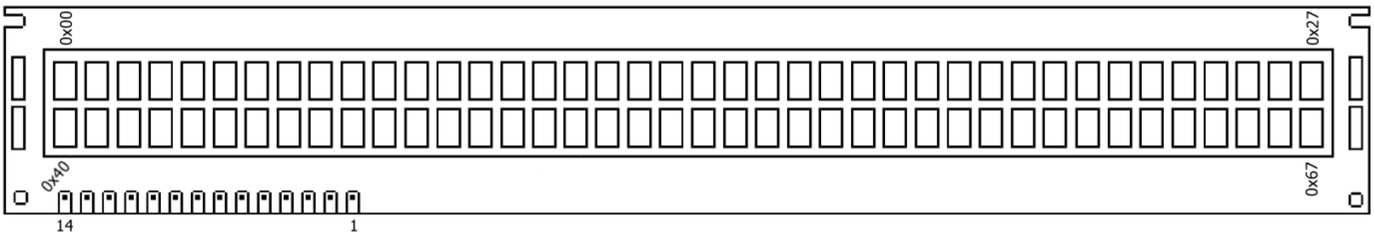
The *Extended Concise* LCD Data Sheet for HD44780

Version: 25.6.1999

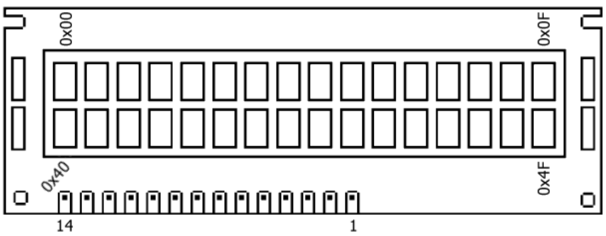
Instruction	RS	RW	D7	D6	D5	D4	D3	D2	D1	D0	Description	Clock-Cycles
NOP	0	0	0	0	0	0	0	0	0	0	No Operation	0
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear display & set address counter to zero	165
Cursor Home	0	0	0	0	0	0	0	0	1	x	Set adress counter to zero, return shifted display to original position. DD RAM contents remains unchanged.	3
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Set cursor move direction (I/D) and specify automatic display shift (S).	3
Display Control	0	0	0	0	0	0	1	D	C	B	Turn display (D), cursor on/off (C), and cursor blinking (B).	3
Cursor / Display shift	0	0	0	0	0	1	S/C	R/L	x	x	Shift display or move cursor (S/C) and specify direction (R/L).	3
Function Set	0	0	0	0	1	DL	N	F	x	x	Set interface data width (DL), number of display lines (N) and character font (F).	3
Set CGRAM Address	0	0	0	1	CGRAM Address						Set CGRAM address. CGRAM data is sent afterwards.	3
Set DDRAM Address	0	0	1	DDRAM Address							Set DDRAM address. DDRAM data is sent afterwards.	3
Busy Flag & Address	0	1	BF	Address Counter							Read busy flag (BF) and address counter	0
Write Data	1	0	Data								Write data into DDRAM or CGRAM	3
Read Data	1	1	Data								Read data from DDRAM or CGRAM	3

x : Don't care	I/D	1 0	Increment Decrement	R/L	1 0	Shift to the right Shift to the left
	S	1 0	Automatic display shift	DL	1 0	8 bit interface 4 bit interface
	D	1 0	Display ON Display OFF	N	1 0	2 lines 1 line
	C	1 0	Cursor ON Cursor OFF	F	1 0	5x10 dots 5x7 dots
	B	1 0	Cursor blinking	DDRAM : Display Data RAM CGRAM : Character Generator RAM		
	S/C	1 0	Display shift Cursor move			

LCD Display with 2 lines x 40 characters :



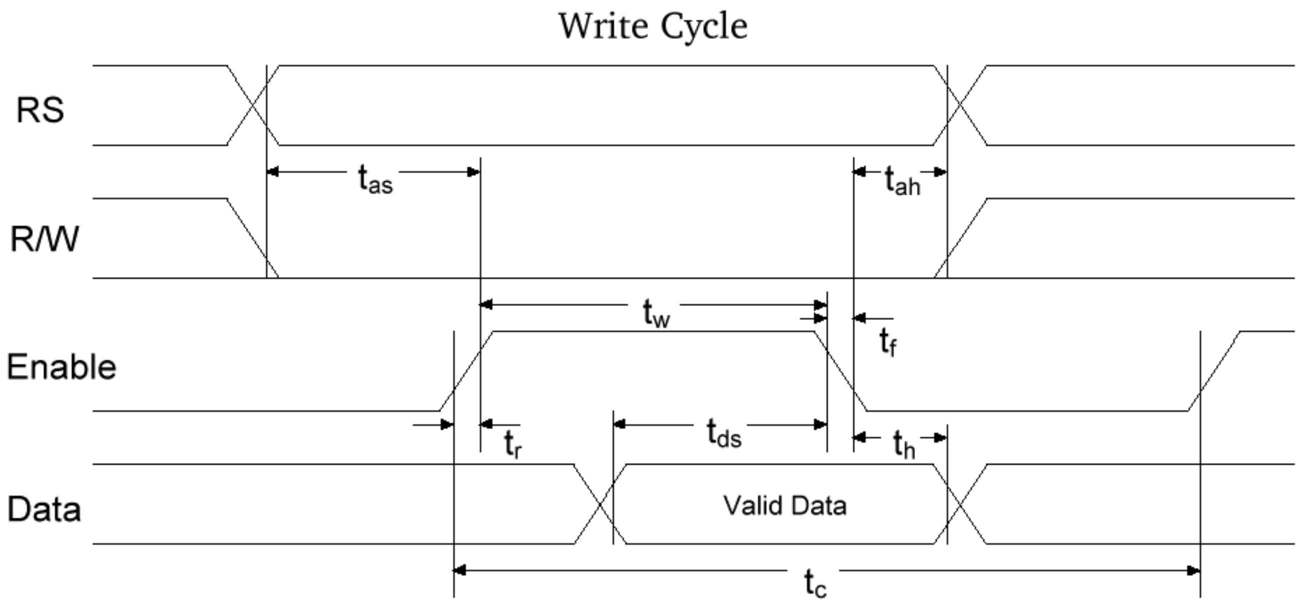
LCD Display with 2 lines x 16 characters :



Pin No	Name	Function	Description
1	Vss	Power	GND
2	Vdd	Power	+ 5 V
3	Vee	Contrast Adj.	(-2) 0 - 5 V
4	RS	Command	Register Select
5	R/W	Command	Read / Write
6	E	Command	Enable (Strobe)
7	D0	I/O	Data LSB
8	D1	I/O	Data
9	D2	I/O	Data
10	D3	I/O	Data
11	D4	I/O	Data
12	D5	I/O	Data
13	D6	I/O	Data
14	D7	I/O	Data MSB

Bus Timing Characteristics

(Ta = - 20 to + 75°C)



Write-Cycle	**V_{DD}**	2.7 - 4.5 V [(2)]	4.5 - 5.5 V [(2)]		2.7 - 4.5 V [(2)]	4.5 - 5.5 V [(2)]	
Parameter	**Symbol**	**Min[(1)]**		**Typ[(1)]**	**Max[(1)]**		**Unit**
Enable Cycle Time	t_c	1000	500	-	-	-	ns
Enable Pulse Width (High)	t_w	450	230	-	-	-	ns
Enable Rise/Fall Time	t_r, t_f	-	-	-	25	20	ns
Address Setup Time	t_{as}	60	40	-	-	-	ns
Address Hold Time	t_{ah}	20	10	-	-	-	ns
Data Setup Time	t_{ds}	195	80	-	-	-	ns
Data Hold Time	t_h	10	10	-	-	-	ns

(1) *The above specifications are indications only (based on Hitachi HD44780). Timing will vary from manufacturer to manufacturer.*

(2) *Power Supply :* *HD44780 S :* $V_{DD} = 4.5 - 5.5$ *V*
HD44780 U : $V_{DD} = 2.7 - 5.5$ *V*

This data sheet refers to specifications for the Hitachi HD44780 LCD Driver chip, which is used for most LCD modules.

Common types are :
1 line x 20 characters
2 lines x 16 characters
2 lines x 20 characters
2 lines x 40 characters
4 lines x 20 characters
4 lines x 40 characters