NHD-0420H1Z-FSW-GBW

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0420-	4 Lines x 20 Characters
H1Z-	Model
F-	Transflective
SW-	Side White LED Backlight
G-	STN Positive - Gray
B-	6:00 Optimal View
W-	Wide Temp.
	RoHS Compliant

Document Revision History

Revision	Date	Description	Changed by
0	10/21/2008	Initial Release	-
1	1/28/2010	User Guide Reformat	MC
2	1/5/2011	Update Driver Information	JT
3	5/6/2011	Electrical characteristics updated	AK
4	9/9/2015	Mechanical drawing, electrical and optical characteristics updated, timing characteristics added	SB
5	10/10/2016	Updated Electrical Characteristics	TM
6	3/13/18	Backlight Characteristics Updated	SB

Functions and Features

- 4 lines x 20 characters
- Built-in controller ST7066U
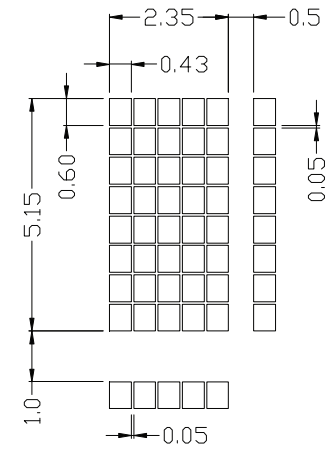- +5.0V Power Supply
- 1/16 duty, 1/4 bias
- RoHS compliant

SYMBOL	REVISION	DATE

Dimensions:
79±0.5
75±0.5
66±0.5
60(V.A.)
56.5(A.A.)

2
4
7
8.75

2-Ø2.0

13.0(MAX)
8.6±0.5

9
16

P2.54*7=17.78

1
8

23.6(A.A.)
28(V.A.)
34±0.5
36±0.5

9.11
2
2
37

0.65

Front

Back

1.6

2.35
0.5
0.43
0.60
0.05
5.15
1.0
0.05
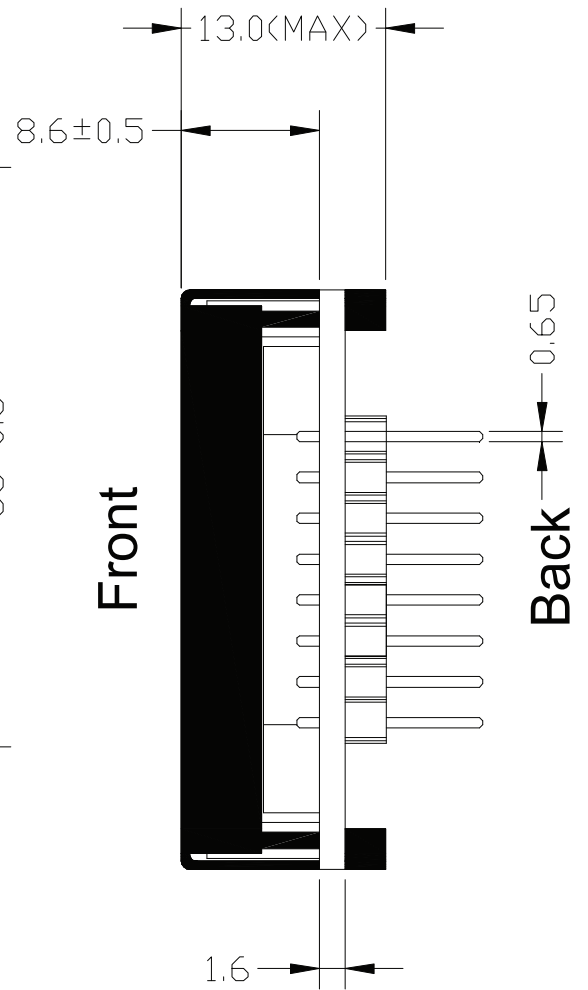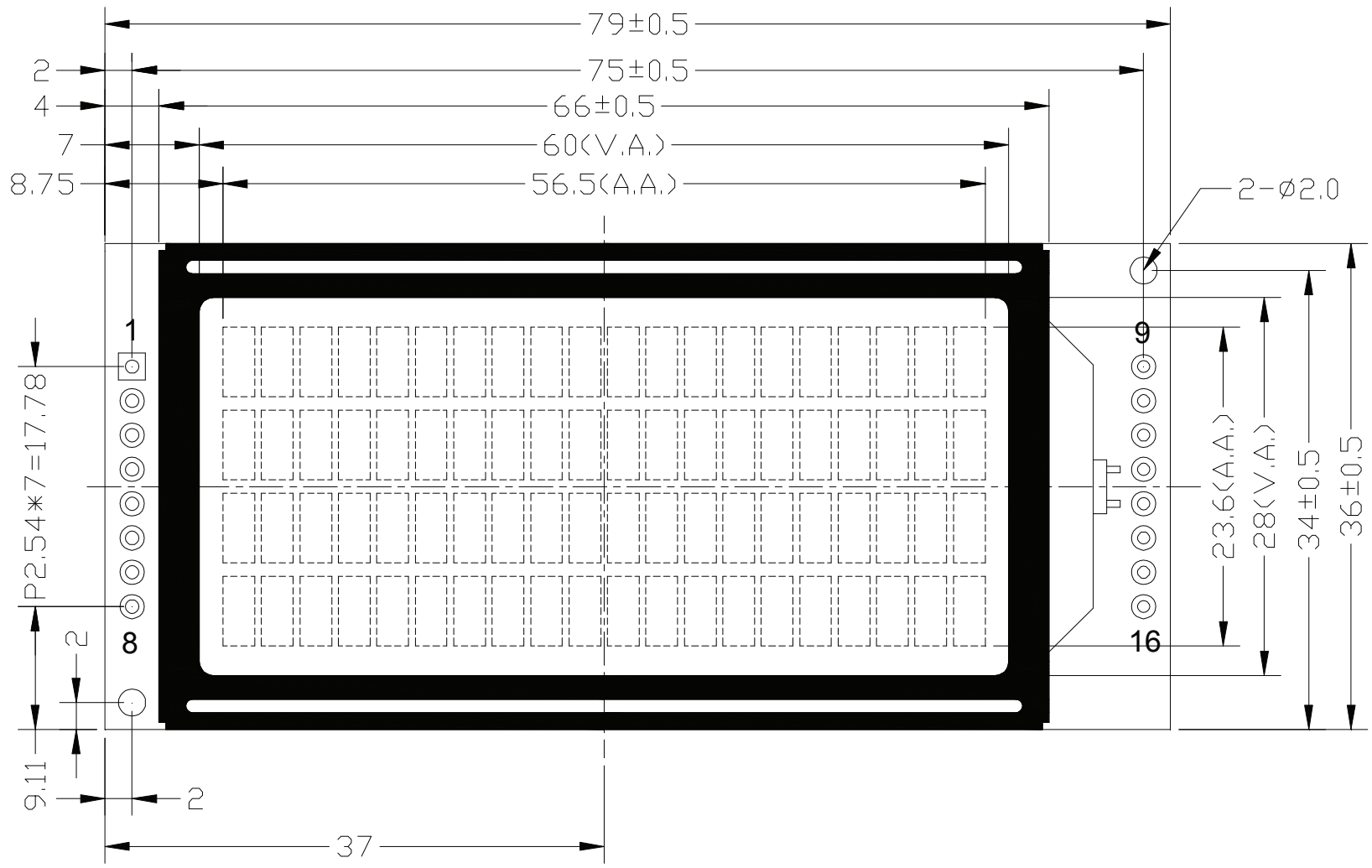
PIN ASSIGNMENT

1	VSS
2	VDD
3	V0
4	RS
5	RW
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

Notes:
1. Driver: 1/16 Duty, 1/4 Bias
2. Voltage: 5.0V VDD, 4.4V VLCD
3. Display Mode: STN Positive / Gray / Transflective
4. Optimal View: 6:00
5. Backlight: White LED
6. Driver IC: ST7066U 8/4-Bit MPU Interface

Pin Description and Wiring Diagram

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$_0$	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.
15	LED+	Power Supply	Backlight Anode (+5.0V via on-board resistor)
16	LED-	Power Supply	Backlight Cathode(Ground)

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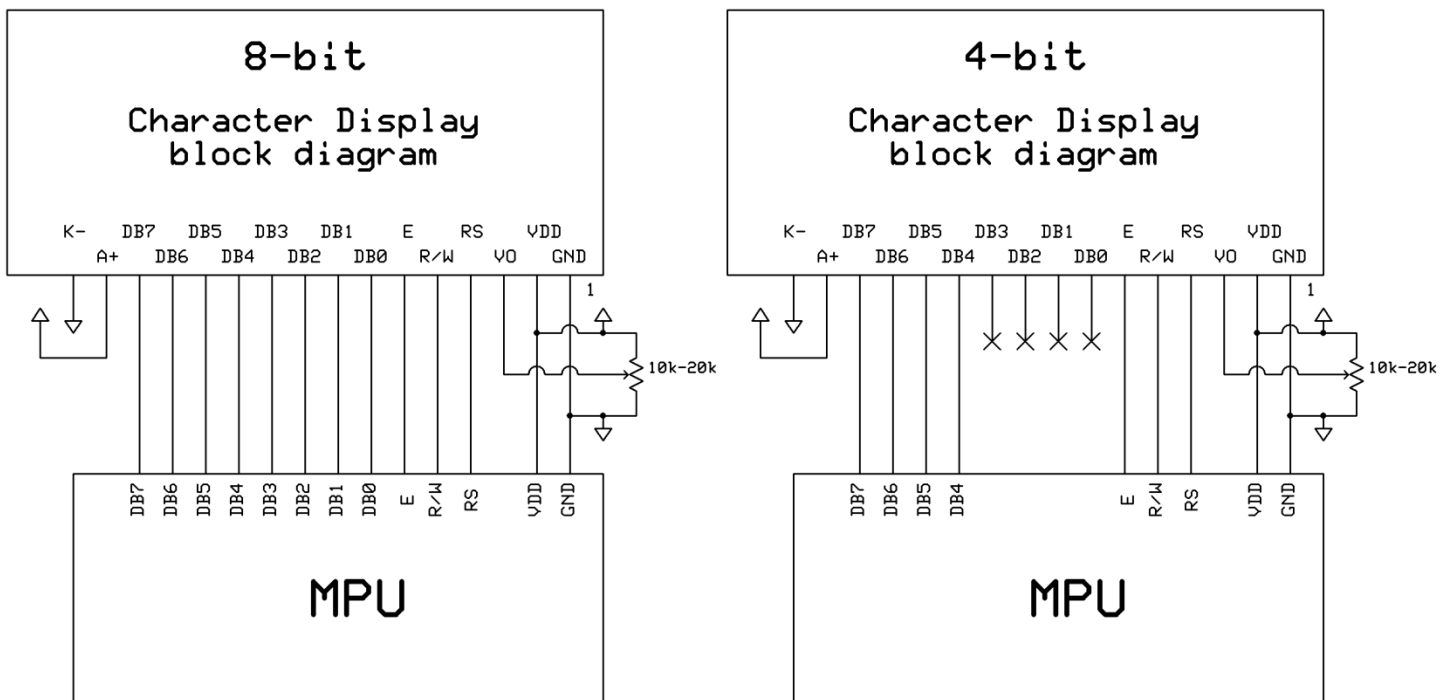
Electrical Characteristics

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}	Ta=25°C,	1.0	1.5	2.5	mA
Supply for LCD (contrast)	V_{LCD}	V_{DD}=5.0V	4.2	4.4	4.6	V
"H" Level input	V_{IH}	-	$0.7*V_{DD}$	-	V_{DD}	V
"L" Level input	V_{IL}	-	0	-	0.6	V
"H" Level output	V_{OH}	-	3.9	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	$0.2*V_{SS}$	V
Backlight Supply Voltage	V_{LED}	-	4.8	5.0	5.2	V
Backlight Supply Current	I_{LED}	V_{LED} =5.0V	8	15	25	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+		-	40	-	°
	Bottom	φY-	CR ≥ 2	-	60	-	°
	Left	θX-		-	60	-	°
	Right	θX+		-	60	-	°
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.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

DDRAM Address

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
14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

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 DDRA and set DDRAM address to "00H" from AC	1.53ms
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.	1.53ms
Entry mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction And blinking of entire display	39us
Display ON/ OFF control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and Blinking of cursor (B) on/off Control bit.	
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display Shift control bit, and the Direction, without changing of DDRAM data.	39us
Function set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-Bit/4-bit), numbers of display Line (N: =2-line/1-line) and, Display font type (F: 5x11/5x8)	39us
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39us
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39us
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.	0us
Write data To Address	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43us
Read data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43us

Timing Characteristics

Writing data from MPU to ST7066U
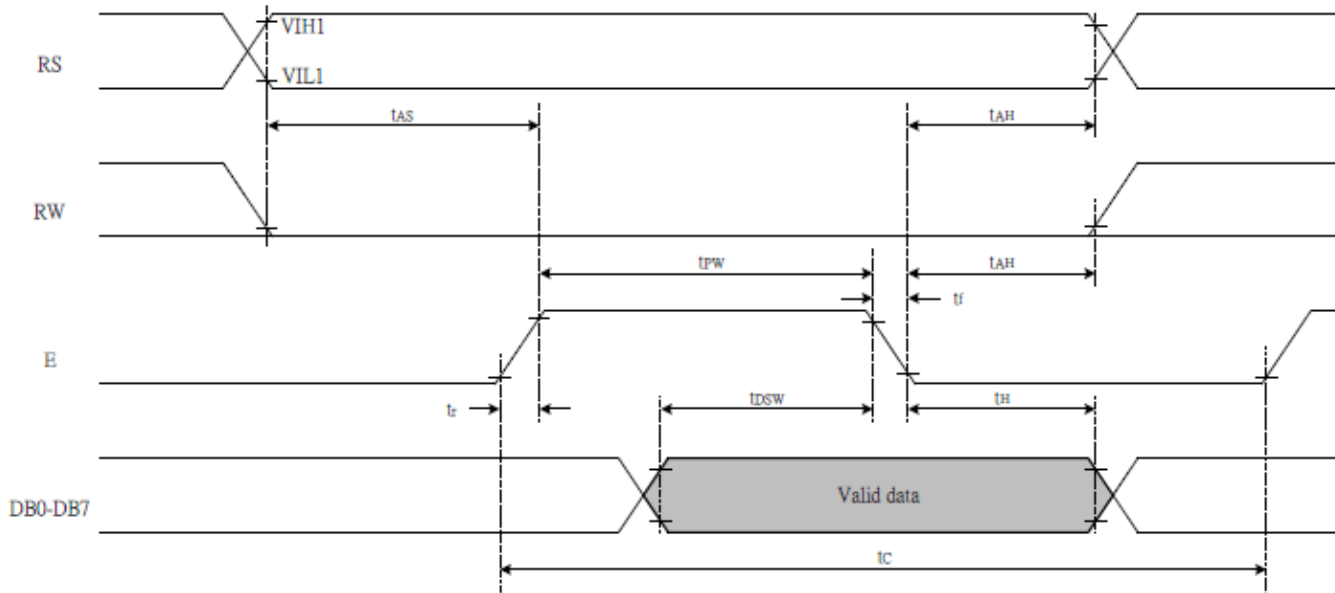
TA = 25°C, VCC = 5V

	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
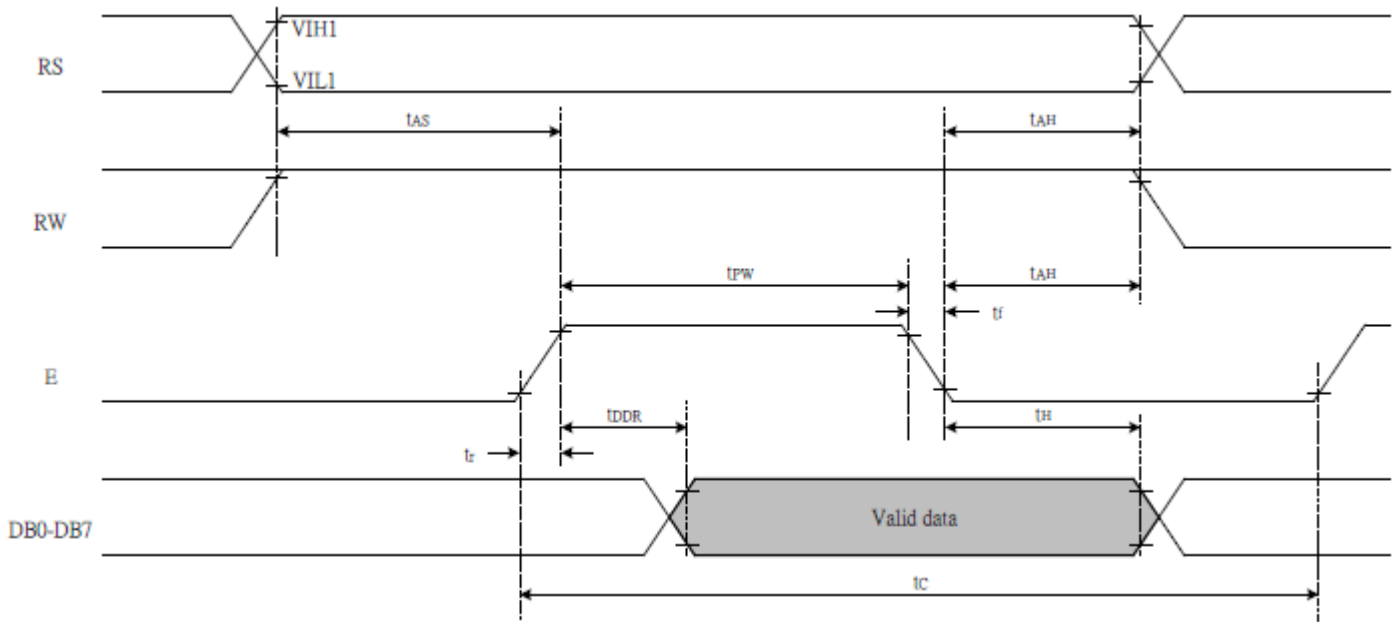
TA = 25°C, VCC = 5V

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

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:

```c
/***********************************************************/
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 For 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

See Terms & Conditions at http://www.newhavendisplay.com/index.php?main_page=terms

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