

NHD-0240AZ-FSW-FBW

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0240-	2 Lines x 40 Characters
AZ-	Model
F-	Transflective
SW-	Side white LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature

Table of Contents

Document Revision History.....	2
Mechanical Drawing	3
Pin Description	4
Wiring Diagram	4
Electrical Characteristics	5
Optical Characteristics	5
Controller Information.....	5
DDRAM Address	5
Table of Commands.....	6
Timing Characteristics.....	7
Built-in Font Table	9
Example Initialization Program	10
Quality Information.....	12

Additional Resources

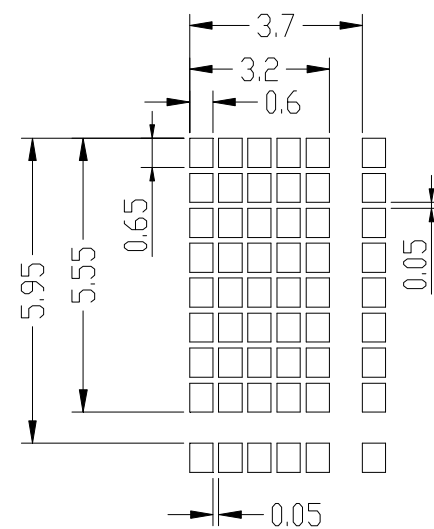
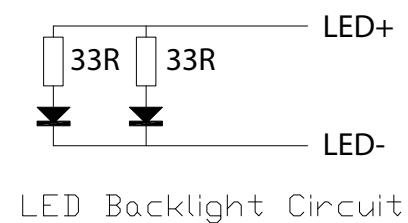
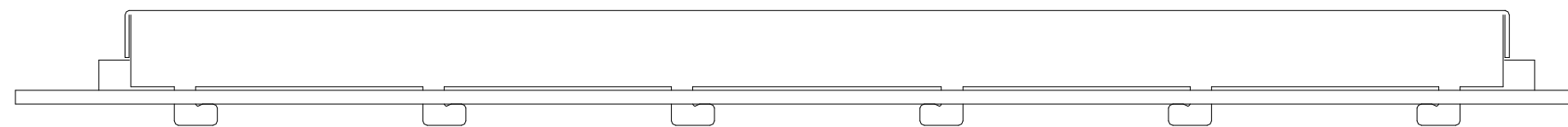
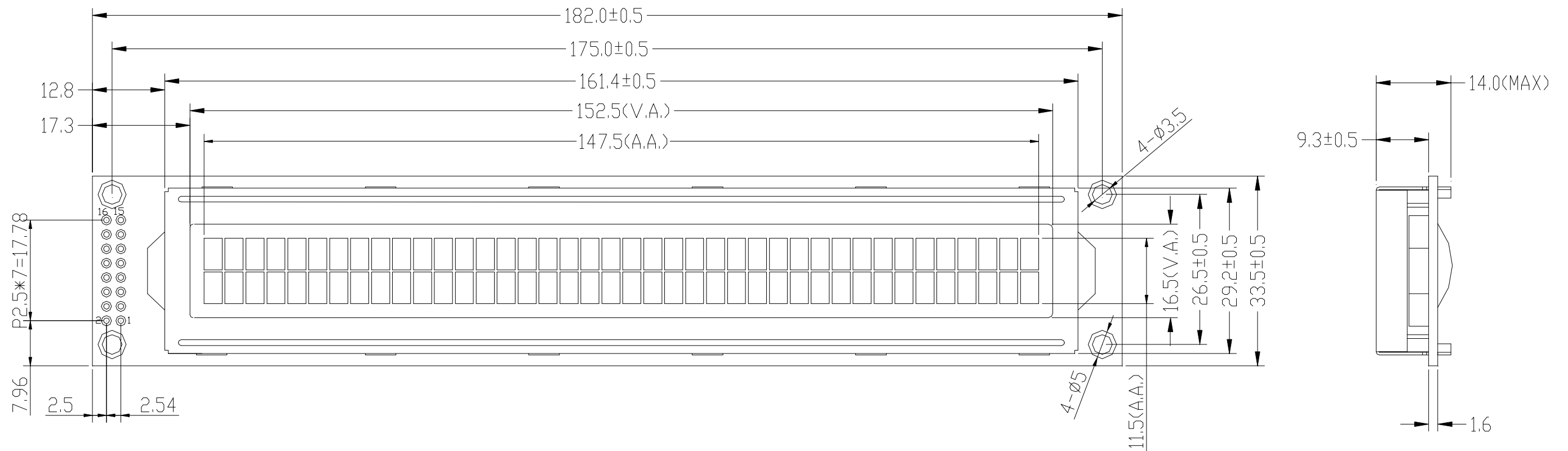
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **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
-	06/06/2025	Initial Release	KL

Mechanical Drawing



Pin No.	Symbol
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7-10	DB0 – DB3
11-14	DB4 – DB7
15	LED-A
16	LED-K

Product Description: 2x40 Character LCD

1. Driver IC: ST7066U
2. Driving Mode: 1/16 Duty, 1/5 Bias
3. Interface: 4/8-bit 6800 Parallel
4. Power Requirement: 5.0V LCD, 3.5V/38mA Backlight
5. Optical Features: FSTN (+), Transflective, 6:00 View, White Backlight
6. Recommended Pin Header: 2x8pin 2.54mm pitch

Standard Tolerance: (Unless otherwise specified) Linear: ±0.3mm	 NEWHAVEN DISPLAY INTERNATIONAL	
	Drawing/Part Number: NHD-0240AZ-FSW-FBW	Revision: -
Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection 	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 06/06/2025	Approved Date: 06/06/2025
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.		

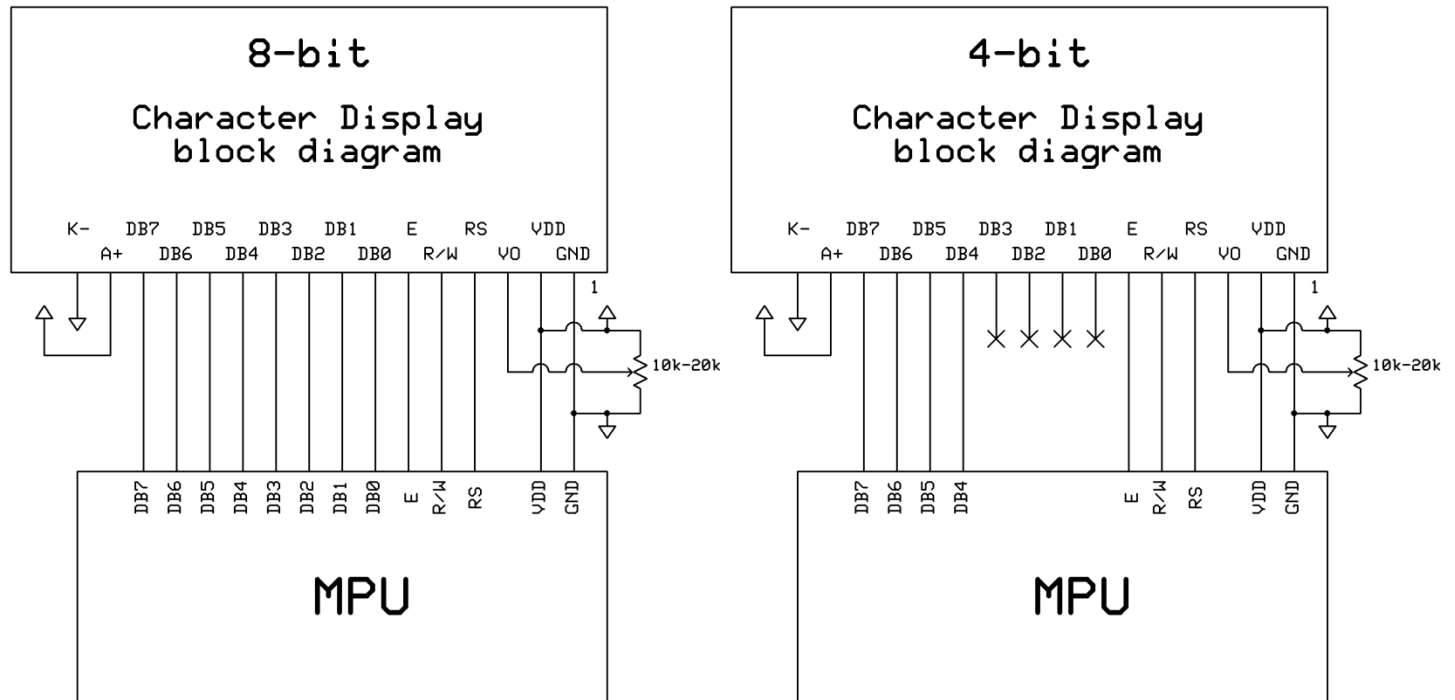
Pin Description

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for LCD and Logic (+5.0V)
3	VO	Adj. Power Supply	Supply Voltage for Contrast (approx. +0.5V)
4	RS	MPU	Register Select signal: '0' = Command, '1' = Data
5	R/W	MPU	Read/Write select signal: '1' = Read, '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-A	Power Supply	Backlight Anode (3.5V via on-board resistor)
16	LED-K	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 2.54mm pitch pins

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

Wiring Diagram



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	5.3	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	-	2.5	3.0	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	4.3	4.5	4.7	V
"H" Level input	Vih	-	0.7*VDD	-	VDD	V
"L" Level input	Vil	-	0	-	0.6	V
"H" Level output	Voh	-	0.75*VDD	-	-	V
"L" Level output	Vol	-	-	-	0.2*VDD	V
Backlight Supply Voltage	Vled	-	3.3	3.5	3.7	V
Backlight Supply Current	Iled	VLED=3.5V	26	38	50	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR ≥ 2	-	35	-	°
	Bottom		-	40	-	°
	Left		-	50	-	°
	Right		-	50	-	°
Contrast Ratio	CR	-	2	5	-	-
Response Time	Rise	T _{OP} = 25°C	-	100	250	ms
	Fall		-	150	250	ms

Controller Information

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

DDRAM Address

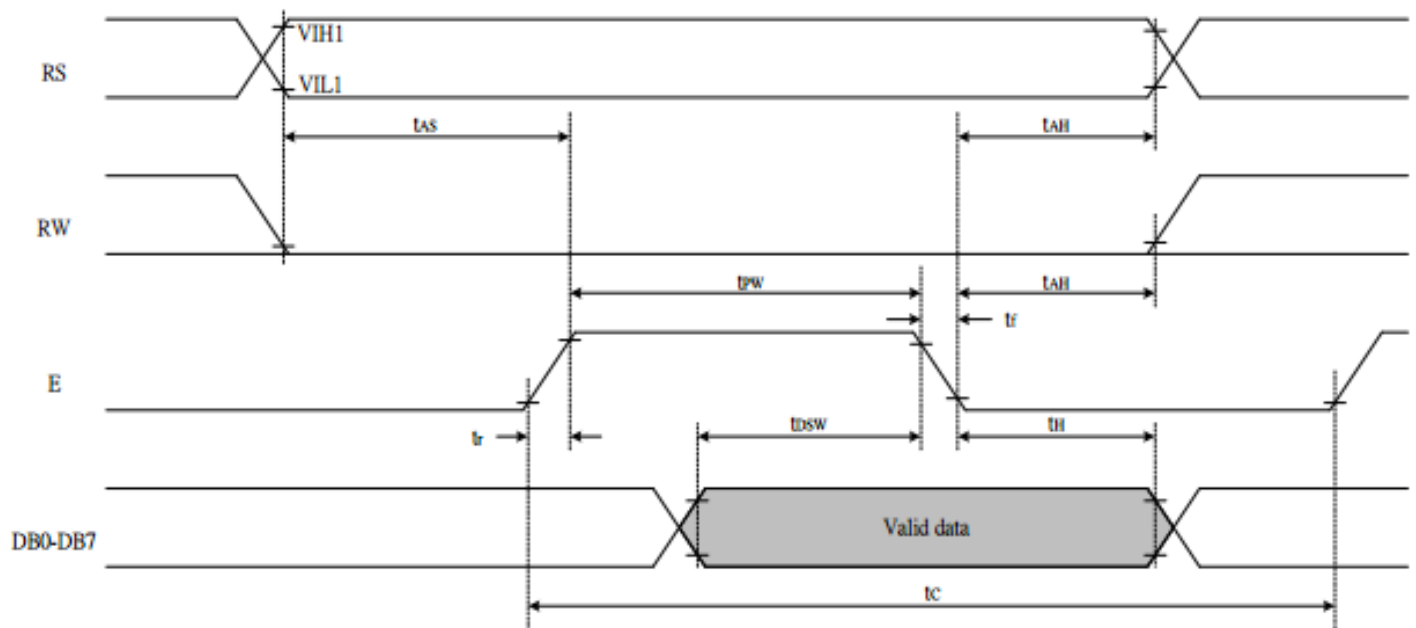
1	2	3	-	-	-	-	38	39	40
00	01	02	-	-	-	-	25	26	27
40	41	42	-	-	-	-	65	66	67

Table of Commands

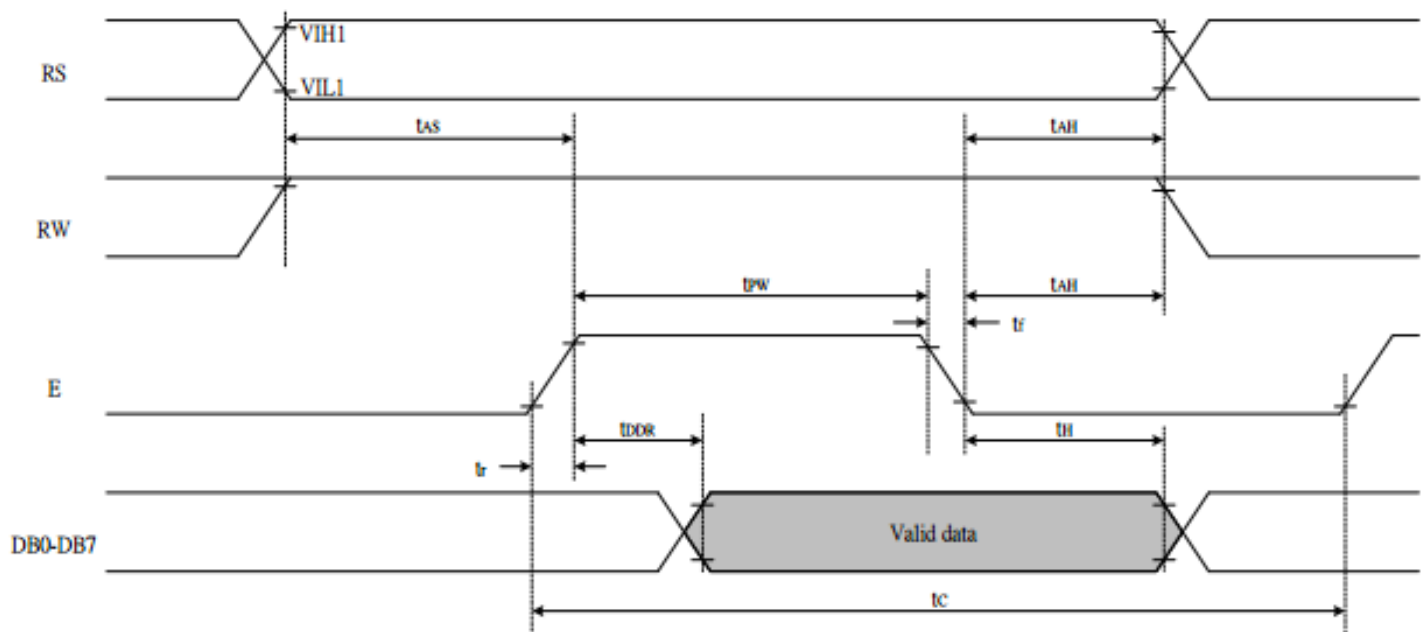
Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor 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

Write data from MPU to ST7066U



Read data from ST7066U to MPU



Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f_{OSC}	OSC Frequency	R = 91K Ω	190	270	350	KHz
<i>External Clock Operation</i>						
f_{EX}	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μ s
<i>Write Mode (Writing data from MPU to ST7066U)</i>						
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
<i>Read Mode (Reading Data from ST7066U to MPU)</i>						
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

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	Q	P	`	P				-	9	≡	α	p
xxxx0001	(2)		!	1	A	Q	a	q			■	ア	チ	△	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ウ	×	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ホ	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			イ	ク	ネ	リ	フ	×
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	×	π
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ワ	Φ	円
xxxx1101	(6)		-	=	M	]	m	>			ユ	ズ	ハ	ン	も	÷
xxxx1110	(7)		。	>	N	^	n	→			ヨ	セ	ホ	°	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

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 >= 460ns
    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 >= 460ns
    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 >= 460ns
    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	

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.