FEMA ELECTRONICS CORPORATION

LCD MODULE SPECIFICATION
FOR CUSTOMER'S APPROVAL

CUSTOMER: **All American**

MODULE TYPE: **FGM240128C-FWX1CCW**

APPROVED BY: (FOR CUSTOMER ONLY)

Approved By	Checked By	Prepared By	MT File No.	Date Issued

RECORD OF REVISION

Revision Date	Vision	Contents
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1. General Specification

(1) Mechanical Dimension

Item	Dimension	Unit
Number of Dots	240 x 128	dots
Module dimension (L x W x H)	180.0 x 110.0 x 13.4(Typ)	mm
View area	129.0 x 75.0	mm
Active area	119.97 x 63.97	mm
Dot size	0.47x 0.47	mm
Dot pitch	0.5 x 0.5	mm

(2) Controller IC: SED1335 controller

(3) Temperature Range

	Normal
Operating	0 ~+50℃
Storage	-10 ~+60℃

2. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	0	—	+50	℃
Storage Temperature	T_{ST}	-10	—	+60	℃
Input Voltage	V_I	Vss	—	Vdd	V
Supply Voltage For Logic	Vdd-Vss	-0.3	—	+7	V
Supply Voltage For LCD	Vlcd	—	+18.0	—	V
Negative Voltage Output	VLC	—	-	—	V

3. Electrical Characteristics

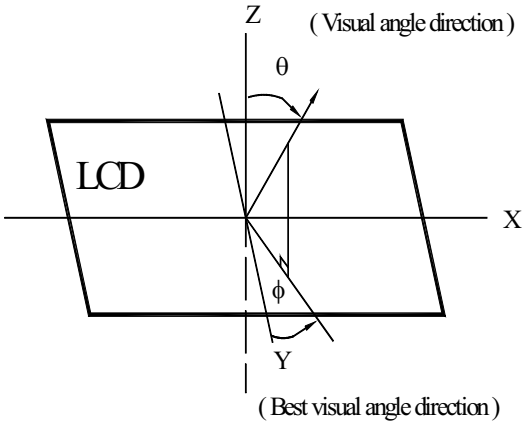
Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	Vdd-Vss	—	4.75	—	5.25	V
Supply Voltage For LCD	VLCD	Ta=0℃ Ta=25℃ Ta=+50℃	— — —	19.0 18.0 17.0	— — —	V
Input High Volt.	V_{IH}	—	2.2	—	Vdd	V
Input Low Volt.	V_{IL}	—	0	—	0.8	V
Output High Volt.	V_{OH}	—	2.4	—	Vdd	V
Output Low Volt.	V_{OL}	—	0	—	0.4	V
Supply Current	Idd	Vdd=5V	—	45	—	mA

4. FSTN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧5	10		60	deg
	(H) φ	CR≧5	-45		45	deg
Contrast Ratio	CR	—		5		—
Response Time 25℃	T rise	—		100	150	ms
	T fall	—		150	200	ms

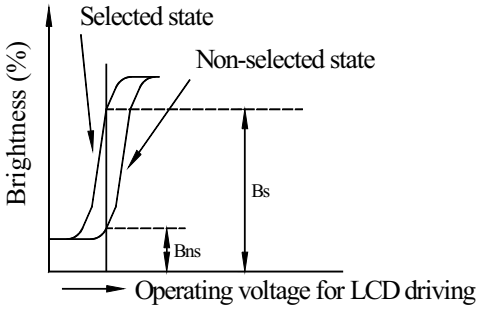
4.1 Definitions

■View Angles

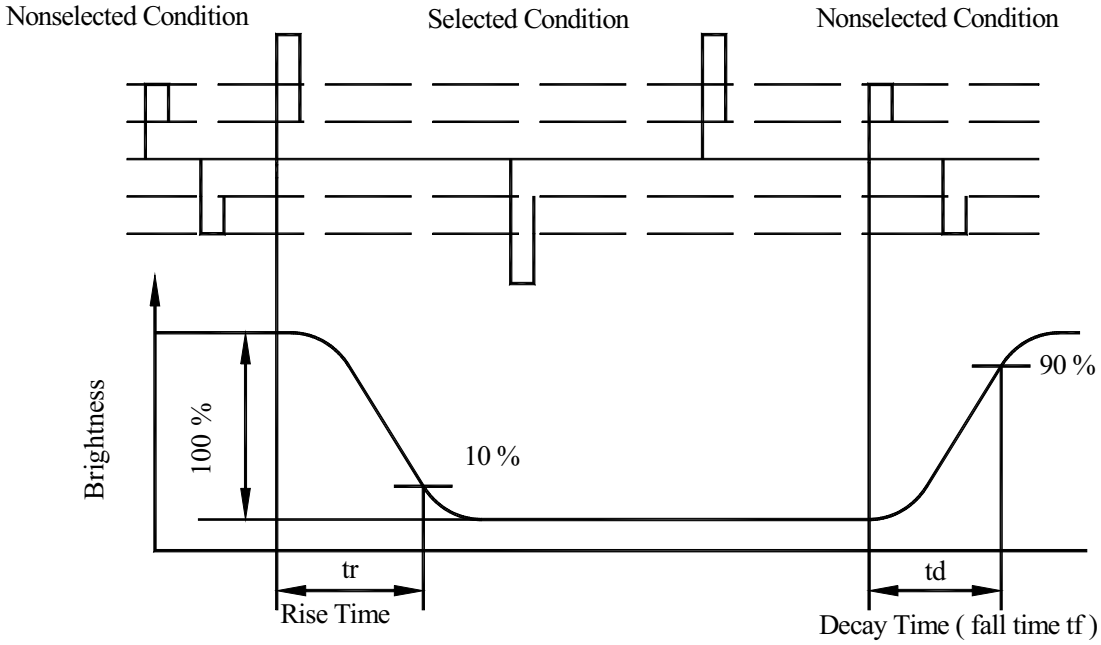


■Contrast Ratio

$$CR = \frac{\text{Brightness at selected state (BS)}}{\text{Brightness at non-selected state (Bns)}}$$



■Response Time



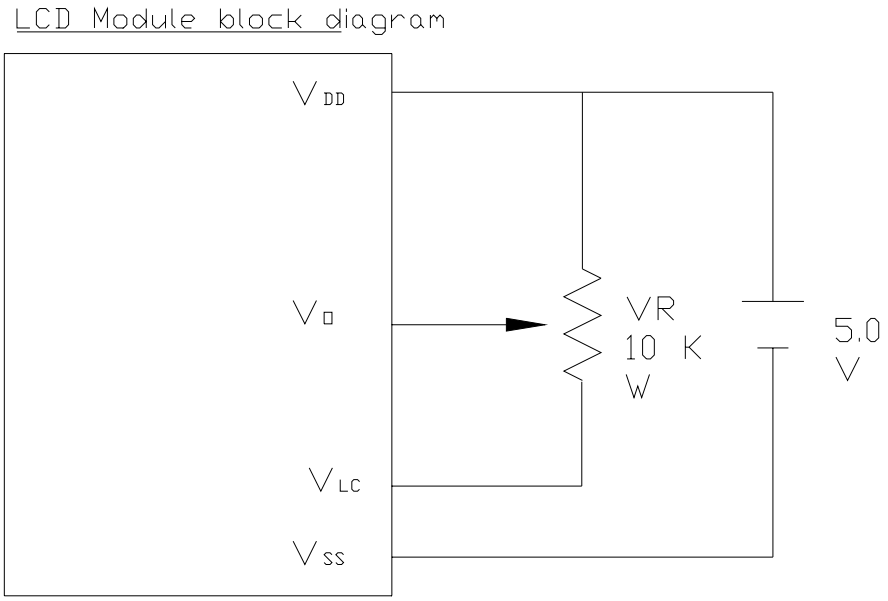
5. Interface Description

Pin No.	Symbol	Level	Description
1	/RST	H/L	Controller Reset Signal
2	/RD	H/L	Data read. Read data from Controller when RD = L
3	/WR	H/L	Data write. Write data into Controller when WR = L
4	SEL2	H/L	MPU interface Select (Note 1)
5	SEL1	H/L	MPU interface Select (Note 1)
6	/CS	H/L	Controller IC "Chip Select" signal
7	A0	H/L	WR=L , A0=H : Command Write A0=L: Data write RD=L , A0=H : Status Read A0=L: Data read
8~15	DB0~7	H/L	Data Bus 0~7
16	**VDD**	5V	Power Supply For Logic V+
17	VSS	0V	Power Supply For Logic GND
18	VLC		Connect to Pin2(IC9 AIC1652CS)
19	Vo	Variable	LCD operating Voltage adjust
20	FGND		Metal Frame Ground

Note1: SEL1=L SEL2=L : 8080 series MPU interface
SEL1=H SEL2=L : 6800 series MPU interface

6. Power Supply for LCD Module and LCD Operating Voltage a Adjustment

* LCM operating on " DC 5V " input with internal negative voltage



7. Backlight Information

7.1 Specification **CCFL/white**

No.2 3 4 5 shall be lighted at constant lamp current (IL : 5.0 mA) and shall be measured 3 minutes after the table below. The measurement shall be conducted on the condition that ambient temperature : 25 ± 2 ℃humidity : 30 ~ 85%, with no wind.

NO	Items	Requirements	Remarks
1	Lamp Current (IL)	5.0 ± 0.5 (mArms)	
2	Lamp Voltage (VL)	205 ± 20 (Vrms)	
3	Lamp Power (P) (Reference Value)	1.03 (Wrms)	VL * IL
4	Luminance	150 min (cd/m)	Note 1
5	Chromaticity (X) (Y)	0.308 ± 0.01 0.330 ± 0.01	Note 2
6	Starting Voltage (VS)	400 MAX (25℃) (Vrms) 600 MAX (0℃) (Vrms)	Note 3
7	Life time	10000 min (h)	Note 4

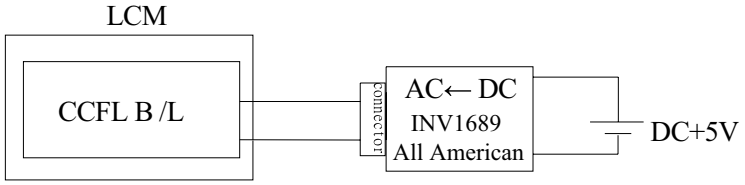
Note 1. The average value is measured though the glass.
Note 2. The tube center / center point shall be measured.
Note 3. All the tubes shall be lighted. Slide in method shall be used for voltage application.
Note 4.Life

Judgement conditions.

A The luminance becomes 50% of the initial luminance.
B Not normal lighting.
C When a severe appearance failure is found.

7.2 Backlight driving methods

CCFL backlight



8. Quality Assurance

◆ Screen Cosmetic Criteria

No.	Defect	Judgement Criterion	Partition
1	Spots	A)Clear Size:d mm / Acceptable Qty in active area d ≦0.1 — Disregard 0.1<d≦0.2 — 6 0.2<d≦0.3 — 2 0.3<d — 0 Note:Including pin holes and defective dots which must be within one pixel size. B)Unclear Size:d mm / Acceptable Qty in active area d ≦0.2 — Disregard 0.2<d≦0.5 — 6 0.5<d≦0.7 — 2 0.7<d — 0	Minor
2	Bubbles in Polarizer	Size:d mm / Acceptable Qty in active area d≦0.3 — Disregard 0.3<d≦1.0 — 3 1.0<d≦1.5 — 1 1.5<d — 0	Minor
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor

9. Reliability

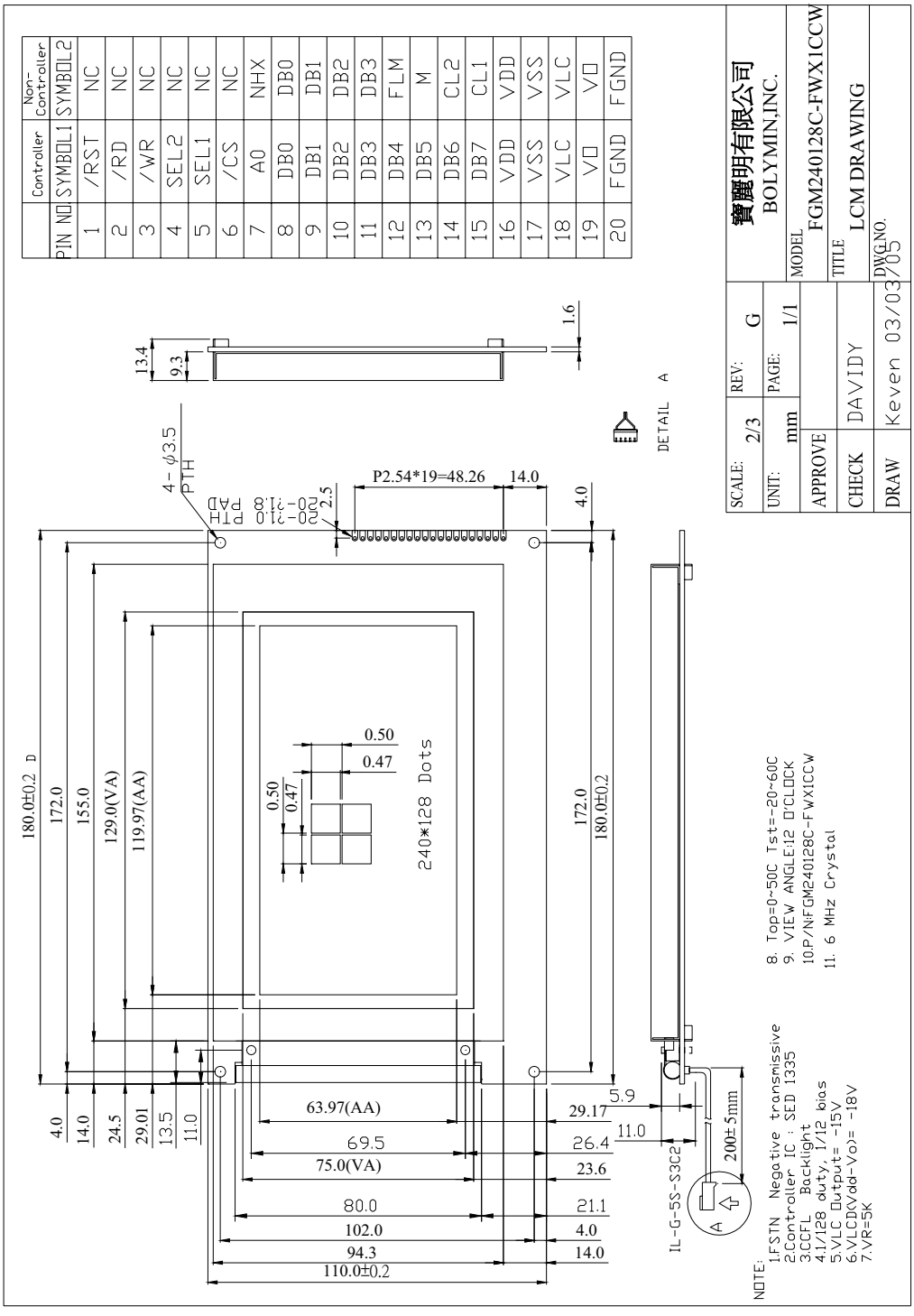
■Content of Reliability Test

Environmental Test				
No.	Test Item	Content of Test	Test Condition	Applicable Standard
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	60℃ 200hrs	——
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10℃ 200hrs	——
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50℃ 200hrs	——
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0℃ 200hrs	——
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	70℃,90%RH 96hrs	——
6	High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40℃,90%RH 96hrs	——
7	Temperature Cycle	Endurance test applying the low and high temperature cycle. -10℃ 25℃ 60℃ 30min 5min 30min 1 cycle	-10℃/60℃ 10 cycles	——
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	——
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msedc 3 times of each direction	——
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	——
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

***Supply voltage for logic system=5V. Supply voltage for LCD system = Operating voltage at 25℃

10. Appendix (Drawing , SED1335 controller data)

10.1 Drawing



10-2 SED1335 controller data

10.2.1. Timing Characteristics

8080 Family Interface Timing

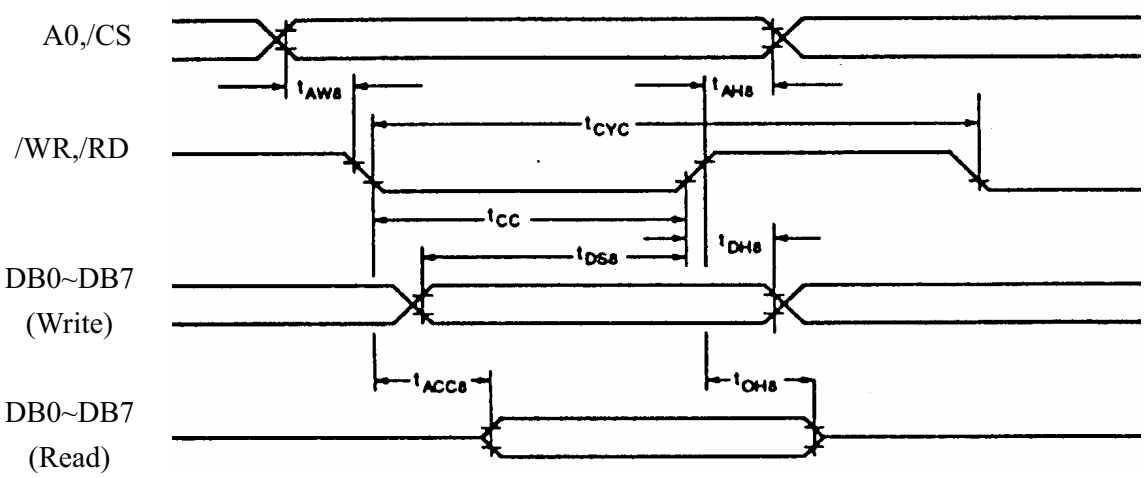
Parameter	Condition	Symbol	Min	Max	Unit	Remark
Address Hold Time	CL=100 pF VDD=2.7 ~4.5	tAH8	10		ns	A0,/CS
Address Setup Time		tAW8	0		ns	
System Cycle Time		tCYC	Note		ns	/WR,/RD
Strobe Pulse Width		tOC	150		ns	
Data Setup Time		tDS8	120		ns	DB0~DB7
Data Hold Time		tDH8	5		ns	
/RD Access Time		tACC8	-	80	ns	
Output Disable Time		tOH8	10	55	ns	

Note: For memory control and system control commands:

tCYC8=2tC+tOC+tCEA+75 > tACV +245

For all other commands:

tCYC8=4tC+tOC+30


A0,/CS
/WR,/RD
DB0~DB7
(Write)
DB0~DB7
(Read)
tAWS
tAHS
tCYC
tCC
tDHS
tDSS
tACCS
tOHS

6800 Family Interface Timing

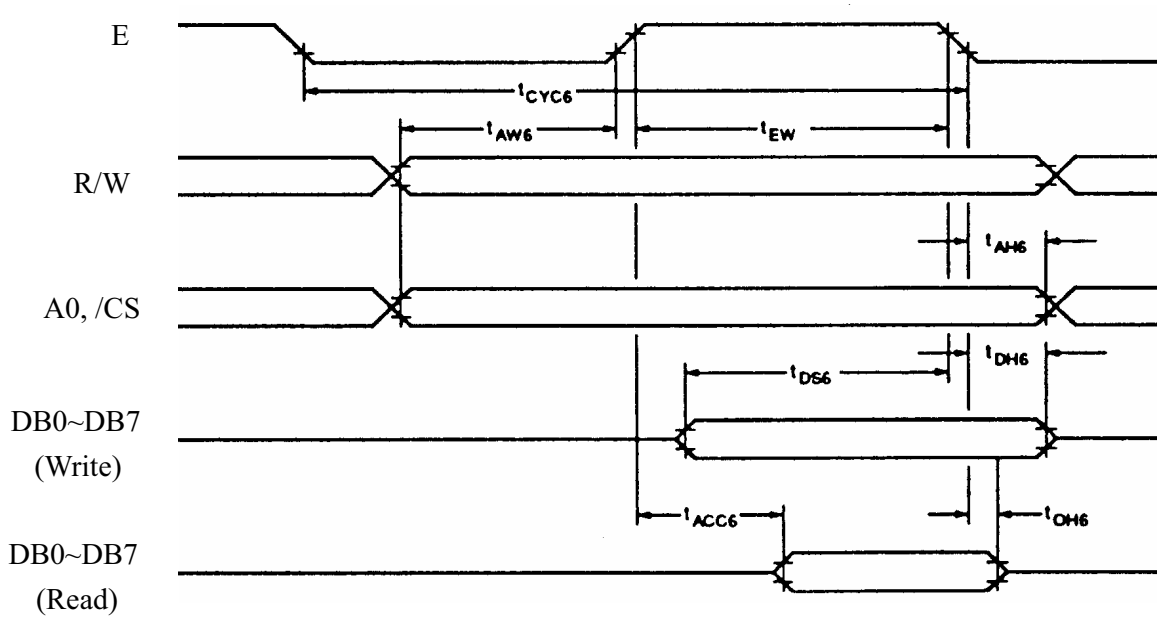
Parameter	Condition	Symbol	Min	Max	Unit	Remark
System Cycle Time	CL=100 pF VDD=2.7 ~4.5	tCYC6	Note		ns	A0,/CS, R/W
Address Setup Time		tAW6	10		ns	
Address Hold Time		tAH6	0		ns	
Data Setup Time		tDS6	120		ns	DB0~DB7
Data Hold Time		tDH6	0		ns	
Output Disable Time		tOH6	10	75	ns	
Access Time		tACC6	-	130	ns	
Enable Pulsewidth		tEW	150	-	ns	E

Note: For memory control and system control commands:

tCYC6=2tC+tEW+tCEA+75 > tACV +245

For all other commands:

tCYC6=4tC+tEW+30



AC Electrical Characteristics

10.2.2 Instruction Set

Class	Command	Code											Hex	Command Description	Command read parameters	
		/RD	/WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			Number of byters	Section
System Control	SYSTEM	1	0	1	0	1	0	0	0	0	0	0	40	Initialized Device and display	8	8.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter Standby mode	0	8.2.2
Display Control	DISP	1	0	1	0	1	0	1	1	0	0	D	58,	Enable and disable display and	1	8.3.1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	set Display start address and	10	8.3.2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor byte	2	8.3.3
	CGRAM	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character	2	8.3.6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	8.3.4
	HDOT SCR	1	0	1	0	1	0	1	1		1	0	5A	set horizontal scroll position	1	8.3.7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	set display overlay format	1	8.3.5
Drawing Control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	set cursor address	2	8.4.1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	read cursor address	2	8.4.2
Memory Control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	write to display memory	-	8.5.1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	read from display memory	-	8.5.2

Note:

1. In general, the internal registers of the SED1335F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.

   2 bytes parameters(where two bytes are treated as 1 data item) are handled as following:

   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.

   b. SYSTEM SET, SCROLL, CGRAM ADR. : Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.
3. Please refer to SED1335F LCD Controller Data Book for detail.