User's Guide

ATM1602B

Liquid Crystal Display Module

CONTENTS

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		C_r 4	-25			deg
			-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		C_r 2	-60		35	deg
			-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	μ A
"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			
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			

Write Cycle

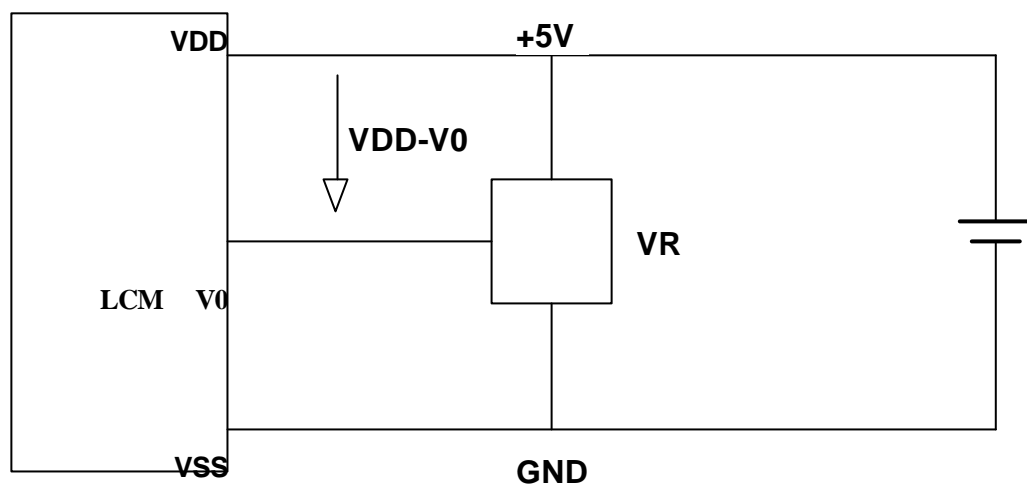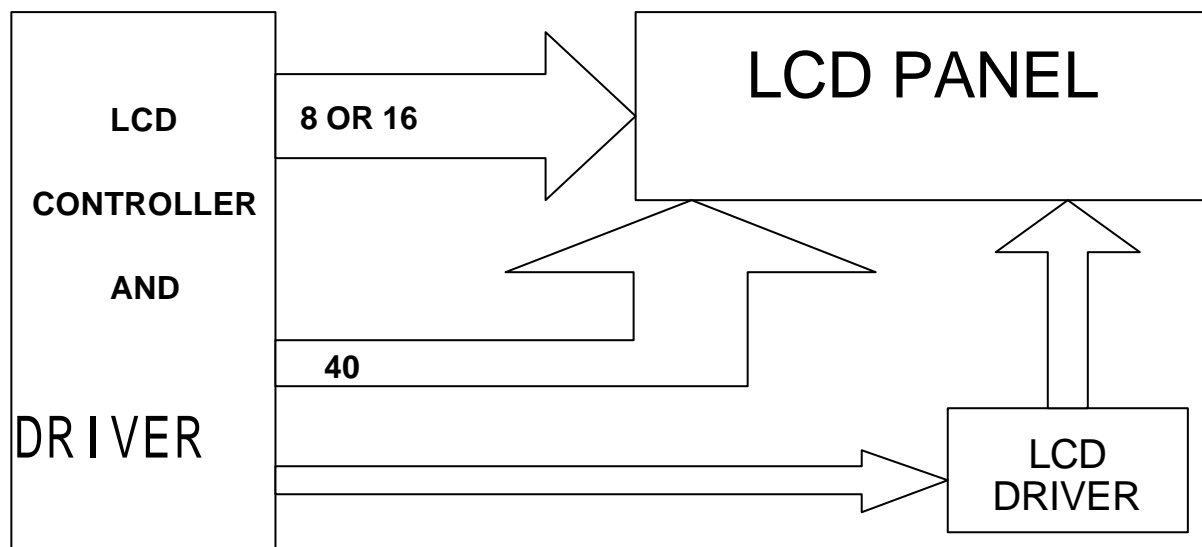| Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	t_c	E	500			
Enable pulse width	t_w	E	300			
Enable rise/fall time	t_r, t_f	E			25	
RS,R/W setup time	t_{su1}	RS; R/W	100			ns
RS,R/W address hold time	t_{h1}	RS; R/W	10			
Data setup time	t_{su2}	DB0-DB7	60			
Data hold time	t_{h2}	DB0-DB7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

Timing Characteristics

Write Timing
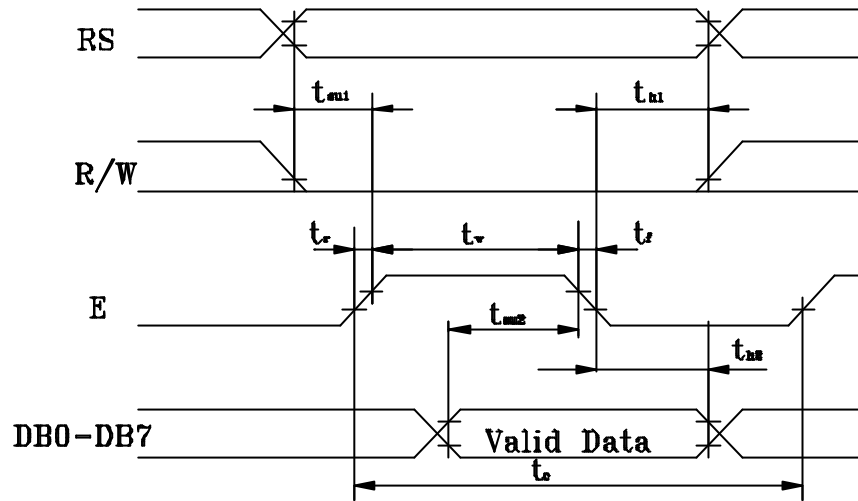
Read Timing
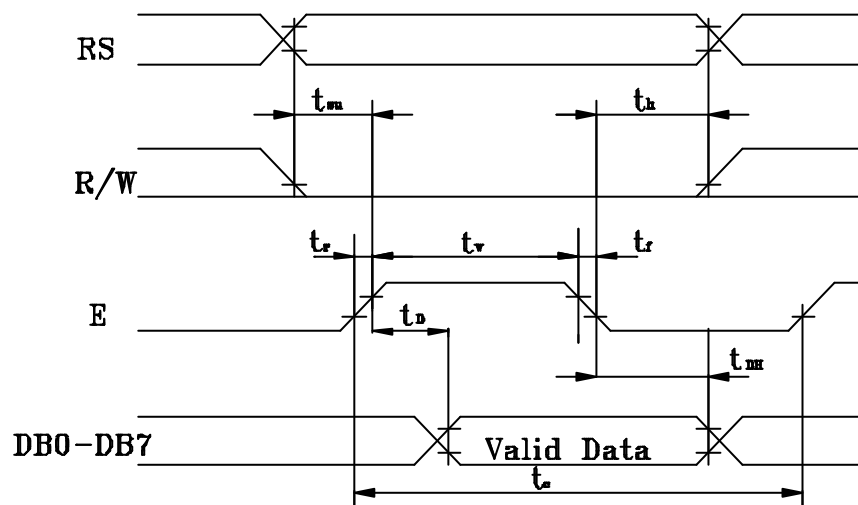
Block Diagram

VDD-Vo: LCD DRIVING VOLTAGE

VR: 10K-20K

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	40μ s
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	40μ s
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	40μ s
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	40μ s
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	40μ s
Set DD RAM Address	0	0	1	DD RAM address							The address length that can be set is 80 address	40μ s
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)	0μ s
Write Data	1	0	Write data									46μ s
Read Data	1	1	Read data									46μ s

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

Upper 4 bits / Lower 4 bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	@	P	`	p				─	タ	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	ム	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	メ	β	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		$	4	D	T	d	t			、	エ	ト	ヤ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	ユ	σ	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			ィ	ク	ネ	リ	√	x̄
xxxx1001	(2)		)	9	I	Y	i	y			ゥ	ケ	ノ	ル	⁻¹	y
xxxx1010	(3)		*	:	J	Z	j	z			ェ	コ	ハ	レ	j	千
xxxx1011	(4)		+	;	K	[	k	{			ォ	サ	ヒ	ロ	×	万
xxxx1100	(5)		,	<	L	¥	l	|			ャ	シ	フ	ワ	¢	円
xxxx1101	(6)		-	=	M	]	m	}			ュ	ス	ヘ	ン	£	÷
xxxx1110	(7)		.	>	N	^	n	→			ョ	セ	ホ	゛	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	゜	ö	█

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