

# NHD-0108CZ-FSW-GBW-33V3

## Character Liquid Crystal Display Module

NHD- Newhaven Display  
0108- 1 line x 8 characters  
CZ- Model  
F- Transflective  
SW- Side White LED Backlight  
G- STN- Gray  
B- 6:00 view  
W- Wide Temperature (-20°C~+70°C)  
33V3- 3.3VDD, 3V Backlight  
**RoHS Compliant**

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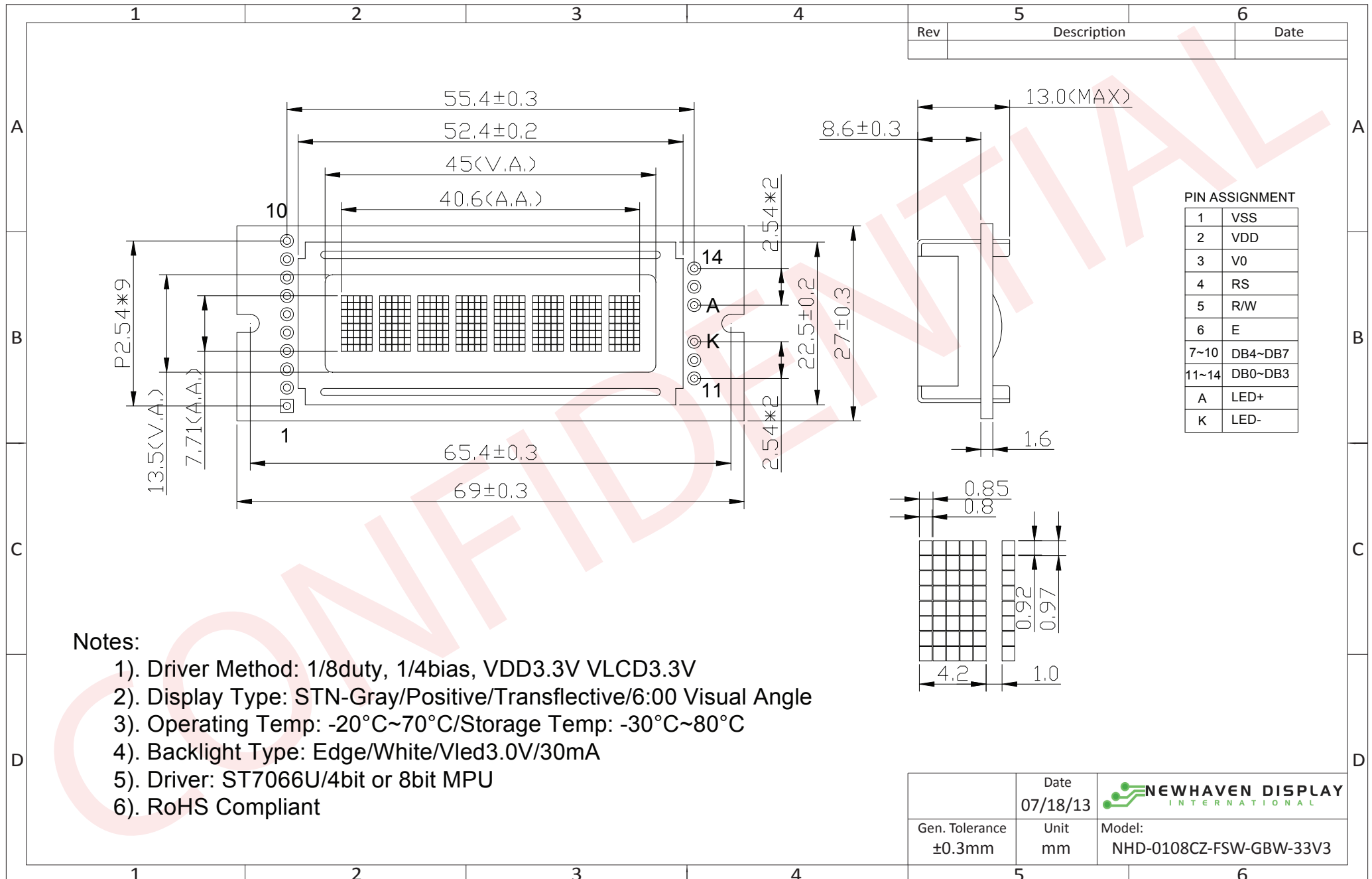
## Document Revision History

Revision	Date	Description	Changed by
0	10/31/2011	33V – Improved LCD Liquid; VDD = 3.3V	SB
1	07/18/2013	Mechanical and Timing characteristics updated	KA

## Functions and Features

- 1 line x 8 characters
- Built-in controller (ST7066U or equivalent)
- +3.3V power supply
- 4-bit or 8-bit MPU interface
- RoHS compliant

# Mechanical Drawing



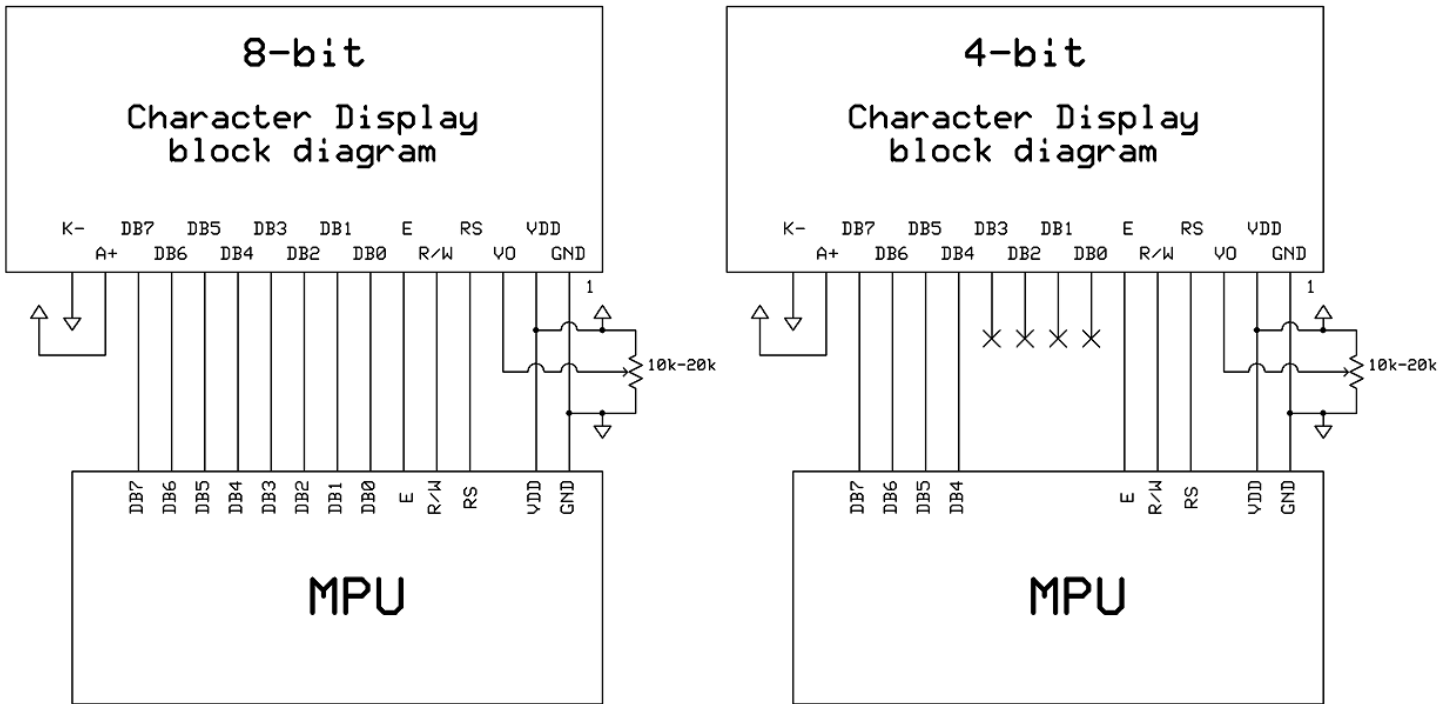
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for logic (+3.3V)
3	VO	Adj Power Supply	Power supply for contrast (approx. 0V)
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	DB4 – DB7	MPU	Four high order bi-directional three-state data bus lines.
11-14	DB0 – DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
A	LED+	Power Supply	Power supply for LED Backlight (+3.0V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 2.54mm pitch pins

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		-	3.3	-	V
Supply Current	IDD	Ta=25°C, VDD=3.3V	-	1.5	2.5	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	3.3	-	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	-	2.8	3.0	3.3	V
Backlight Supply Current	Iled	Vled=3.0V	-	30	40	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr ≥ 2	-	40	-	°
Viewing Angle – Bottom			-	60	-	°
Viewing Angle – Left			-	60	-	°
Viewing Angle - Right			-	60	-	°
Contrast Ratio	Cr		2	5	-	-
Response Time (rise)	Tr	-	-	150	250	ms
Response Time (fall)	Tf	-	-	200	300	ms

## Controller Information

Built-in ST7066U controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7066U.pdf](http://www.newhavendisplay.com/app_notes/ST7066U.pdf)

## DDRAM Address

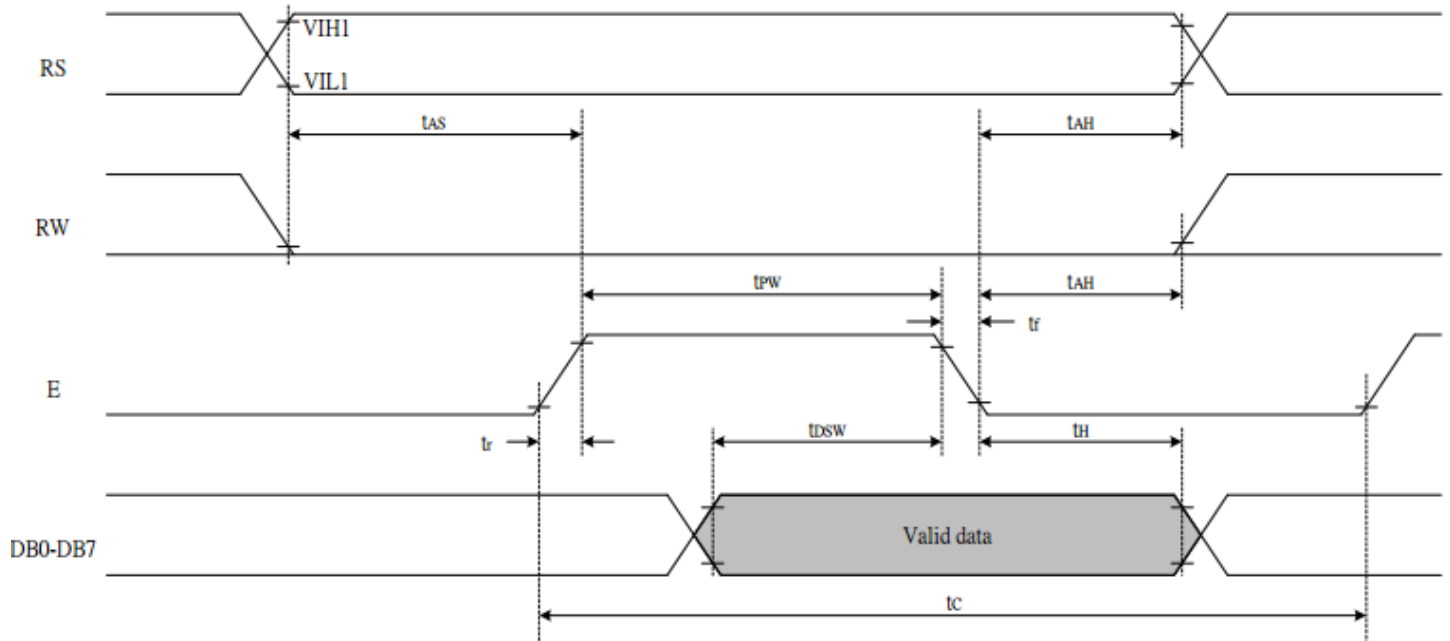
1	2	3	4	5	6	7	8
00	01	02	03	04	05	06	07

## 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	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	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	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	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	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	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

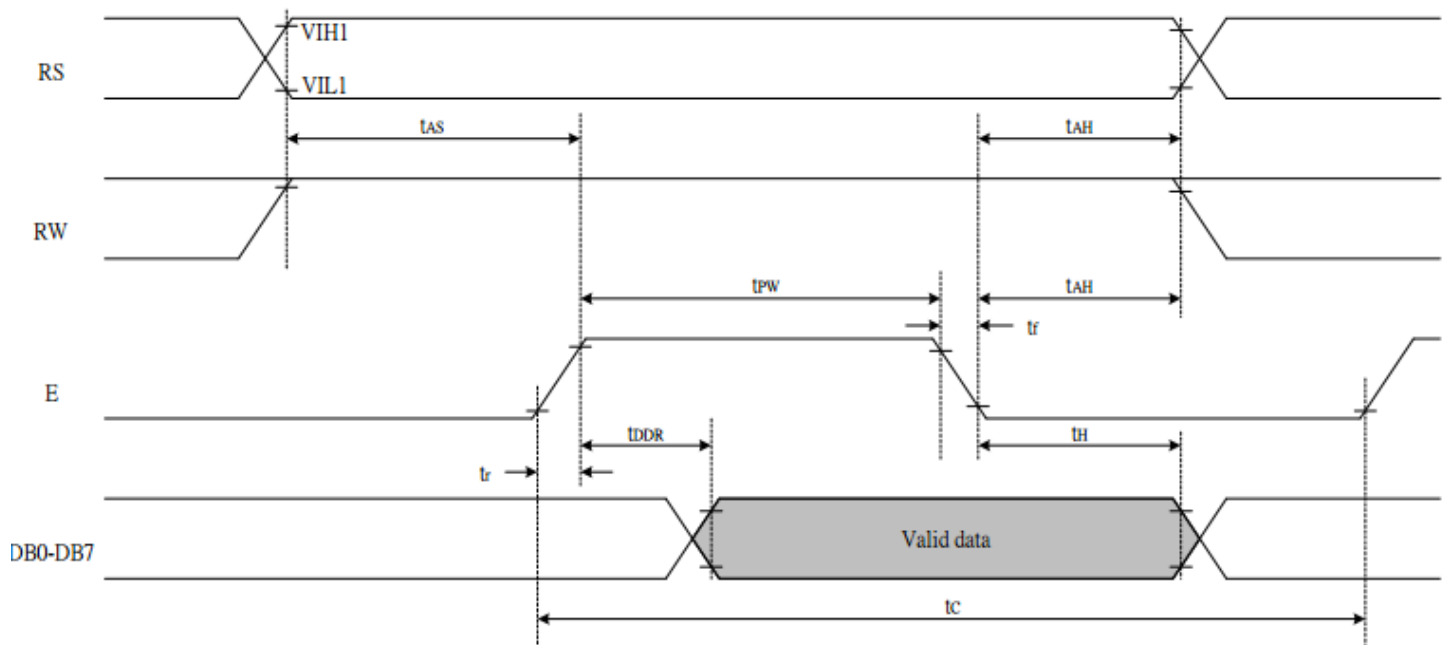
# Timing Characteristics

## 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	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)			0	a	P	\	P				一	タ	三	⊗	ρ
0001	(2)		!	1	A	Q	a	q			•	フ	チ	△	⊗	q
0010	(3)		"	2	B	R	b	r			「	イ	ウ	×	ρ	θ
0011	(4)		#	3	C	S	c	s			」	ウ	テ	セ	ε	⊗
0100	(5)		\$	4	D	T	d	t			√	エ	ト	カ	μ	⊗
0101	(6)		%	5	E	U	e	u			•	オ	カ	1	⊗	⊗
0110	(7)		&	6	F	V	f	v			ヲ	〇	ニ	ヨ	ρ	Σ
0111	(8)		'	7	G	W	g	w			フ	十	又	ヲ	g	π
1000	(1)		<	8	H	X	h	x			イ	ウ	※	リ	フ	⊗
1001	(2)		>	9	I	Y	i	y			ウ	ウ	ノ	ル	リ	γ
1010	(3)		*	:	J	Z	j	z			エ	コ	ノ	ル	j	≠
1011	(4)		+	;	K	C	k	c			※	ウ	ヒ	〇	⊗	π
1100	(5)		,	<	L	≠	l	l			※	ウ	ウ	ウ	⊗	π
1101	(6)		-	=	M	I	m	〉			ユ	又	ノ	ル	⊗	÷
1110	(7)		.	>	N	^	n	→			ヨ	セ	※	ノ	π	
1111	(8)		/	?	O	L	o	←			ウ	ウ	又	ノ	⊗	■

## Example Initialization Code

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	
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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)



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