

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

ACM 1602B SERIES

DATE:

August 9, 1999

ACM1602B SERIES LCD MODULE

1.0 MECHANICAL SPECS

1. Overall Module Size	84.0mm(W) x 44.0mm(H) x max 13.5mm(D) for LED backlight version 84.0mm(W) x 44.0mm(H) x max 9.5mm(D) for reflective version
2. Dot Size	0.56mm(W) x 0.61mm(H)
3. Dot Pitch	0.61mm(W) x 0.66mm(H)
4. Duty	1/16
5. Controller IC	KS0066
6. LC Fluid Options	TN, STN
7. Polarizer Options	Reflective, Transflective, Transmissive
8. Backlight Options	LED
9. Temperature Range Options	Standard (0°C ~ 50°C),Wide(-20°C ~ 70°C)

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	°C
Storage temperature (Standard)	Tst	-10	-	60	°C
Operating temperature (Wide temperature)	Top	-20	-	70	°C
Storage temperature (Wide temperature)	Tst	-30	-	80	°C
Input voltage	Vin	Vss		Vdd	V
Supply voltage for logic	Vdd- Vss	2.7	-	5.5	V
Supply voltage for LCD drive	Vdd- Vo	3.0	4.6	6.5	V

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3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Input voltage (high)	V _{ih}	H level	2.2	-	V _{dd}	V
Input voltage (low)	V _{il}	L level	0	-	0.6	V
Recommended LC Driving Voltage (Standard Temp)	V _{dd} - V _o	0°C	-	4.8	5.4	V
		25°C	4.2	4.6	-	
		50°C	3.9	4.3	-	
Recommended LC Driving Voltage (Wide Temp)	V _{dd} - V _o	-20°C	-	6.4	7.2	V
		0°C	-	4.6	-	
		50°C	-	4.2	-	
		70°C	3.5	4.0	-	
Power Supply Current	I _{dd}	V _{dd} =5.0V, f _{osc} =270kHz	-	0.8	1.8	mA
LED Power Supply Voltage	V _{fled}	R=6.8Ω	-	4.6	5.0	V
LED Power Supply Current	I _{fled}	R=6.8Ω	-	120	300	mA

4.0 OPTICAL CHARACTERISTICS (T_a=25°C, V_{dd}= 5.0V±0.25V, TN LC fluid)

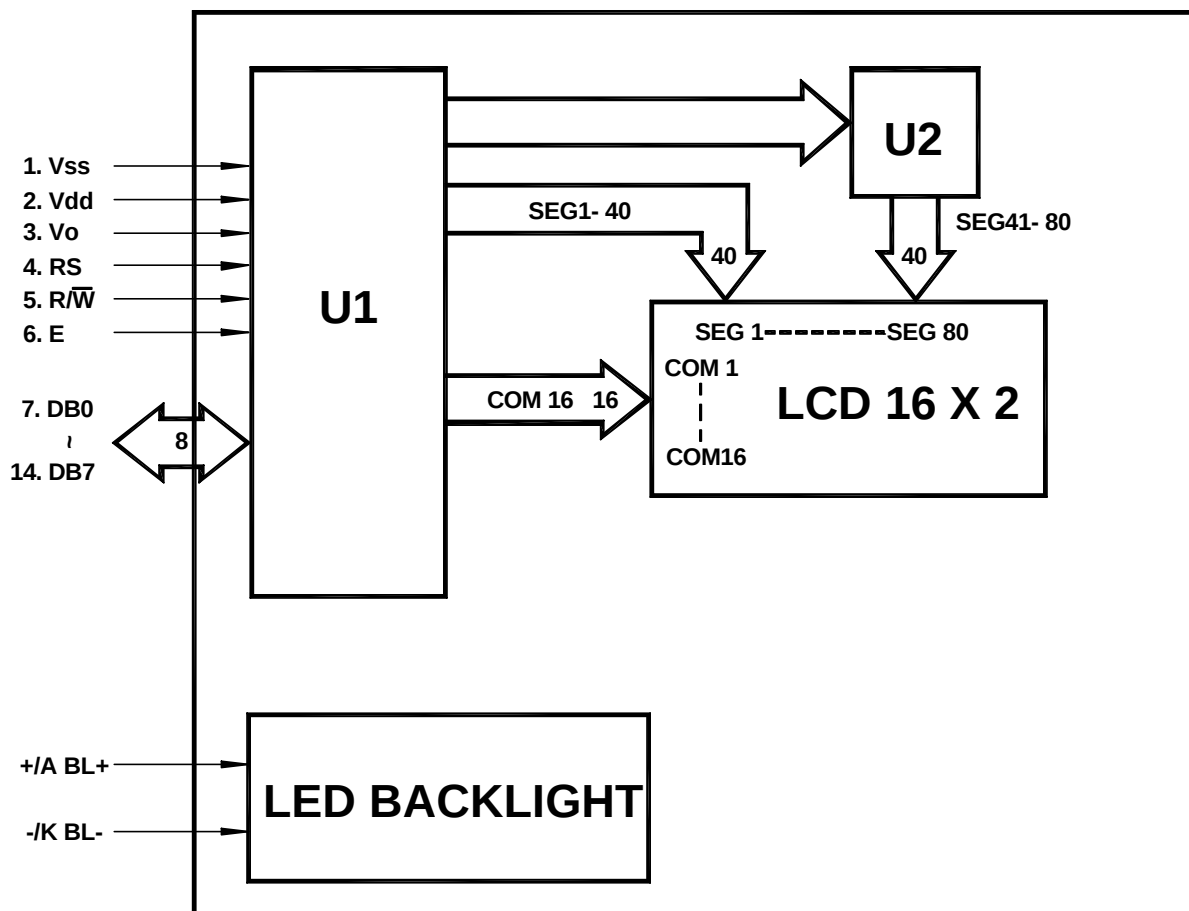
Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 4.0	-25	-	-	deg
Viewing angle (vertical)	φ	Cr ≥ 4.0	-30	-	30	deg
Contrast Ratio	Cr	φ=0°, θ=0°	-	2	-	
Response time (rise)	T _r	φ=0°, θ=0°	-	120	150	ms
Response time (fall)	T _f	φ=0°, θ=0°	-	120	150	ms

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4.1 OPTICAL CHARACTERISTICS (Ta=25° C, Vdd= 5.0V±0.25V, STN LC fluid)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	$Cr \geq 2.0$	-60	-	35	deg
Viewing angle (vertical)	ϕ	$Cr \geq 2.0$	-40	-	40	deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	6	-	
Response time (rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms
Response time (fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms

5.0 BLOCK DIAGRAM

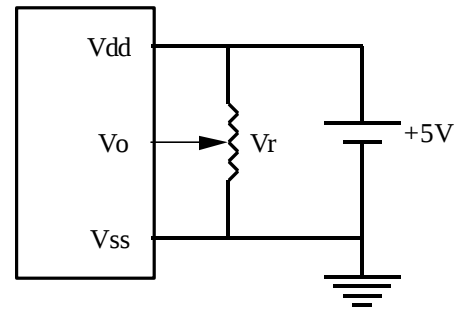


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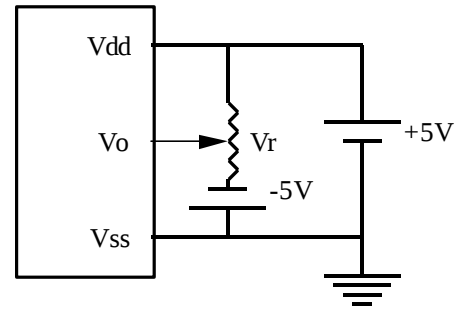
6.0 PIN ASSIGNMENT

Pin No.	Symbol	Function
1	Vss	Ground
2	Vdd	+5V
3	Vo	LCD contrast adjust
4	RS	Register select
5	R/W	Read / write
6	E	Enable
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7
-	BL-	Power Supply for BL-
+	BL+	Power Supply for BL+

7.0 POWER SUPPLY



STANDARD TEMP RANGE



WIDE TEMP RANGE

$V_r = 10K\Omega \sim 20K\Omega$

8.0 TIMING CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_c	Fig. a, Fig. b	500	-	-	ns
Enable pulse width	t_w	Fig. a, Fig. b	220	-	-	ns
Enable rise/fall time	t_r, t_f	Fig. a, Fig. b	-	-	25	ns
RS, R/W set up time	t_{su}	Fig. a, Fig. b	40	-	-	ns
RS, R/W hold time	t_h	Fig. a, Fig. b	10	-	-	ns
Data delay time	t_d	Fig. b	-	-	120	ns
Data set up time	t_{dsu}	Fig. a	60	-	-	ns
Data hold time	t_{dh}	Fig. a, Fig. b	20	-	-	ns

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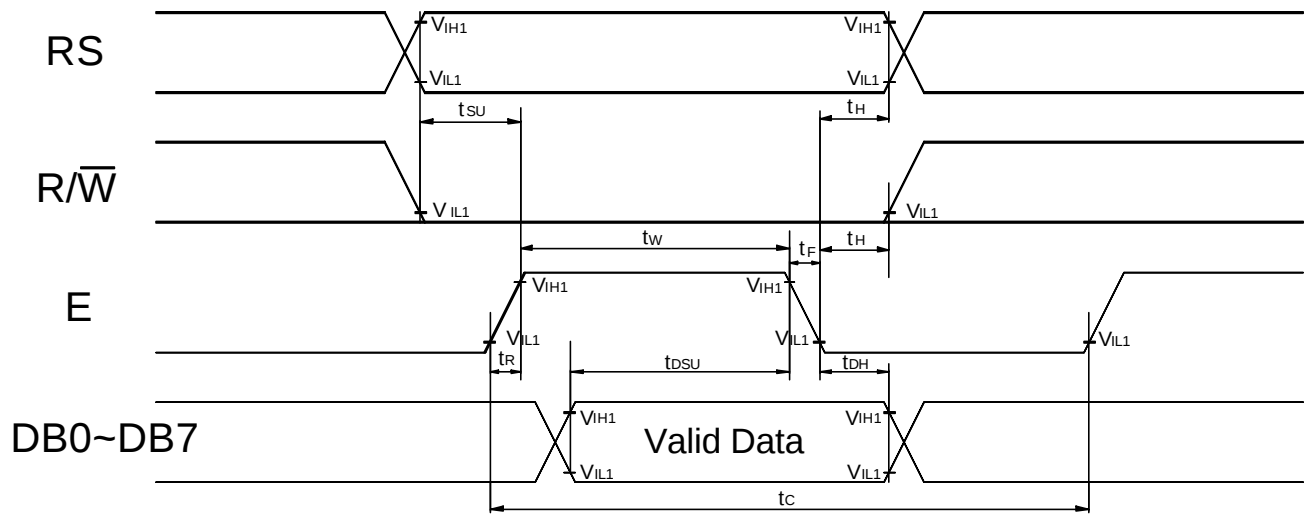


Fig. a Interface timing (data write)

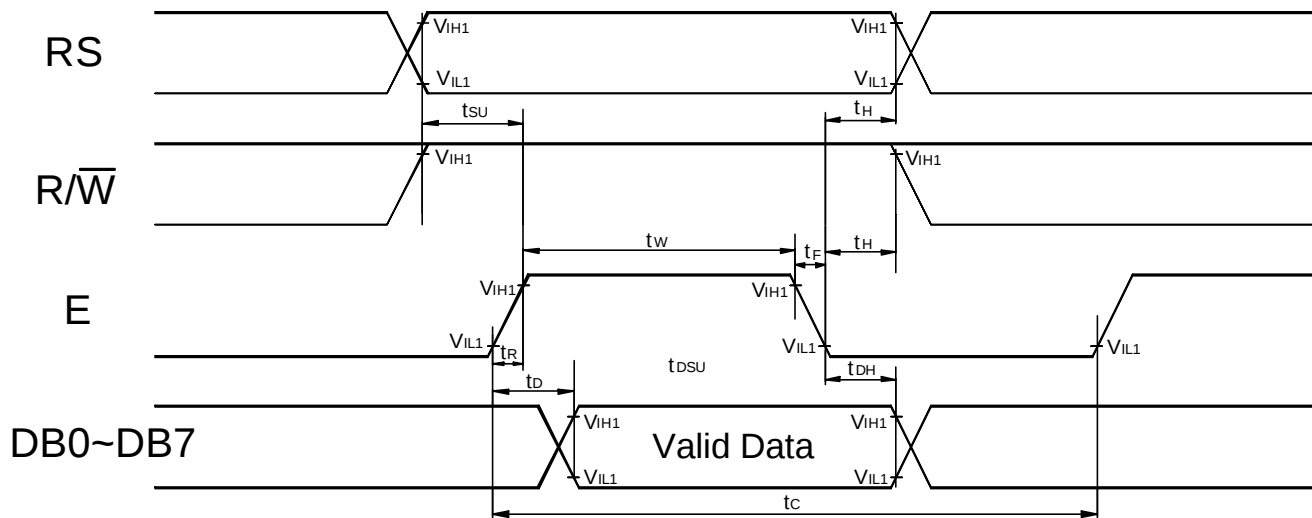


Fig. b Interface timing (data read)

Technical drawing of the ST7068U LCD module, showing top and side views with dimensions and pin connections.

Top View Dimensions:

- Overall width: 84.0 ± 0.3
- Overall height: 44.0 ± 0.3
- Pin 1 to Pin 14 distance: 36.0
- Pin 14 to Pin 15 distance: 26.3
- Pin 15 to Pin 16 distance: 4.0
- Pin 16 to Pin 17 distance: 7.4
- Pin 17 to Pin 18 distance: 12.3
- Pin 18 to Pin 19 distance: 13.0
- Pin 19 to Pin 20 distance: 15.0
- Pin 20 to Pin 21 distance: 10.2
- Pin 21 to Pin 22 distance: 4.0
- Pin 22 to Pin 23 distance: 76.0
- Pin 23 to Pin 24 distance: 10.2
- Pin 24 to Pin 25 distance: 4.0
- Pin 25 to Pin 26 distance: 10.2
- Pin 26 to Pin 27 distance: 4.0
- Pin 27 to Pin 28 distance: 10.2
- Pin 28 to Pin 29 distance: 4.0
- Pin 29 to Pin 30 distance: 10.2
- Pin 30 to Pin 31 distance: 4.0
- Pin 31 to Pin 32 distance: 10.2
- Pin 32 to Pin 33 distance: 4.0
- Pin 33 to Pin 34 distance: 10.2
- Pin 34 to Pin 35 distance: 4.0
- Pin 35 to Pin 36 distance: 10.2
- Pin 36 to Pin 37 distance: 4.0
- Pin 37 to Pin 38 distance: 10.2
- Pin 38 to Pin 39 distance: 4.0
- Pin 39 to Pin 40 distance: 10.2
- Pin 40 to Pin 41 distance: 4.0
- Pin 41 to Pin 42 distance: 10.2
- Pin 42 to Pin 43 distance: 4.0
- Pin 43 to Pin 44 distance: 10.2
- Pin 44 to Pin 45 distance: 4.0
- Pin 45 to Pin 46 distance: 10.2
- Pin 46 to Pin 47 distance: 4.0
- Pin 47 to Pin 48 distance: 10.2
- Pin 48 to Pin 49 distance: 4.0
- Pin 49 to Pin 50 distance: 10.2
- Pin 50 to Pin 51 distance: 4.0
- Pin 51 to Pin 52 distance: 10.2
- Pin 52 to Pin 53 distance: 4.0
- Pin 53 to Pin 54 distance: 10.2
- Pin 54 to Pin 55 distance: 4.0
- Pin 55 to Pin 56 distance: 10.2
- Pin 56 to Pin 57 distance: 4.0
- Pin 57 to Pin 58 distance: 10.2
- Pin 58 to Pin 59 distance: 4.0
- Pin 59 to Pin 60 distance: 10.2
- Pin 60 to Pin 61 distance: 4.0
- Pin 61 to Pin 62 distance: 10.2
- Pin 62 to Pin 63 distance: 4.0
- Pin 63 to Pin 64 distance: 10.2
- Pin 64 to Pin 65 distance: 4.0
- Pin 65 to Pin 66 distance: 10.2
- Pin 66 to Pin 67 distance: 4.0
- Pin 67 to Pin 68 distance: 10.2
- Pin 68 to Pin 69 distance: 4.0
- Pin 69 to Pin 70 distance: 10.2
- Pin 70 to Pin 71 distance: 4.0
- Pin 71 to Pin 72 distance: 10.2
- Pin 72 to Pin 73 distance: 4.0
- Pin 73 to Pin 74 distance: 10.2
- Pin 74 to Pin 75 distance: 4.0
- Pin 75 to Pin 76 distance: 10.2
- Pin 76 to Pin 77 distance: 4.0
- Pin 77 to Pin 78 distance: 10.2
- Pin 78 to Pin 79 distance: 4.0
- Pin 79 to Pin 80 distance: 10.2
- Pin 80 to Pin 81 distance: 4.0
- Pin 81 to Pin 82 distance: 10.2
- Pin 82 to Pin 83 distance: 4.0
- Pin 83 to Pin 84 distance: 10.2
- Pin 84 to Pin 85 distance: 4.0
- Pin 85 to Pin 86 distance: 10.2
- Pin 86 to Pin 87 distance: 4.0
- Pin 87 to Pin 88 distance: 10.2
- Pin 88 to Pin 89 distance: 4.0
- Pin 89 to Pin 90 distance: 10.2
- Pin 90 to Pin 91 distance: 4.0
- Pin 91 to Pin 92 distance: 10.2
- Pin 92 to Pin 93 distance: 4.0
- Pin 93 to Pin 94 distance: 10.2
- Pin 94 to Pin 95 distance: 4.0
- Pin 95 to Pin 96 distance: 10.2
- Pin 96 to Pin 97 distance: 4.0
- Pin 97 to Pin 98 distance: 10.2
- Pin 98 to Pin 99 distance: 4.0
- Pin 99 to Pin 100 distance: 10.2
- Pin 100 to Pin 101 distance: 4.0
- Pin 101 to Pin 102 distance: 10.2
- Pin 102 to Pin 103 distance: 4.0
- Pin 103 to Pin 104 distance: 10.2
- Pin 104 to Pin 105 distance: 4.0
- Pin 105 to Pin 106 distance: 10.2
- Pin 106 to Pin 107 distance: 4.0
- Pin 107 to Pin 108 distance: 10.2
- Pin 108 to Pin 109 distance: 4.0
- Pin 109 to Pin 110 distance: 10.2
- Pin 110 to Pin 111 distance: 4.0
- Pin 111 to Pin 112 distance: 10.2
- Pin 112 to Pin 113 distance: 4.0
- Pin 113 to Pin 114 distance: 10.2
- Pin 114 to Pin 115 distance: 4.0
- Pin 115 to Pin 116 distance: 10.2
- Pin 116 to Pin 117 distance: 4.0
- Pin 117 to Pin 118 distance: 10.2
- Pin 118 to Pin 119 distance: 4.0
- Pin 119 to Pin 120 distance: 10.2
- Pin 120 to Pin 121 distance: 4.0
- Pin 121 to Pin 122 distance: 10.2
- Pin 122 to Pin 123 distance: 4.0
- Pin 123 to Pin 124 distance: 10.2
- Pin 124 to Pin 125 distance: 4.0
- Pin 125 to Pin 126 distance: 10.2
- Pin 126 to Pin 127 distance: 4.0
- Pin 127 to Pin 128 distance: 10.2
- Pin 128 to Pin 129 distance: 4.0
- Pin 129 to Pin 130 distance: 10.2
- Pin 130 to Pin 131 distance: 4.0
- Pin 131 to Pin 132 distance: 10.2
- Pin 132 to Pin 133 distance: 4.0
- Pin 133 to Pin 134 distance: 10.2
- Pin 134 to Pin 135 distance: 4.0
- Pin 135 to Pin 136 distance: 10.2
- Pin 136 to Pin 137 distance: 4.0
- Pin 137 to Pin 138 distance: 10.2
- Pin 138 to Pin 139 distance: 4.0
- Pin 139 to Pin 140 distance: 10.2
- Pin 140 to Pin 141 distance: 4.0
- Pin 141 to Pin 142 distance: 10.2
- Pin 142 to Pin 143 distance: 4.0
- Pin 143 to Pin 144 distance: 10.2
- Pin 144 to Pin 145 distance: 4.0
- Pin 145 to Pin 146 distance: 10.2
- Pin 146 to Pin 147 distance: 4.0
- Pin 147 to Pin 148 distance: 10.2
- Pin 148 to Pin 149 distance: 4.0
- Pin 149 to Pin 150 distance: 10.2
- Pin 150 to Pin 151 distance: 4.0
- Pin 151 to Pin 152 distance: 10.2
- Pin 152 to Pin 153 distance: 4.0
- Pin 153 to Pin 154 distance: 10.2
- Pin 154 to Pin 155 distance: 4.0
- Pin 155 to Pin 156 distance: 10.2
- Pin 156 to Pin 157 distance: 4.0
- Pin 157 to Pin 158 distance: 10.2
- Pin 158 to Pin 159 distance: 4.0
- Pin 159 to Pin 160 distance: 10.2
- Pin 160 to Pin 161 distance: 4.0
- Pin 161 to Pin 162 distance: 10.2
- Pin 162 to Pin 163 distance: 4.0
- Pin 163 to Pin 164 distance: 10.2
- Pin 164 to Pin 165 distance: 4.0
- Pin 165 to Pin 166 distance: 10.2
- Pin 166 to Pin 167 distance: 4.0
- Pin 167 to Pin 168 distance: 10.2
- Pin 168 to Pin 169 distance: 4.0
- Pin 169 to Pin 170 distance: 10

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10.0 RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		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° C±5° C).

*The LCDs subjected to the test must not have dew condensation.

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11.0 DISPLAY INSTRUCTION TABLE

COMMAND	R S	R/ W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0	DESCRIPTION	Executing time fosc=250khz
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears Display & Returns to Address 0.	1.64ms
Cursor at Home	0	0	0	0	0	0	0	0	1	x	Returns Cursor to Address 0. Also returns the display being shifted to the original position. DDRAM contents remain unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	I/D: Set Cursor Moving Direction I/D=1: Increment I/D=0: Decrement S: Specify Shift of Display S=1: The display is shifted S=0: The display is not shifted	40μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Display D=1: Display on D=0: Display off Cursor C=1: Cursor on C=0: Cursor off Brink B=1: Brink on B=0: Brink off	40μs
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Moves cursor or shifts the display w/o changing DD RAM contents S/C=0: Cursor Shift (RAM unchanged) S/C=1: Display Shift (RAM unchanged) R/L=1: Shift to the Right R/L=0: Shift to the Left	40μs
Function Set	0	0	0	0	1	DL	N	F	x	x	Sets data bus length (DL), # of display lines (N), and character fonts (F). DL=1: 8 bits F=0: 5x7 dots DL=0: 4 bits F=1: 5x10 dots N=0: 1 line display N=1: 2 lines display	40μs
Set CG RAM Address	0	0	0	1	Character Generator (CG) RAM Address						Sets CG RAM address. CG RAM data is sent and received after this instruction.	40μs
Set DD RAM Address	0	0	1	Display Data (DD) RAM Address / Cursor Address							Sets DD RAM address. DD Ram data is sent and received after this instruction.	40μs
Busy Flag / Address Read	0	1	B F	Address counter used for both DD & CG RAM address							Reads Busy Flag (BF) and address counter contents.	40μs
Write Data	1	0	Write Data								Writes data into DDRAM or CGRAM.	46μs
Read Data	1	1	Read Data								Reads data from DDRAM or CGRAM.	46μs

x: Don't Care.

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12.0 STANDARD CHARACTER PATTERNS

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	@	P	`	P				-	9	≡	⊗	P
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	⊗	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	⊗	⊗
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	⊗
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ハ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	1	⊗	Ω
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			イ	ク	ネ	リ	、	⊗
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	、	Y
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	キ
xxxx1011	(4)		+	;	K	[	k	{			オ	サ	ヒ	ロ	×	⊗
xxxx1100	(5)		,	<	L	¥	l				ハ	シ	フ	ワ	⊗	⊗
xxxx1101	(6)		-	=	M	]	m	}			ユ	ズ	ハ	ン	⊗	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	⊗	
xxxx1111	(8)		/	?	O	_	o	+			ッ	ソ	マ	°	⊗	■

Note: The character generator RAM is the RAM with which the user can rewrite character patterns by program.