DISPLAYTRONIC

XIAMEN ZETTLER ELECTRONICS CO., LTD.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

ACM1602E SERIES CHARACTER MODULE VER1.1

CUSTOMER APPROVAL			
1.POLARIZER OPTIONS: ☐R=REFLECTIVE ☐F=TRANSFLECTIVE ☐N=TRANSMISSIVE NEGATIVE ☐M=TRANSMISSIVE POSITIVE **2.BACKLIGHT OPTIONS:☐N=NONE ☐E=EL ☐L=LED (Y-G) ☐C=CCFL** **3. BACKLIGHT COLOR: ☐A= AMBER ☐B= BLUE ☐G= GREEN ☐W=WHITE ☐R= RED ☐RGB= RED+GREEN+BLUE** **4.FLUID OPTIONS: ☐T=TN ☐F=FSTN ☐Y=STN-YELLOW GREEN ☐G=STN-GRAY ☐B=STN-BLUE** **5. VIEWING DIRECTION: ☐B=BOTTOM VIEW(6 O'CLOCK) ☐T=TOP VIEW(12 O'CLOCK)** **6.TEMPERATURE RANGE: ☐ S=STANDARD TEMPERATURE RANGE ☐H=DUAL POWER,WIDE TEMPERATURE RANGE ☐W=SINGLE POWER,WIDE TEMPERATURE RANGE** **7.OTHERS REQUIREMENT:** **※ PART NO. : _____**			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

DISPLAYTRONIC ENGINEERING APPROVAL		
DESIGN BY	**CHECKED BY**	**APPROVED BY**

REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
VER1.1	**15/6-2006**		**MODIFY THE COVER,ADD CONTENT AND REVISION RECORD.**

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1.0 MECHANICAL SPECS

1. Overall Module Size	85.0mm(W) x 36.0mm(H) x max 13.5mm(D) for LED backlight version 85.0mm(W) x 36.0mm(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	SPLC780D or compatible
6. LC Fluid Options	TN, STN
7. Polarizer Options	Reflective, Transflective, Transmissive
8. Backlight Options	LED
9. Temperature Range Options	Standard (0ºC ~ 50ºC), Wide (-20ºC ~ 70ºC)

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	ºC
Storage temperature (Standard)	Tst	-10	-	60	ºC
Operating temperature (Wide temperature)	Top	-20	-	70	ºC
Storage temperature (Wide temperature)	Tst	-30	-	80	ºC
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

3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Input voltage (high)	Vih	H level	2.2	-	Vdd	V
Input voltage (low)	Vil	L level	0	-	0.6	V
Recommended LC Driving Voltage (Standard Temp)	Vdd - Vo	0ºC	-		5.4	V
		25ºC	4.2	4.6	-	
		50ºC	3.9		-	
Recommended LC Driving Voltage (Wide Temp)	Vdd -Vo	-20ºC	-		6.4	V
		0ºC	-	4.8	-	
		70ºC	3.5		-	
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	-	1.2	1.8	mA
LED Power Supply Voltage	Vfled	IF=120mA	-	3.9	4.3	V
LED Power Supply Current	Ifled	5.0V, 6.8Ω	-	120	200	mA

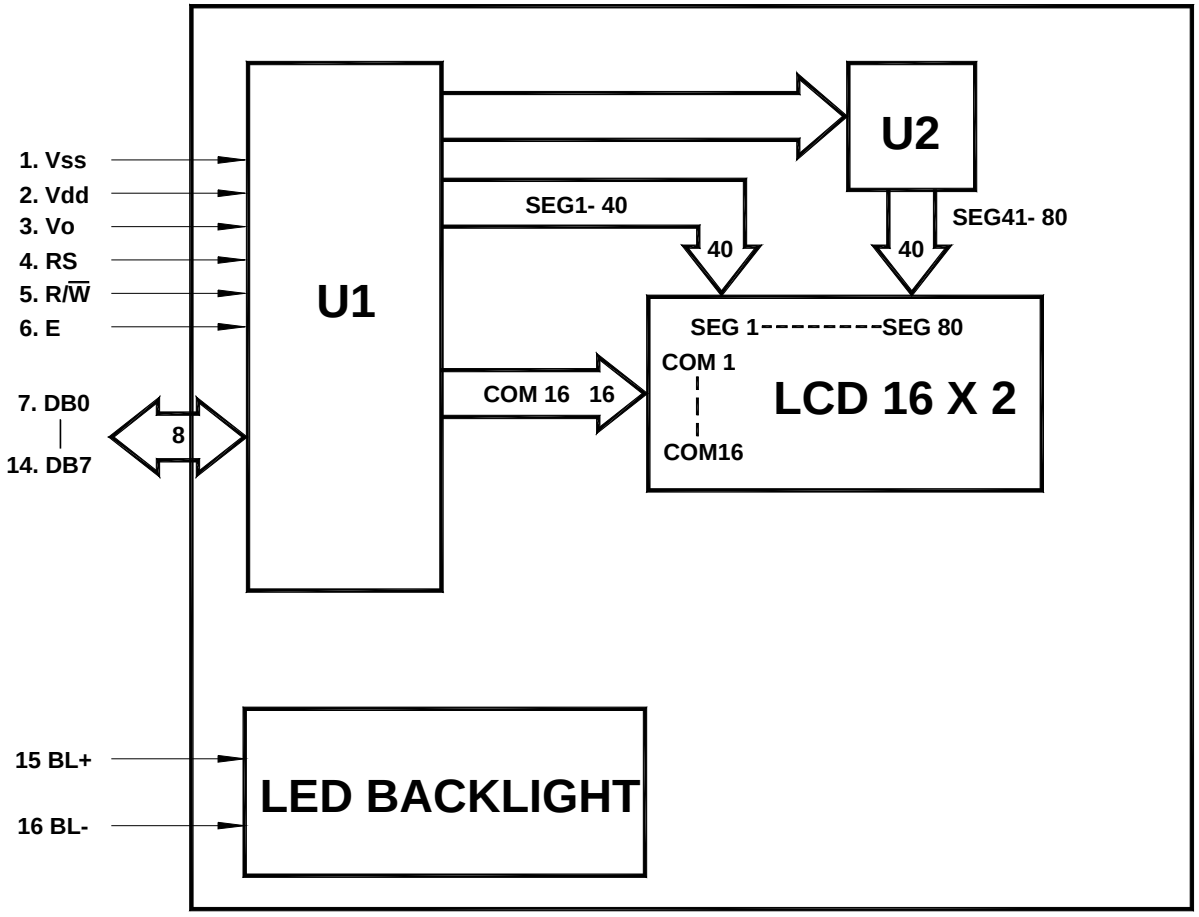
4.0 OPTICAL CHARACTERISTICS (Ta=25ºC, Vdd= 5.0V±0.25V, TN LC fluid)

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)	Tr	ϕ=0°, θ=0°	-	120	150	ms
Response time (fall)	Tf	ϕ=0°, θ=0°	-	120	150	ms

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

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

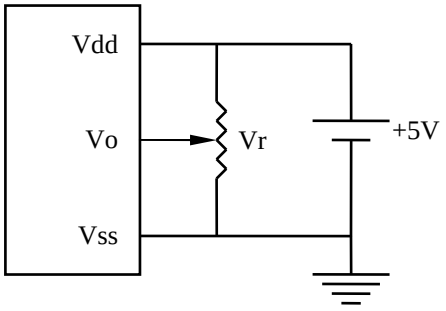
5.0 BLOCK DIAGRAM



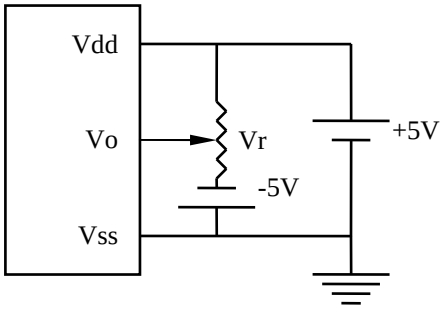
6.0 PIN ASSIGNMENT

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
15/+	BL+	Power Supply for BL+
16/-	BL-	Power Supply for BL-

7.0 POWER SUPPLY



STANDARD TEMP RANGE



WIDE TEMP RANGE

Vr = 10KΩ ~ 20KΩ

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

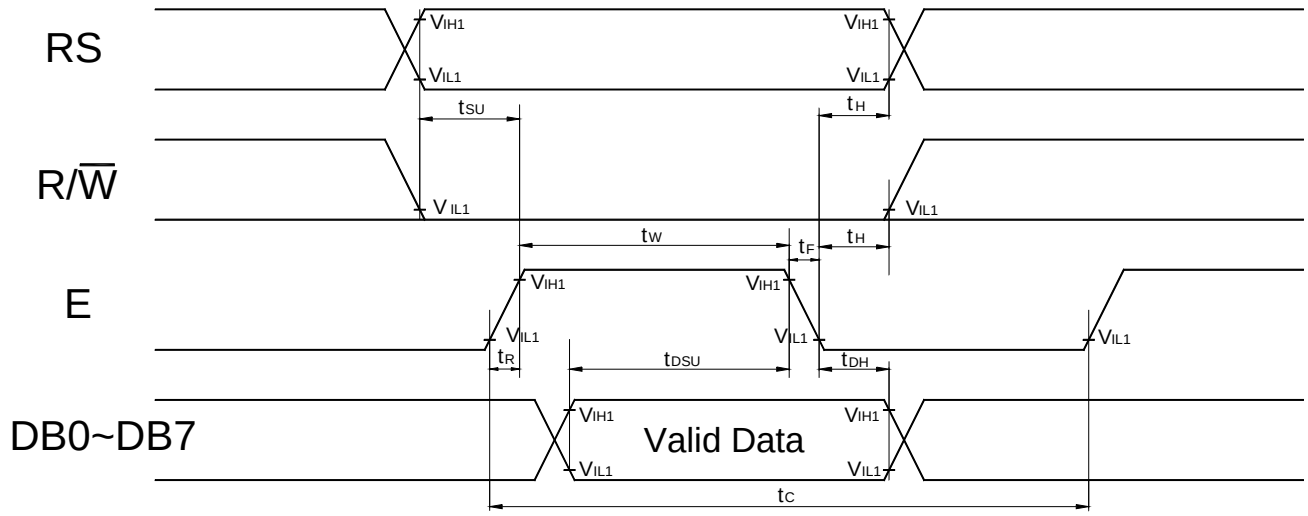


Fig. a Interface timing (data write)

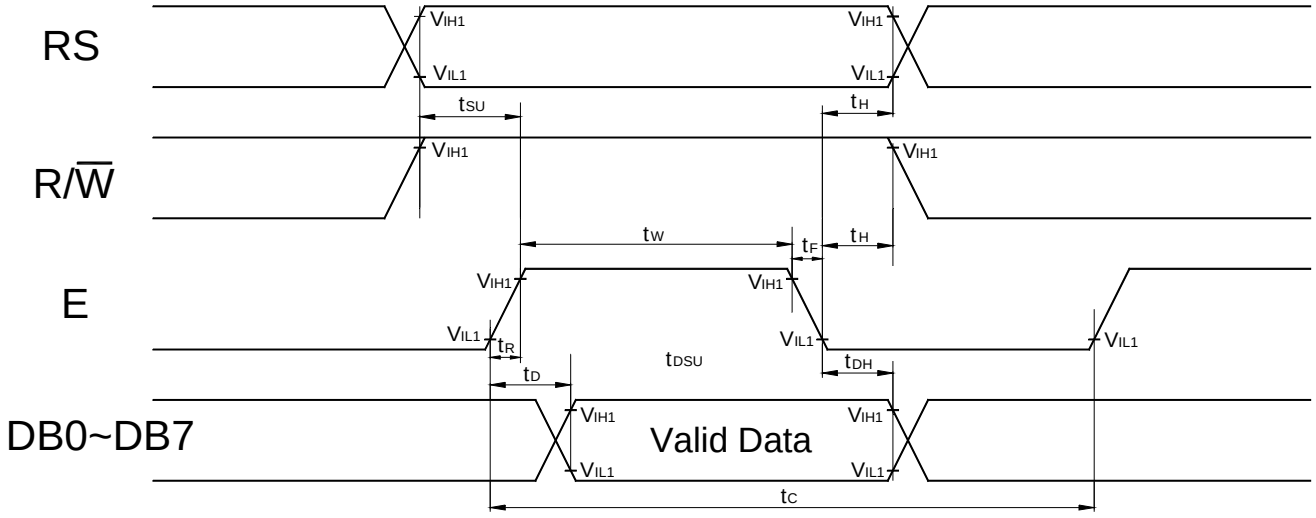
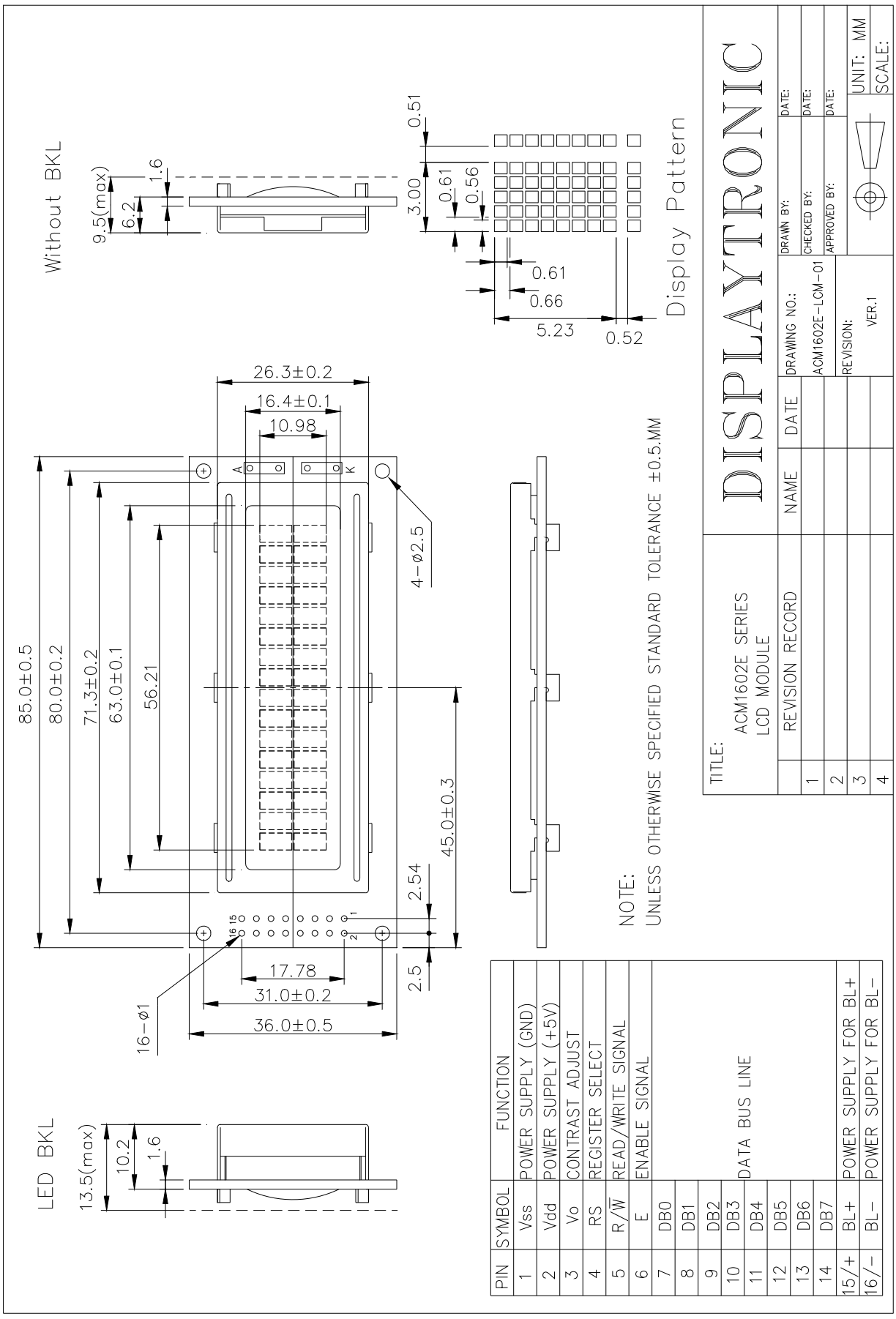


Fig. b Interface timing (data read)

9.0 MECHANICAL DIAGRAM



PIN	SYMBOL	FUNCTION
1	Vss	POWER SUPPLY (GND)
2	Vdd	POWER SUPPLY (+5V)
3	Vo	CONTRAST ADJUST
4	RS	REGISTER SELECT
5	R/$\overline{W}$	READ/WRITE SIGNAL
6	E	ENABLE SIGNAL
7	DB0	DATA BUS LINE
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15/+	BL+	POWER SUPPLY FOR BL+
16/−	BL−	POWER SUPPLY FOR BL−

10.0 RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40ºC,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60ºC, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20ºC, 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 (25ºC±5ºC).
*The LCDs subjected to the test must not have dew condensation.

11.0 DISPLAY INSTRUCTION TABLE

COMMAND	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	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	BF	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.

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)															
xxxx0001	(2)															
xxxx0010	(3)															
xxxx0011	(4)															
xxxx0100	(5)															
xxxx0101	(6)															
xxxx0110	(7)															
xxxx0111	(8)															
xxxx1000	(1)															
xxxx1001	(2)															
xxxx1010	(3)															
xxxx1011	(4)															
xxxx1100	(5)															
xxxx1101	(6)															
xxxx1110	(7)															
xxxx1111	(8)															

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