

# User's Guide

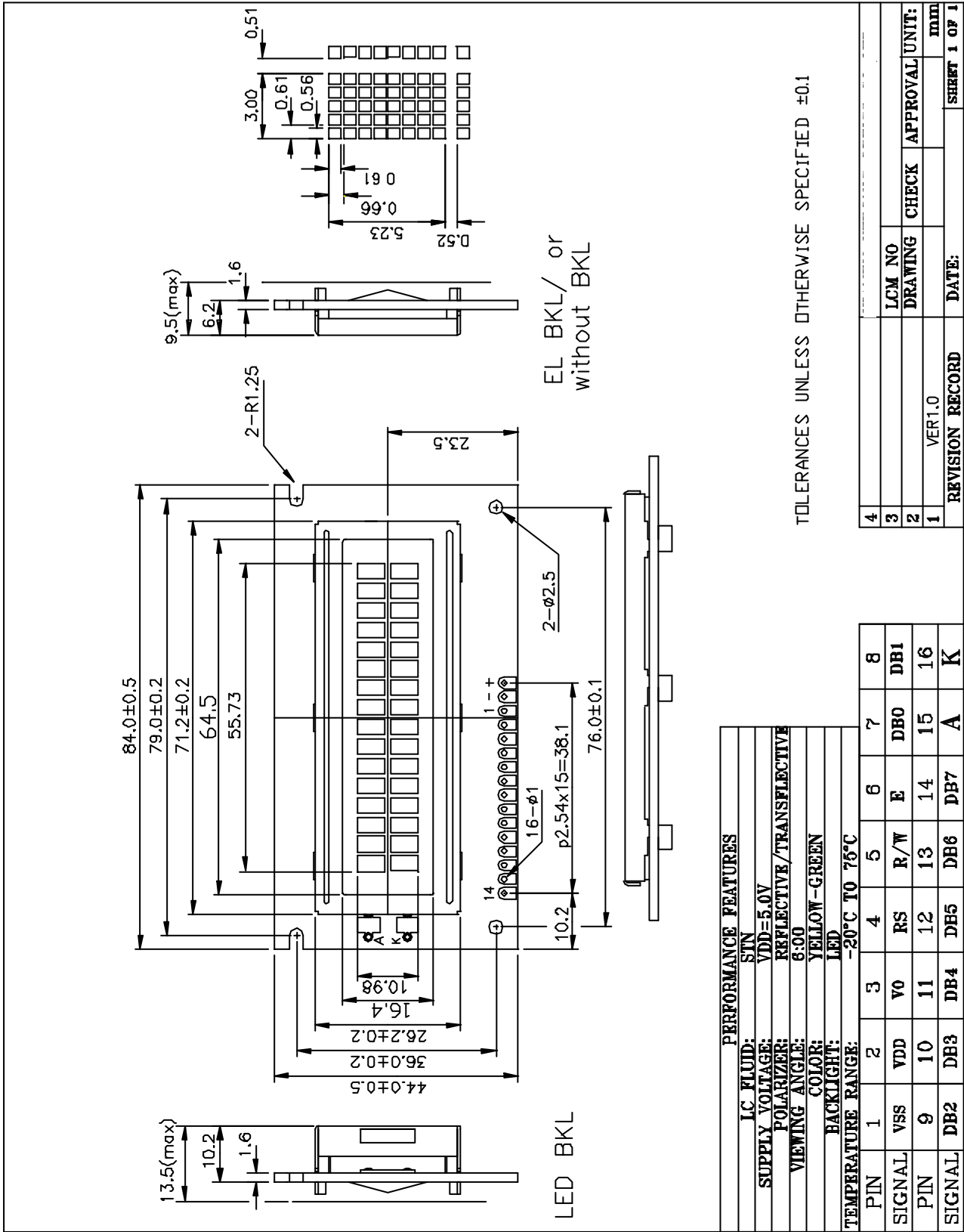
# ATM1602B

Liquid Crystal Display Module

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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 ( $T_a=25$  ,  $V_{DD}=5.0V \pm 0.25V$ )

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 ( $T_a=25$  ,  $V_{DD}=5.0V \pm 0.25V$ )

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	$\mu A$
“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 ( $V_{DD}=5.0V+10\%$ ,  $V_{SS}=0V$ ,  $T_a=25$  )

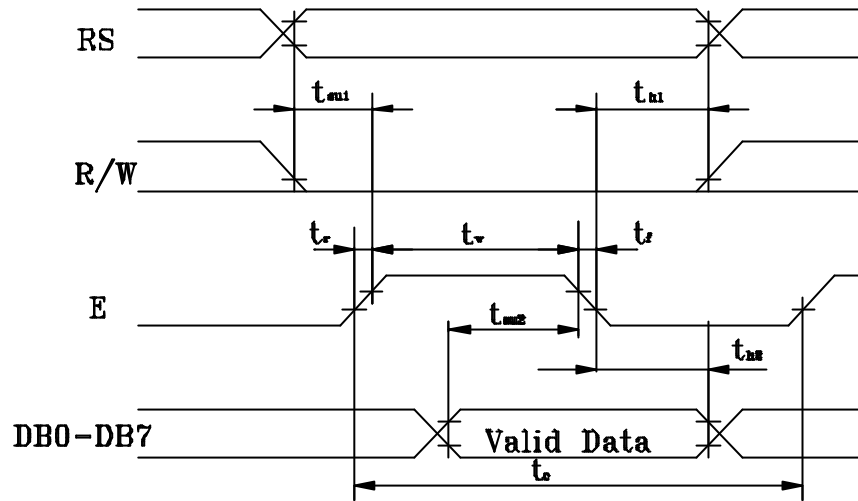
Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	$t_c$	E	500	-	-	ns
Enable pulse width	$t_w$	E	300	-	-	
Enable rise/fall time	$t_r, t_f$	E	-	-	25	
RS,R/W setup time	$t_{su}$	RS; R/W	100	-	-	
RS,R/W address hold time	$t_h$	RS; R/W	10	-	-	
Read data output delay	$t_D$	DB0-DB7	60	-	190	
Read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

## Write Cycle

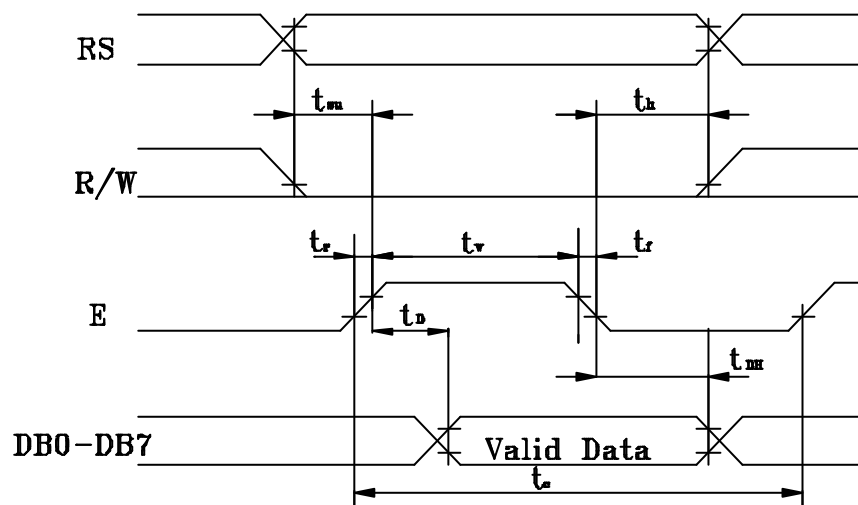
Parameter	Symbol	Test pin	Min.	Type	Max.	Unit
Enable cycle time	$t_c$	E	500	-	-	ns
Enable pulse width	$t_w$	E	300	-	-	
Enable rise/fall time	$t_r, t_f$	E	-	-	25	
RS,R/W setup time	$t_{su1}$	RS; R/W	100	-	-	
RS,R/W address hold time	$t_{h1}$	RS; R/W	10	-	-	
Data setup time	$t_{su2}$	DB0-DB7	60	-	-	
Data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

## Timing Characteristics

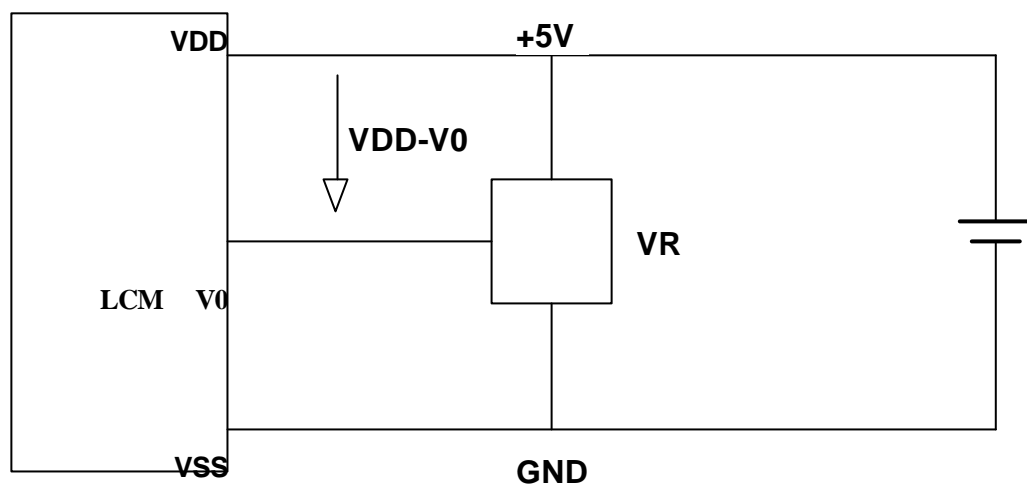
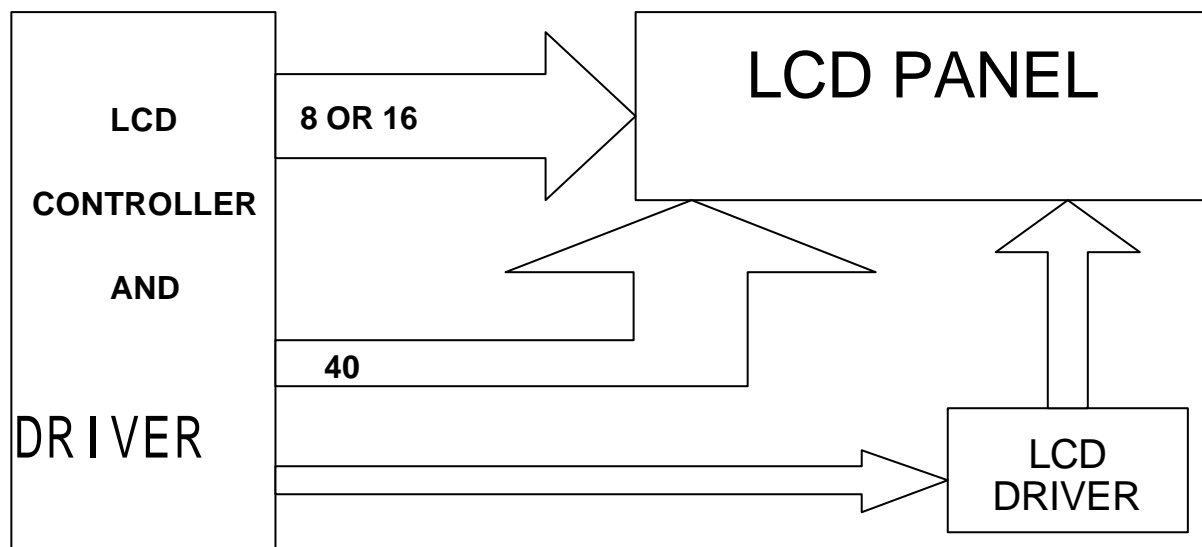
### Write Timing



### Read Timing



## Block Diagram



VDD-V<sub>0</sub>: 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	40 μs
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	40 μs
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	40 μs
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	40 μs
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	40 μs
Set DD RAM Address	0	0	1	DD RAM address						The address length that can be set is 80 address	40 μs	
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)	0 μs	
Write Data	1	0	Write data									46 μs
Read Data	1	1	Read data									46 μs

### 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

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

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