User’s Guide

ATM1602B

Liquid Crystal Display Module

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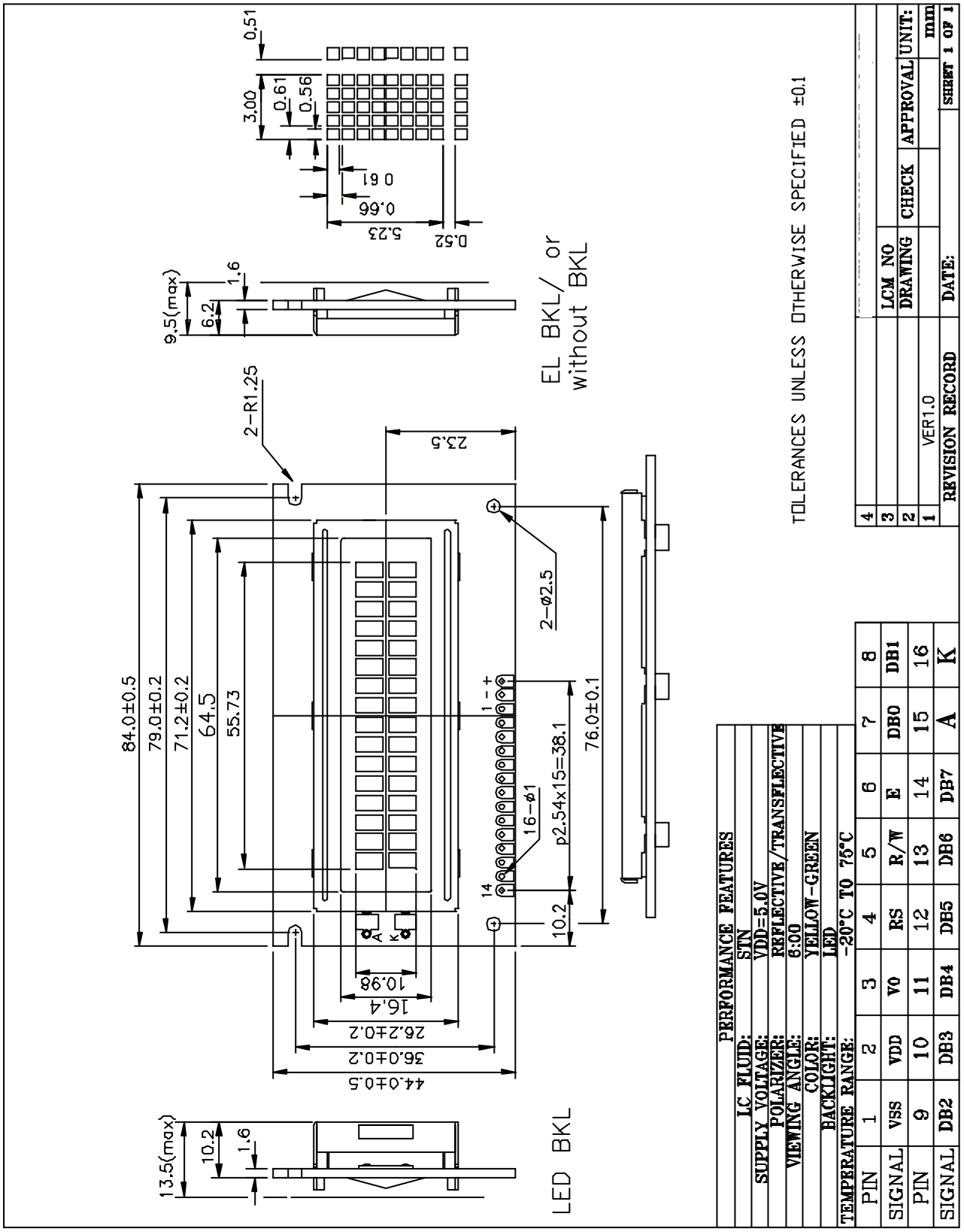
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Mechanical Diagram



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℃)。

Description Of Terminals

Pin No.	Pin Name	Input/ Output	External Connection	Function
1	VSS	—	Power Supply	VSS:GND
2	VDD	—		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

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	$C_r \geq 4$	-25	—	—	deg
	Φ		-30	—	30	
Contrast 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℃, V_{DD}=5.0V±0.25V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ	$C_r \geq 2$	-60	—	35	deg
	Φ		-40	—	40	
Contrast ratio	C_r		—	6	—	—
Response time(rise)	T_r	—	—	150	250	ms
Response time(fall)	T_r	—	—	150	250	ms

Electrical Characteristics

DC Characteristics

Parameter	Symbol	Conditions	Min.	Type	Max.	Unit
Supply voltage for LCD	$V_{DD}-V_O$	T_A=25℃	—	4.6	—	V
Input voltage	V_{DD}		4.7	—	5.5	V
Supply current	I_{DD}	V_{DD}=5.0V;T_A=25℃	—	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
Backlight supply power	V_F		—	4.2	4.5	V

AC Characteristics

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

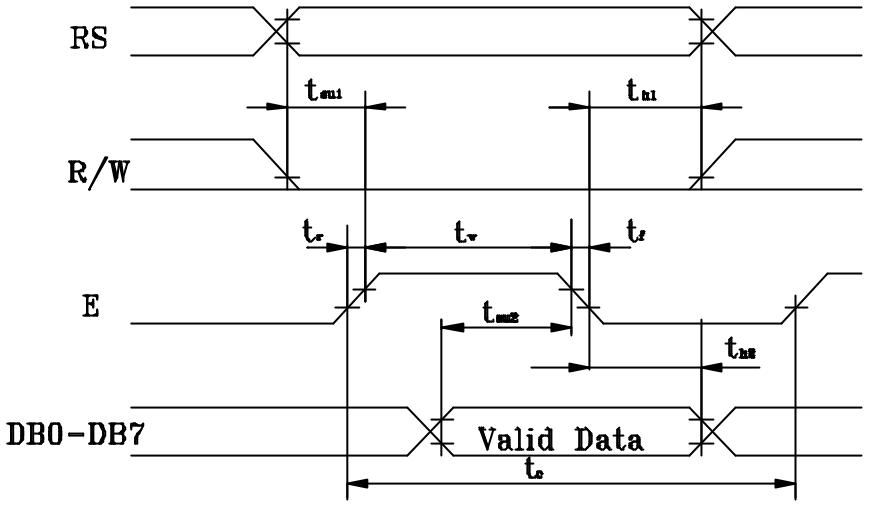
Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	t_c	E	500	–	–	ns
Enable pulse width	t_w	E	300	–	–	
Enable rise/fall time	t_r, t_f	E	–	–	25	
RS,R/W setup time	t_{su}	RS; R/W	100	–	–	
RS.R/W address hold time	t_h	RS; R/W	10	–	–	
Read data output delay	t_D	DB0-DB7	60	–	190	
Read data hold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

Write Cycle

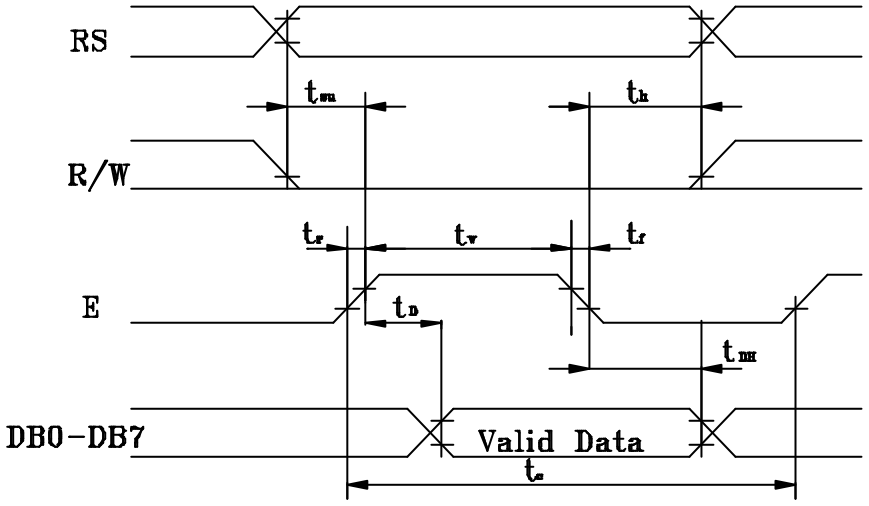
Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	t_c	E	500	–	–	ns
Enable pulse width	t_w	E	300	–	–	
Enable rise/fall time	t_r,t_f	E	–	–	25	
RS,R/W setup time	t_{su1}	RS; R/W	100	–	–	
RS,R/W address hold time	t_{h1}	RS; R/W	10	–	–	
Data setup time	t_{su2}	DB0-DB7	60	–	–	
Data hold time	t_{h2}	DB0-DB7	10	–	–	

Timing Characteristics

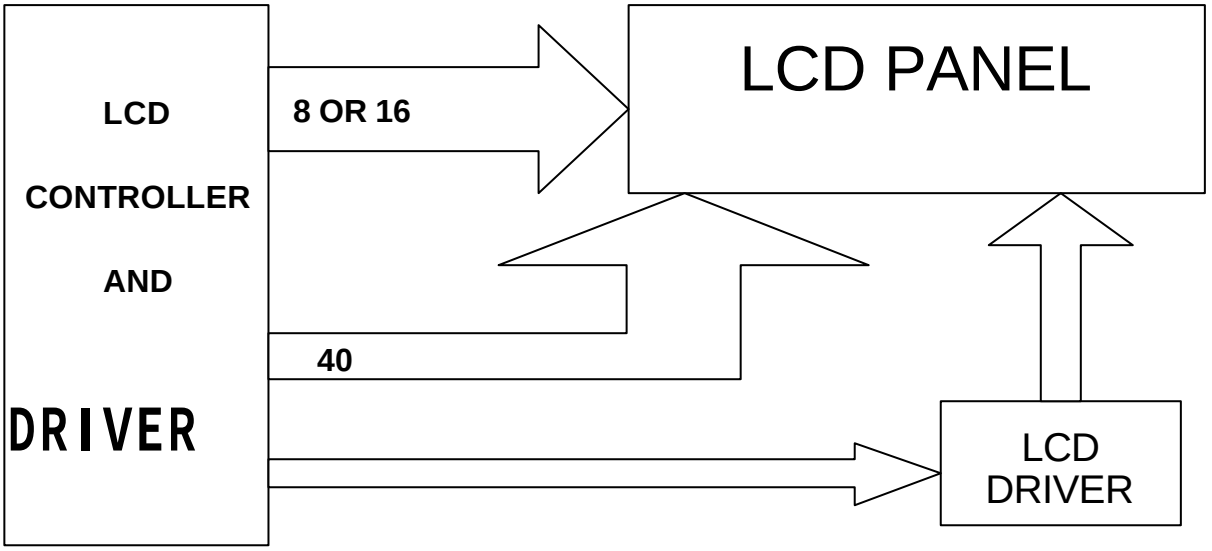
Write Timing

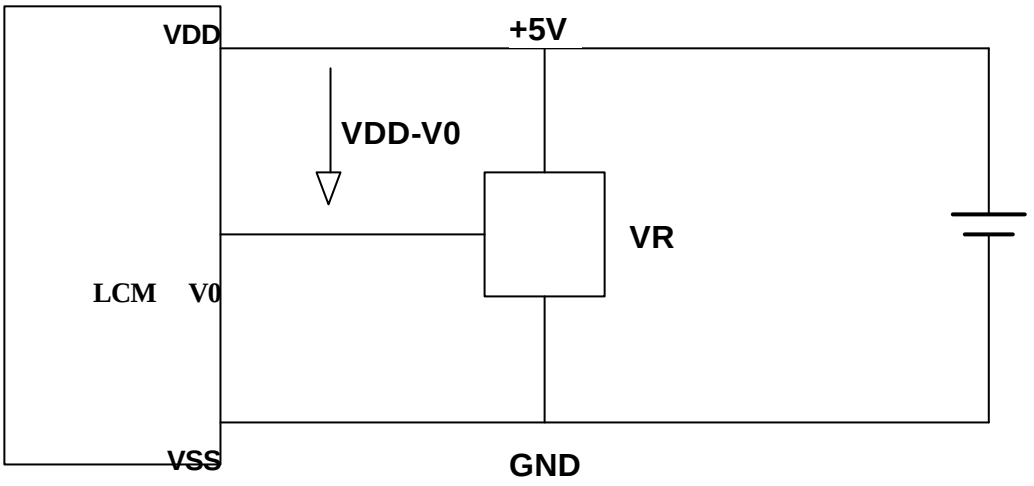


Read Timing



Block Diagram





VDD-Vo: LCD DRIVING VOLTAGE

VR: 10K-20KΩ

Display command

Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note	Executing time fosc=250khz
Clear Display	0	0	0	0	0	0	0	0	0	1		1.64ms
Cursor home	0	0	0	0	0	0	0	0	1	*		1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	1/D	S	DB1=1:Increment DB1=0:Decrement DB0=1:The display is shifted DB0=0:The display is not shifted	40μs
Display on/off	0	0	0	0	0	0	1	D	C	B	DB2=1:Display on DB2=0: Display off DB1=1:Cursor on DB1=0: Cursor off DB0=1:Brinking on DB0=0: Brinking off	40μs
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	DB3=1:Shifts display one character DB2=1:Right shift DB2=0:Left shift	40μs
System Set	0	0	0	0	1	DL	N	F	*	*	DB4=1:8 bits DB4=0:4 bits DB3=1:2 lines display (1/16 duty) DB3=0:1 line display DB2=1:5 × 10 dots , 1/11 duty DB2=1:5 × 7 dots , 1/8 duty	40μs
Set CG RAM Address	0	0	0	1	CG RAM address corresponds to cursor address						The address length that can be set is 64 address	40μs
Set DD RAM Address	0	0	1	DD RAM address							The address length that can be set is 80 address	40μs
Read Busy Flag/Address Counter	0	1	BF	Address counter used for both DD&CG RAM address							DB7=1:Busy (instruction not accepted) DB7=0:Ready(for instruction)	0μs
Write Data	1	0	Write data									46μs
Read Data	1	1	Read data									46μs

DD RAM Address:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Address for line 1	00	01	02	03	04	05	06	07	08	09	A	B	C	D	E	F
Address for line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

Reliability and Life Time

1.Reliability Test

Storage Condition	Content	Evaluations and Assessment*			
		Current consumption	Oozing	Contrast	Other appearances
Operation at high temperature and humidity	40℃,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60℃, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20℃, 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℃,45±20%RH.

Standard Character Pattern



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