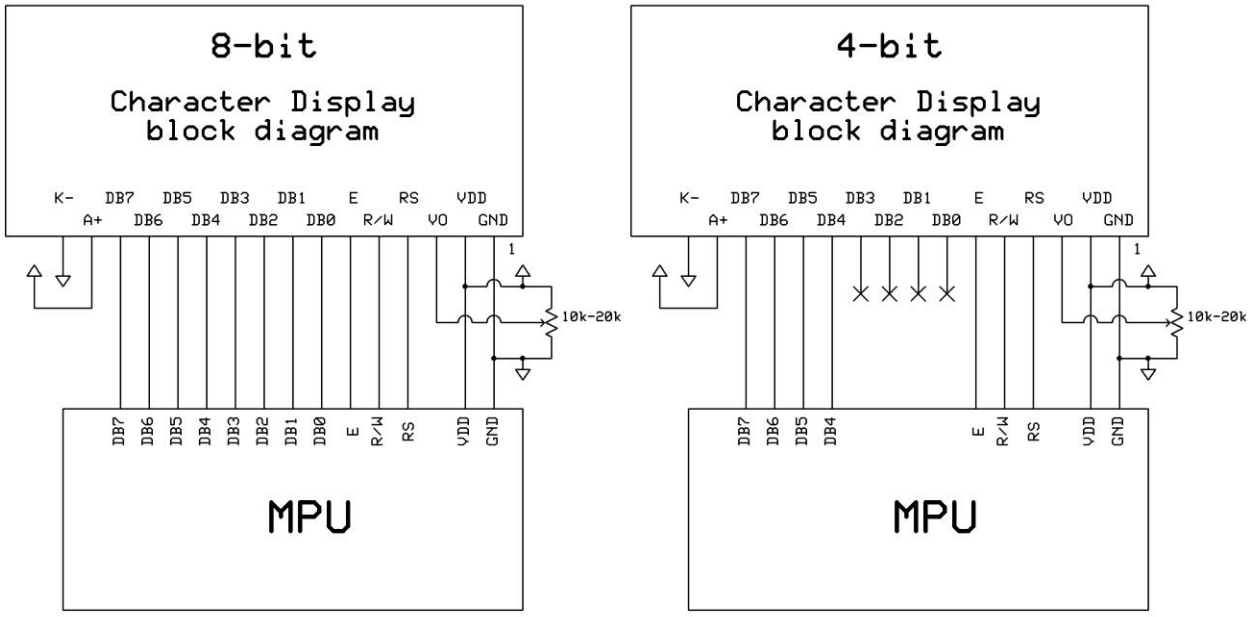
Pin Description

Pin No.	Symbol	External Connection	Function Description
1	V_{SS}	Power Supply	Ground
2	V_{DD}	Power Supply	Supply Voltage for logic (+5.0V)
3	V_0	Adj Power Supply	Supply Voltage for contrast (approx. 0.6V)
4	RS	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	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14	DB4 – DB7	MPU	Four high order bi-directional three-state data bus lines.
A	LED+	Power Supply	Power supply for LED Backlight (60mA @ +4.1V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 2.54mm pitch pins
Backlight connector: --- **Mates with**: ---

Wiring Diagram



DDRAM Address

1	2	3	4	5	6	7	8
00	01	02	03	04	05	06	07
40	41	42	43	44	45	46	47

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}	-	4.8	5.0	5.2	V
Supply Current	I_{DD}	V_{DD} = 5.0V	1.0	1.5	2.0	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	4.2	4.4	4.6	V
"H" Level input	V_{IH}	-	2.2	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.6	V
"H" Level output	V_{OH}	-	2.4	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.4	V
Backlight Supply Current	I_{LED}	-	40	60	90	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 60 mA	3.8	4.1	4.4	V

*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	40	-	º
	Bottom	φY-		-	60	-	º
	Left	θX-		-	60	-	º
	Right	θX+		-	60	-	º
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	200	300	ms

Controller Information

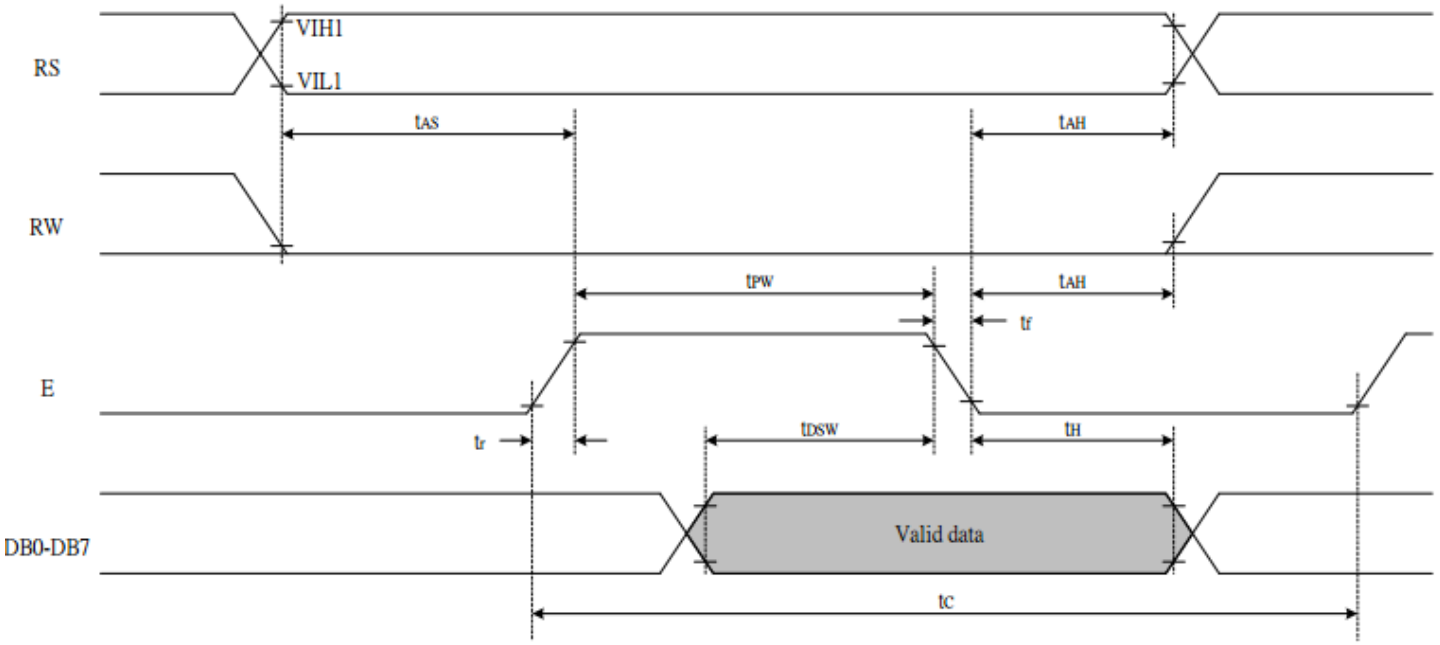
Built-in ST7066U Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414848155159-ST7066U

Table of Commands

Instruction	Instruction code										Description	Execution time (fosc= 270 KHZ
	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	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM Address to “00H” from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry mode Set	0	0	0	0	0	0	0	1	I/D	SH	Sets cursor move direction and specifies display shift. These parameters are performed during data write and read.	37µs
Display ON/ OFF control	0	0	0	0	0	0	1	D	C	B	D=1: Entire display on C=1: Cursor on B=1: Blinking cursor on	37µs
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	-	-	Sets cursor moving and display shift control bit, and the direction without changing DDRAM data.	37µs
Function set	0	0	0	0	1	DL	N	F	-	-	DL: Interface data is 8/4 bits N: Number of lines is 2/1 F: Font size is 5x11/5x8	37µs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37µs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37µs
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.	0s
Write data To Address	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	37µs
Read data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37µs

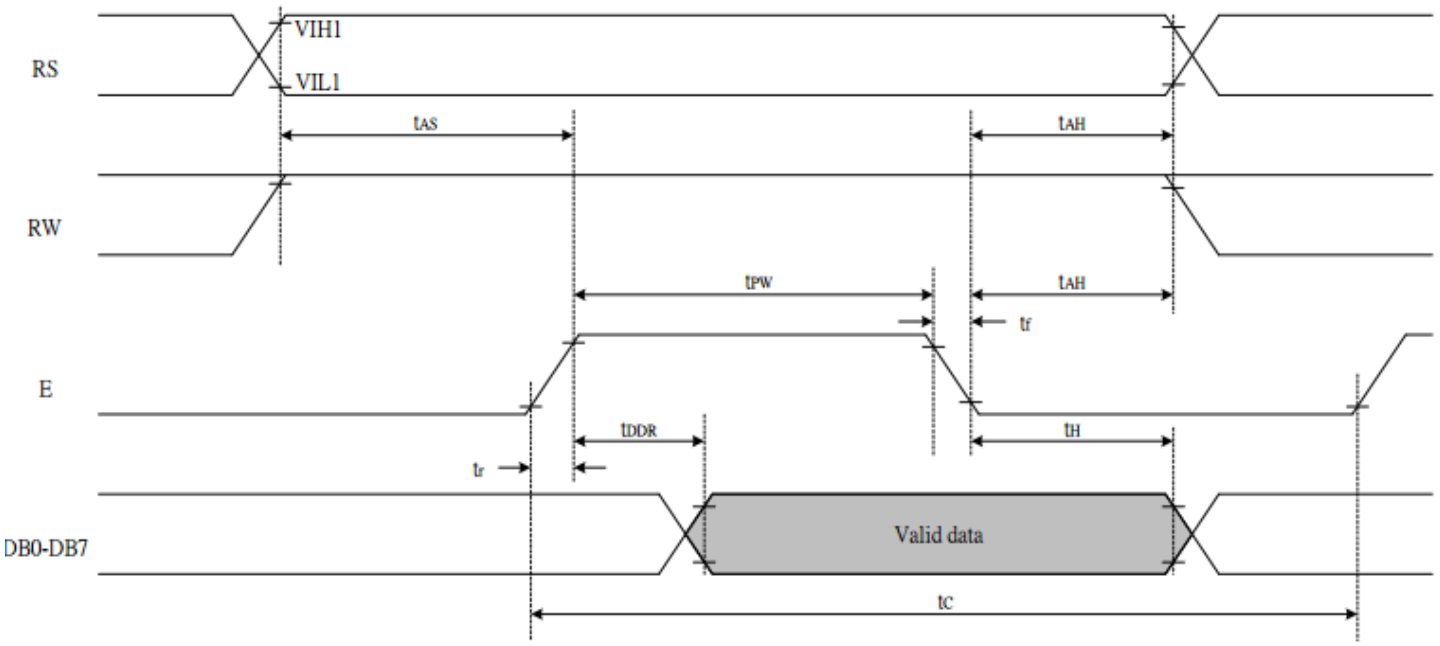
Timing Characteristics

Writing data from MPU to ST7066U



Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Reading data from ST7066U to MPU



Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Built-in Font Table

b7-b4 / b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	(2)															
0010	(3)															
0011	(4)															
0100	(5)															
0101	(6)															
0110	(7)															
0111	(8)															
1000	(1)															
1001	(2)															
1010	(3)															
1011	(4)															
1100	(5)															
1101	(6)															
1110	(7)															
1111	(8)															

Example Initialization Program

8-bit Initialization:

```
/*********************************************************/
void command(char i)
{
    P1 = i;                 //put data on output Port
    D_I =0;                 //D/I=LOW : send instruction
    R_W =0;                 //R/W=LOW : Write
    E  = 1;
    Delay(1);               //enable pulse width  >= 300ns
     E  = 0;                //Clock enable: falling edge
}
/*********************************************************/
void write(char i)
{
    P1 = i;                 //put data on output Port
    D_I =1;                 //D/I=HIGH : send data
    R_W =0;                 //R/W=LOW : Write
    E  = 1;
    Delay(1);               //enable pulse width  >= 300ns
    E  = 0;                 //Clock enable: falling edge
}
/*********************************************************/
void init()
{
    E = 0;
    Delay(100);             //Wait >40 msec after power is applied
    command(0x30);              //command 0x30 = Wake up
    Delay(30);              //must wait 5ms, busy flag not available
    command(0x30);              //command 0x30 = Wake up #2
    Delay(10);              //must wait 160us, busy flag not available
    command(0x30);              //command 0x30 = Wake up #3
    Delay(10);              //must wait 160us, busy flag not available
    command(0x38);              //Function set: 8-bit/2-line
    command(0x10);              //Set cursor
    command(0x0c);              //Display ON; Cursor ON
    command(0x06);              //Entry mode set
}
/*********************************************************/
```

4-bit Initialization:

```
/*********************************************************/
void command(char i)
{
    P1 = i;                 //put data on output Port
    D_I =0;                 //D/I=LOW : send instruction
    R_W =0;                 //R/W=LOW : Write
    Nybble();               //Send lower 4 bits
    i = i<<4;               //Shift over by 4 bits
    P1 = i;                 //put data on output Port
    Nybble();               //Send upper 4 bits
}
/*********************************************************/
void write(char i)
{
    P1 = i;                 //put data on output Port
    D_I =1;                 //D/I=HIGH : send data
    R_W =0;                 //R/W=LOW : Write
    Nybble();               //Clock lower 4 bits
    i = i<<4;               //Shift over by 4 bits
    P1 = i;                 //put data on output Port
    Nybble();               //Clock upper 4 bits
}
/*********************************************************/
void Nybble()
{
    E = 1;
    Delay(1);               //enable pulse width  >= 300ns
    E = 0;                  //Clock enable: falling edge
}
/*********************************************************/
void init()
{
    P1 = 0;
    P3 = 0;
    Delay(100);             //Wait >40 msec after power is applied
    P1 = 0x30;              //put 0x30 on the output port
    Delay(30);              //must wait 5ms, busy flag not available
    Nybble();               //command 0x30 = Wake up
    Delay(10);              //must wait 160us, busy flag not available
    Nybble();               //command 0x30 = Wake up #2
    Delay(10);              //must wait 160us, busy flag not available
    Nybble();               //command 0x30 = Wake up #3
    Delay(10);              //can check busy flag now instead of delay
    P1= 0x20;               //put 0x20 on the output port
    Nybble();               //Function set: 4-bit interface
    command(0x28);              //Function set: 4-bit/2-line
    command(0x10);              //Set cursor
    command(0x0F);              //Display ON; Blinking cursor
    command(0x06);              //Entry Mode set
}
/*********************************************************/
```

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.