USER'S GUIDE

VST101B

Liquid Crystal Display Module

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1.0 Mechanical Diagram

2.0 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT
Power Voltage	V_{DD}-V_{SS}	0	7.0	V
Input Voltage	V_{in}	V_{SS}	V_{DD}	
Operating Temperature Range	T_{OP}	0	+50	℃
Storage Temperature Range	T_{ST}	-20	+60	

*Wide Temperature range is available (operating/storage temperature as wide as -20～+70/-30～+80℃)。

3.0 Description Of Terminals

PIN NO.	PIN NAME	INPUT/ OUTPUT	EXTERNAL CONNECTION	FUNCTION
1	VSS	—	Power	VSS:GND
2	VDD	—	Supply	VDD: +5V
3	VO	—		V_{LCD} adjustment
4	RS	INPUT	MPU	Register select signal "0":Instruction register (when writing) Busy flag & address counter (When reading) "1":Data register (when writing & reading)
5	R/W	Input	MPU	Read/write select signal "0" for writing , "1" for reading
6	E	Input	MPU	Operation (data read/write) enable signal
7 / 10	DB0-DB3	Input	MPU	Low-order lines of data bus with 3-state, bi-directional function for use in data transaction with the MPU. These lines are not used when interfacing with a 4-bit microprocessor.
11 / 14	DB4-DB7	Input	MPU	High-order lines of data bus with 3-state, bi-directional function for use in data transactions with the MPU. DB7 may also be used to check the busy flag.
15 / 16	LED "+" LED "-"	Input	LED BACKLIGHT POWER SUPPLY	LED "+" VOLTAGE TYPE:4.2V MAX : 4.5V LED "-" : GND

4.0 Optical Characteristics

for TN Type Display Module (T_a=25℃, V_{DD}=5.0V±0.25V)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Viewing angle	θ	$C_r \geqslant 4$	-25	—	—	deg
	Φ		-30	—	30	
Contrass ratio	C_r		—	2	—	—
Response time(rise)	T_r	—	—	120	150	ms
Response time(fall)	T_r	—	—	120	150	ms

for STN Type Display Module (T_a=25˚C, V_{DD}=5.0V±0.25V)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Viewing angle	θ	$C_r \geqslant 2$	-60	—	35	deg
	Φ		-40	—	40	
Contrass ratio	C_r		—	6	—	—
Response time(rise)	T_r	—	—	150	250	ms
Response time(fall)	T_r	—	—	150	250	ms

5.0 Electrical Characteristics

5.1 DC Characteristics

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYPE	MAX.	UNIT
Supply voltage for LCD	$V_{DD}-V_O$	T_A=25˚C	—	4.6	—	V
Input voltage	V_{DD}		4.7	—	5.5	V
Supply current	I_{DD}	V_{DD}=5.0V;T_A=25˚C	—	1.5	2.5	mA
Input leakage current	I_{LKG}		—	—	1.0	μA
“H” level input voltage	V_{IH}		2.2	—	V_{DD}	V
“L” level input voltage	V_{IL}	Twice initial value or less	0	—	0.6	V
“H” level output voltage	V_{OH}	LOH= -0.25MA	2.4	—	—	V
“L” level output voltage	V_{OL}	LOL=1.6MA	—	—	0.4	V

5.2 AC Characteristics

Read Cycle (V_{DD}=5.0V+10%,V_{SS}=OV, T_a=25˚C)

PARAMETER	SYMBOL	TEST PIN	MIN.	TYPE	MAX.	UNIT

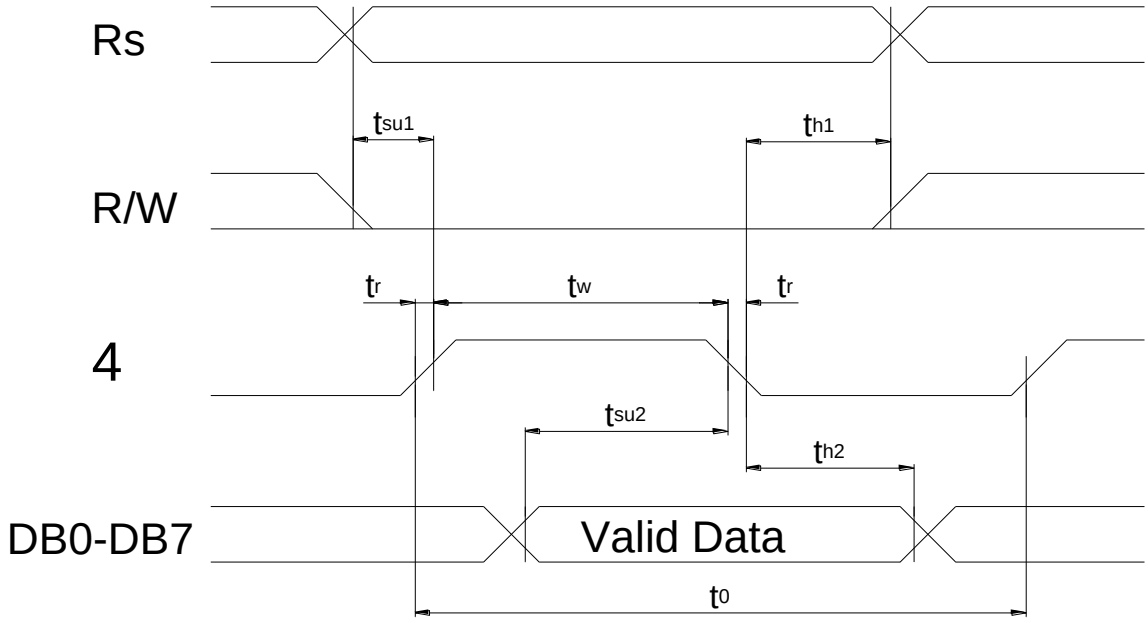
Enable cycle time	t_c	E	500	—	—	
Enable pulse width	t_w	E	300	—	—	
Enable rise/fall time	t_r, t_f	E	—	—	25	
RS,R/W setup time	t_{su}	RS; R/W	100	—	—	ns
RS.R/W address hold time	t_h	RS; R/W	10	—	—	
Read data output delay	t_D	DB0-DB7	60	—	190	
Read data hold time	t_{DH}	DB0-DB7	20	—	—	

5.3 Write Cycle

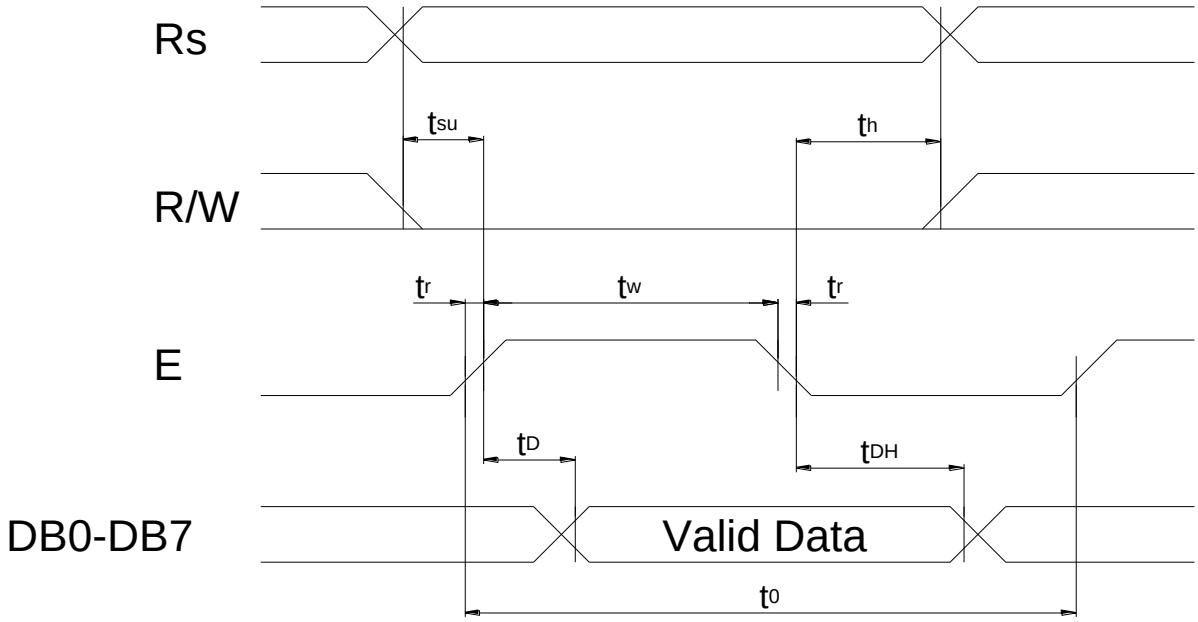
PARAMETER	SYMBOL	TEST PIN	MIN.	TYPE	MAX.	UNIT
Enable cycle time	t_c	E	500	—	—	
Enable pulse width	t_w	E	300	—	—	
Enable rise/fall time	t_r,t_f	E	—	—	25	
RS,R/W setup time	t_{su1}	RS; R/W	100	—	—	ns
RS,R/W address hold time	t_{h1}	RS; R/W	10	—	—	
Data setup time	t_{su2}	DB0-DB7	60	—	—	
Data hold time	t_{h2}	DB0-DB7	10	—	—	

6.0 Timing Characteristics

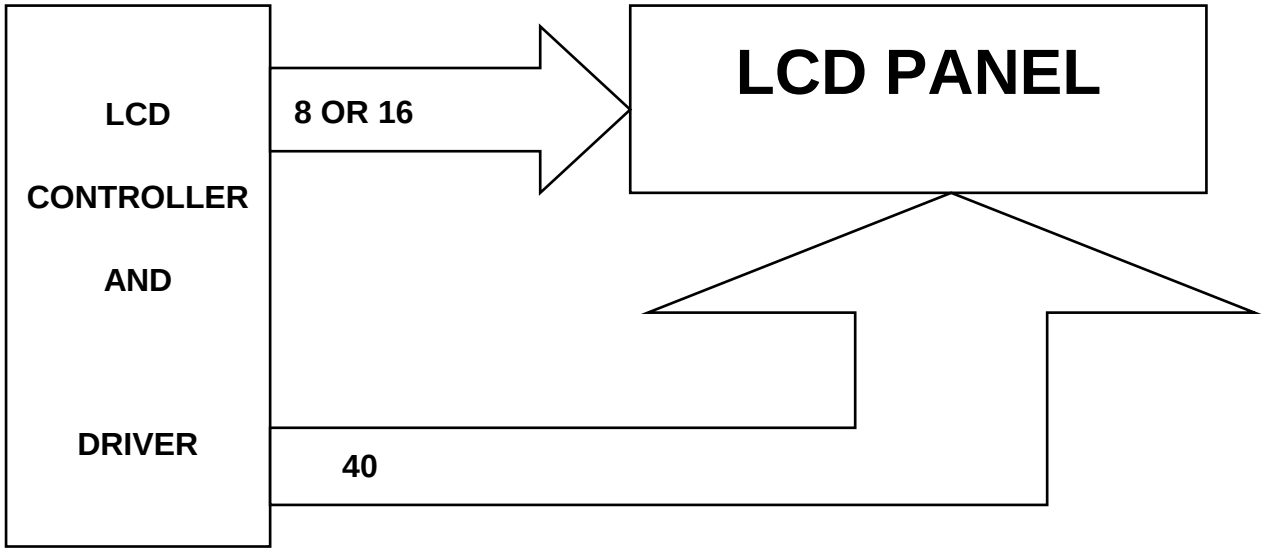
Write Timing

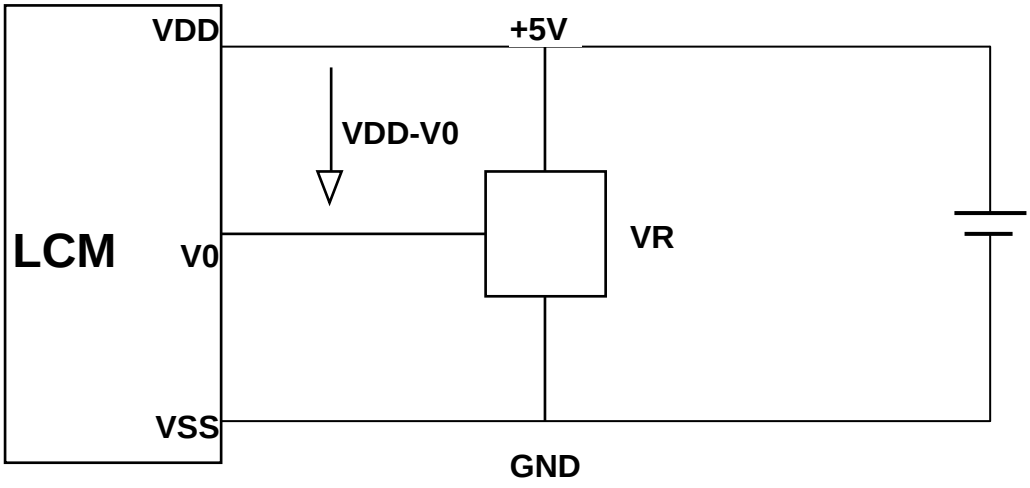


Read Timing



7.0 Block Diagram





VDD-Vo: LCD DRIVING VOLTAGE

VR: 10K-20KΩ

8.0 Display command

PARAMETER	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	NOTE	EXECUTING TIME FOSC=270 KHZ
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.52ms
Cursor 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	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	1/D	S	Assign cursor moving direction and enable the shift of entire display	38 μ s
Display on/off	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off control bit.	38 μ s
Cursor / 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.	38 μ s
Function Set	0	0	0	0	1	DL	N	F	*	*	interface data length (DL: 8-bit/4-bit), numbe SET rs of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	38 μ s
Set CG RAM Address	0	0	0	1	Ac5	Ac4	Ac3	Ac2	Ac1	Ac0	Set DDRAM address in counter	38 μ s
Set DD RAM Address	0	0	1	Ac6	Ac5	Ac4	Ac3	Ac2	Ac1	Ac0	Set DDRAM address in counter	38 μ s
Read Busy Flug/Address Counter	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	
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38 μ s
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	38 μ s

DD RAM Address:

	1	2	3	4	5	6	7	8	9	10
Address for line	00	01	02	03	04	40	41	42	43	44

9.0 Reliability And Life Time

1.Reliability Test

		EVALUATIONS AND ASSESSMENT*			
Storage Condition	**Content**	**Current consumption**	**Oozing**	**Contrast**	**Other appearances**
Operation at high temperature and humidity	40˚C,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60˚C, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20˚C, 240hrs	Twice initial value or less		More than 80% of initial value	No abnormality

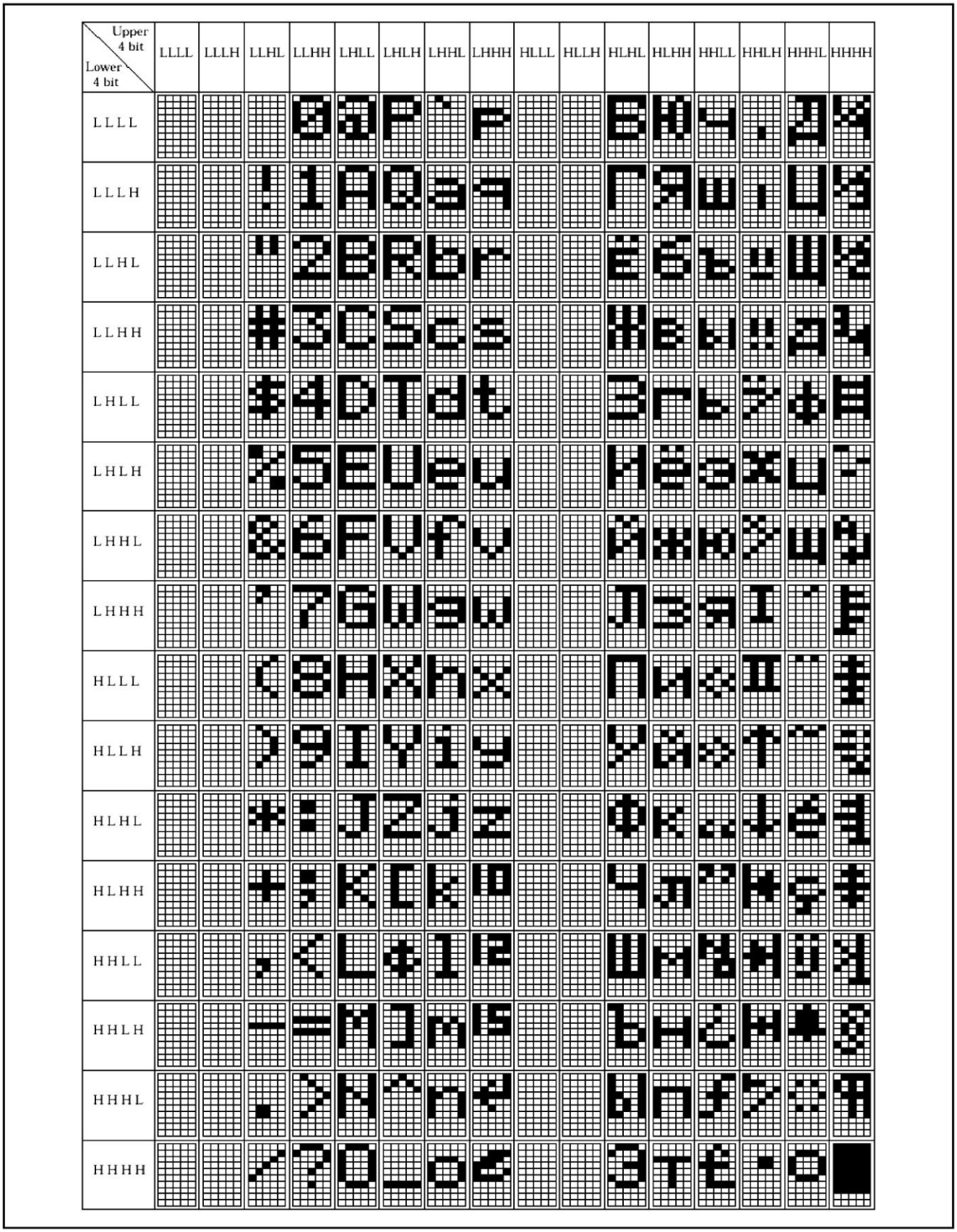
*Evaluations and assessment to be made two hours after returning to room temperature (25℃±5℃).
*The LCDs subjected to the test must not have dew condensation.

2. Liquid crystal panel service life

50,000 hours minimum at 25±10˚C,45±20%RH.

10.0 Standard Character Pattern

8.2. SPLC780C - 02



Note: The user can specify any pattern for character-generator RAM.