NHD-0212WH-ATMI-JT#

Character Liquid Crystal Display Module

NHD-   Newhaven Display
0212-   2 lines x 12 characters
WH-   Display Type: Character
A-   Model
T-   White LED Backlight
M-   STN- Blue (-)
I-   Transmissive, 6:00 view, Wide Temp. (-20°C~+70°C)
JT#-   English/Japanese standard font
                RoHS Compliant

Document Revision History

Revision	Date	Description	Changed by
0	2/15/2008	Initial Release	-
1	11/5/2009	User Guide Reformat	BE
2	1/5/2010	Optical revised	BE
3	10/4/2010	Mechanical drawing updated	BE
4	1/6/2011	Alternate controller information updated	AK
5	10/11/2011	Electrical characteristics updated	AK
6	4/10/2013	Mechanical drawing, Optical characteristics updated	AK

Functions and Features

- **2 lines x 12 characters**
- **Built-in controller (ST7066)**
- **+5.0V Power Supply**
- **1/16 duty, 1/5 bias**
- **RoHS compliant**

Mechanical Drawing

PIN NO.	SYMBOL
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A

Rev	Description	Date

55.7±0.5
51.3
46.7
46.0(VA)
37.85(AA)
2.2
4.5
4.85
8.93

3.65
7.25
8.75
10.15

32.0±0.5
24.7
17.5
14.5(VA)
11.7(AA)

1.0
30.0

4-R1.25
18.96
1.0
17.78
(P1.27*14)
1.5
12.25
31.2

15-Ø0.7PTH
15-Ø1.0PAD

14.5Max
9.9
1.6

LED B/L

3.20
2.65
0.55
0.45
6.20
5.50
0.70
0.60

DOT SIZE
SCALE 5/1
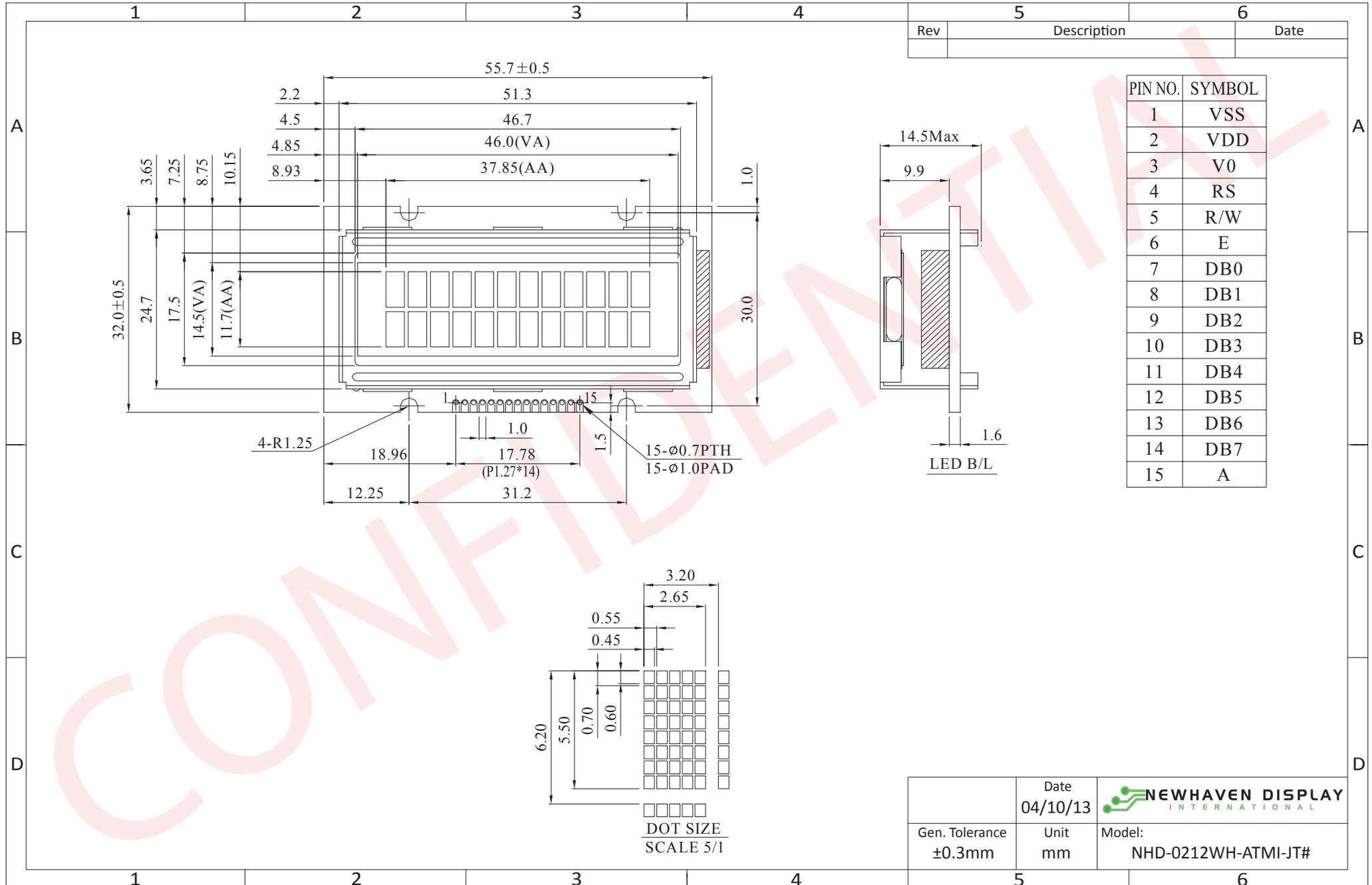
	Date 04/10/13	NEWHAVEN DISPLAY INTERNATIONAL
Gen. Tolerance ±0.3mm	Unit mm	Model: NHD-0212WH-ATMI-JT#

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for logic (+5.0V)
3	V0	Adj Power Supply	Power supply for contrast (approx. 0.8V)
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	A	Power Supply	Power supply for LED Backlight (+3.5V)

Recommended LCD connector: 1.27mm pitch pins
Backlight connector: ---   **Mates with:** ---

[4]
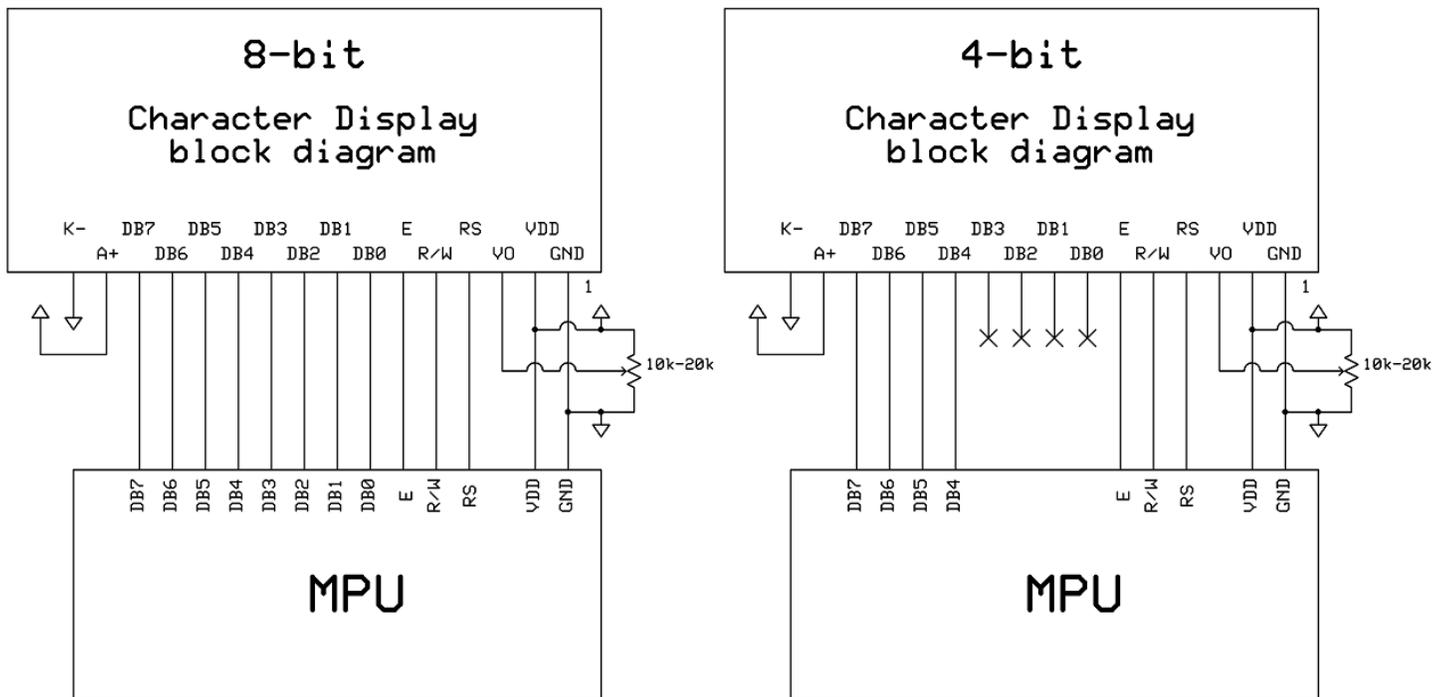
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	ᵒC
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	ᵒC
Supply Voltage	VDD		4.5	5.0	5.5	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	-	1.2	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	3.5	4.2	5.7	V
"H" Level input	Vih		0.7*VDD	-	VDD	V
"L" Level input	Vil		VSS	-	0.6	V
"H" Level output	Voh		3.9	-	VDD	V
"L" Level output	Vol		-	-	0.4	V
Backlight Supply Voltage	Vled	-	3.4	3.5	3.6	V
Backlight Supply Current	Iled	Vled=3.5V	16	20	30	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top			-	20	-	ᵒ
Viewing Angle – Bottom			-	40	-	ᵒ
Viewing Angle – Left		Cr ≥ 2	-	30	-	ᵒ
Viewing Angle – Right			-	30	-	ᵒ
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	150	200	ms
Response Time (fall)	Tf	-	-	150	200	ms

Controller Information

Built-in ST7066 controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

DDRAM Character Address

1	2	3	4	5	6	7	8	9	10	11	12
00	01	02	03	04	05	06	07	08	09	0A	0B
40	41	42	43	44	45	46	47	48	49	4A	4B

Table of Commands

Instruction	Instruction Code										Description	Description Time (270KHz)
	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	1.52 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.	1.52 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.	37 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	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 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 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

Timing Characteristics

Writing data from MPU to ST7066U
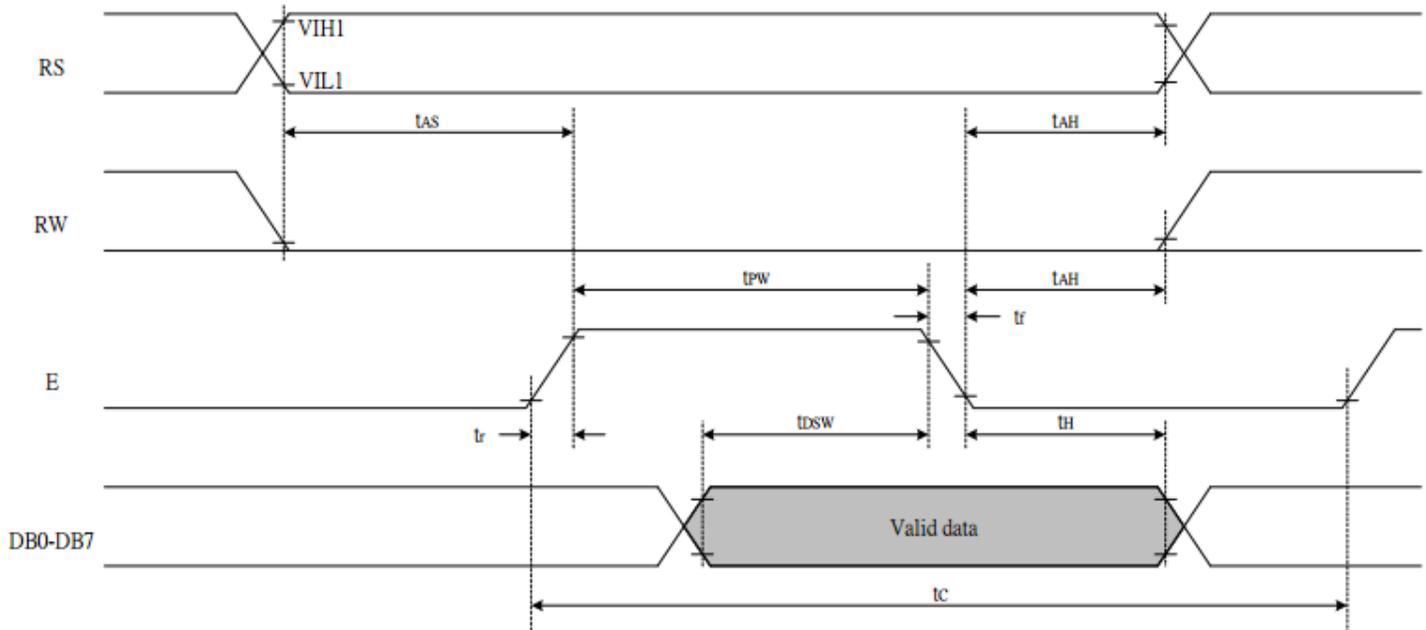
Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	460	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	80	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Reading data from ST7066U to MPU
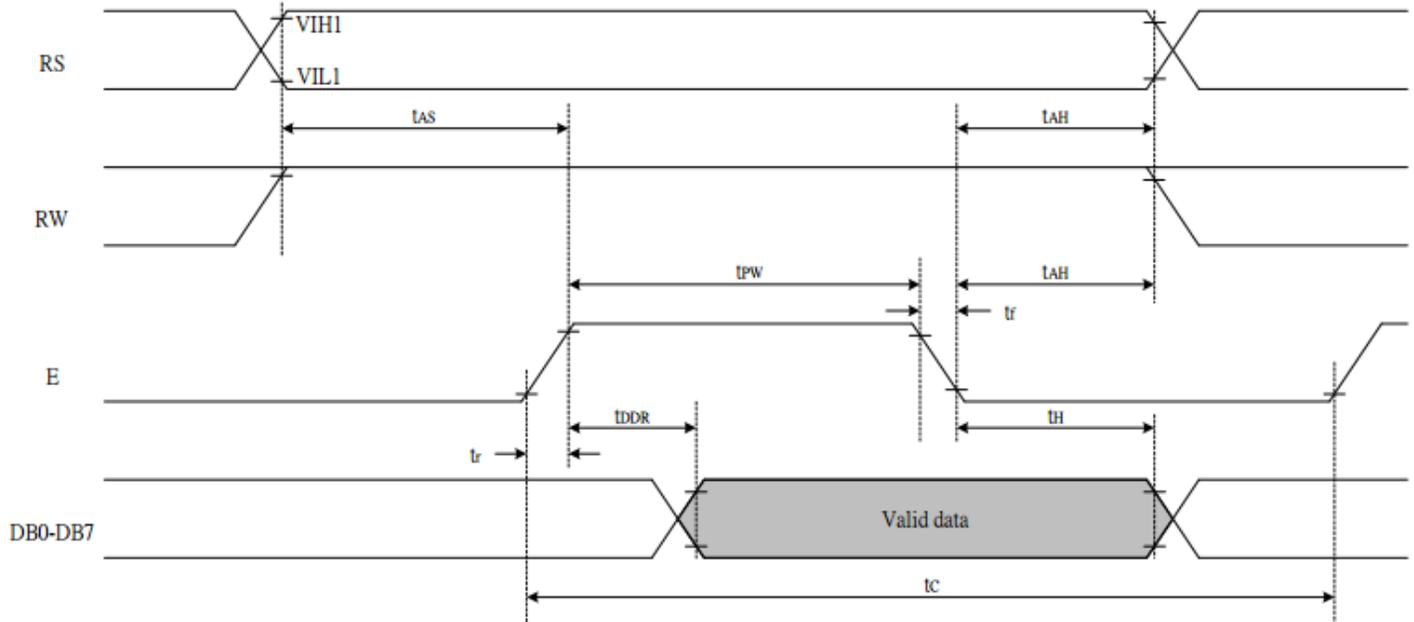
	Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-		ns
T_{PW}	Enable Pulse Width	Pin E	480	-	-		ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25		ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-		ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-		ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320		ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-		ns

[8]

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)			0	@	P	`	p				—	タ	ミ		p
0001	(2)		!	1	A	Q	a	q				｡	ア	チ		q
0010	(3)		"	2	B	R	b	r				｢	イ	ツ		
0011	(4)		#	3	C	S	c	s				｣	ウ	テ		
0100	(5)		$	4	D	T	d	t				､	エ	ト		Ω
0101	(6)		%	5	E	U	e	u				･	オ	ナ		ü
0110	(7)		&	6	F	V	f	v				ヲ	カ	ニ	ρ	
0111	(8)		'	7	G	W	g	w				ア	キ	ヌ	g	π
1000	(1)		(	8	H	X	h	x				ィ	ク	ネ		
1001	(2)		)	9	I	Y	i	y				ゥ	ケ	ノ		y
1010	(3)		*	:	J	Z	j	z				ェ	コ	ハ	j	
1011	(4)		+	;	K	[	k	{				ォ	サ	ヒ		
1100	(5)		,	<	L	¥	l	|				ャ	シ	フ		
1101	(6)		-	=	M	]	m	}				ュ	ス	ヘ		÷
1110	(7)		.	>	N	^	n	→				ョ	セ	ホ		
1111	(8)		/	?	O	_	o	←				ッ	ソ	マ		█

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.

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

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