

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

**DEM 16217 FGH-LA-N**

*Product Specification*

*Version : 1.1.0*

14/Oct/2011

# GENERAL SPECIFICATION

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MODULE NO. :

# DEM 16217 FGH-LA-N

CUSTOMER P/N

Version No.	Change Description	Date
0	Original Version	18.03.2003
1	Change drawing and description	20.07.2004
1.1.0	Change IC	14.10.2011

PREPARED BY: LX

DATE: 14.10.2011

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DATE: 14.10.2011

**CONTENTS**

**1. FUNCTIONS & FEATURES ..... 2**

**2. MECHANICAL SPECIFICATIONS..... 2**

**3. EXTERNAL DIMENSIONS..... 3**

**4. BLOCK DIAGRAM ..... 4**

**5. PIN ASSIGNMENT ..... 4**

**6. PCB DRAWING AND DESCRIPTION ..... 5**

**7. BACKLIGHT ELECTRICAL/OPTICAL CHARACTERISTICS ..... 6**

**8. DISPLAY DATA RAM (DDRAM) ..... 7**

**9. MAXIMUM ABSOLUTE POWER RATINGS (TA=25°C) ..... 7**

**10. ELECTRICAL CHARACTERISTICS ..... 7**

**11. INSTRUCTION TABLE ..... 9**

**12. CHARACTER GENERATOR ROM ..... 10**

**13. LCD MODULES HANDLING PRECAUTIONS.....11**

**14. OTHERS.....11**

**1. FUNCTIONS & FEATURES**

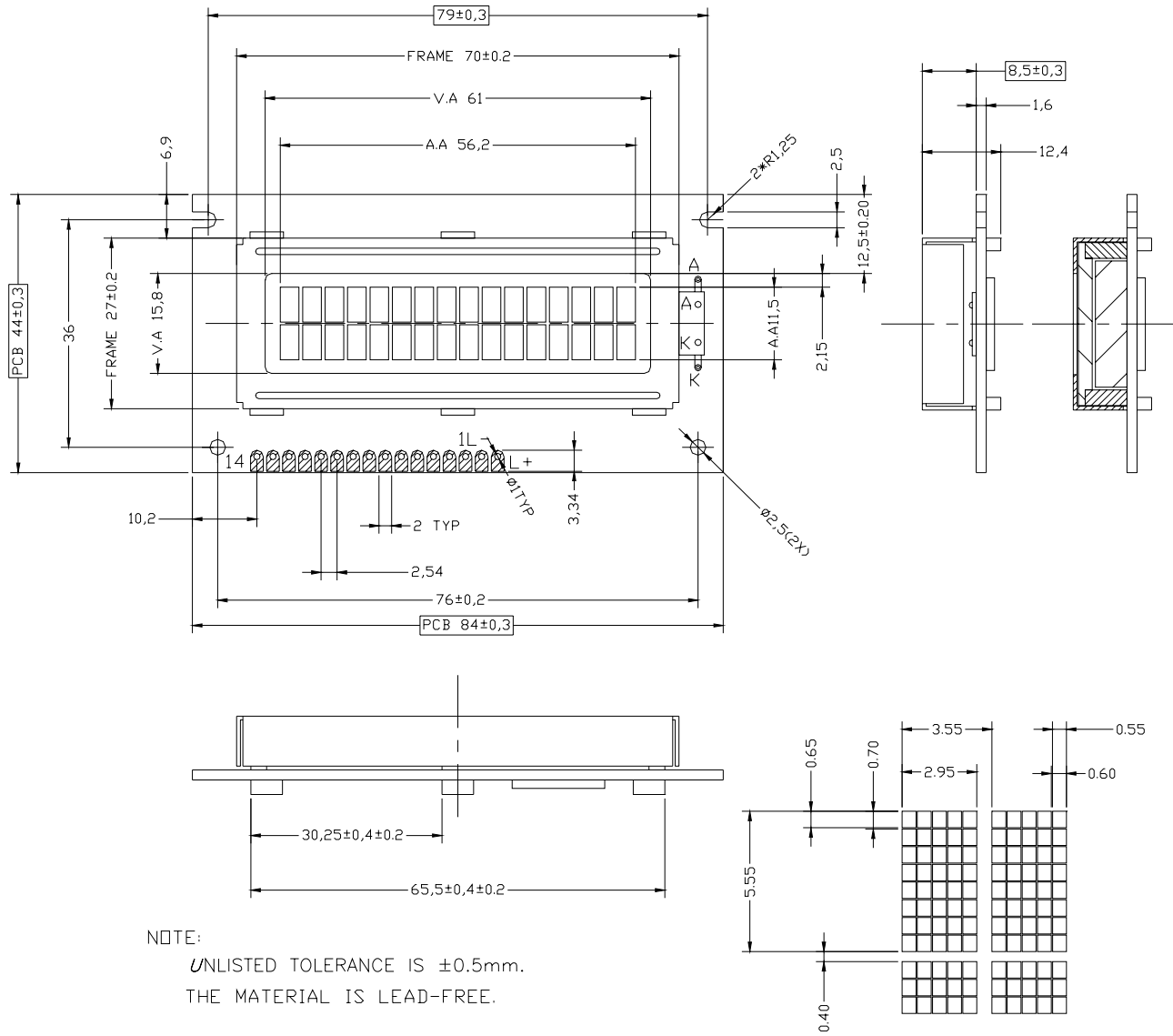
<b>MODULE NAME</b>	<b>LCD TYPE</b>
DEM 16217 FGH-LA-N	FSTN Transflective Negative Mode

- Viewing Direction : 6 O'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- $V_{LCD} (V_{DD} - V_0)$  : 4.5 Volt (typ.)
- Backlight Color : LED, Amber, Lightbox
- Display Format : 16 x 2 Characters (5x8 dots, Format : 192 Kinds)
- Internal Memory : CGROM (10,880 bits )
- Controller : SPLC783A1 (Sunplus)

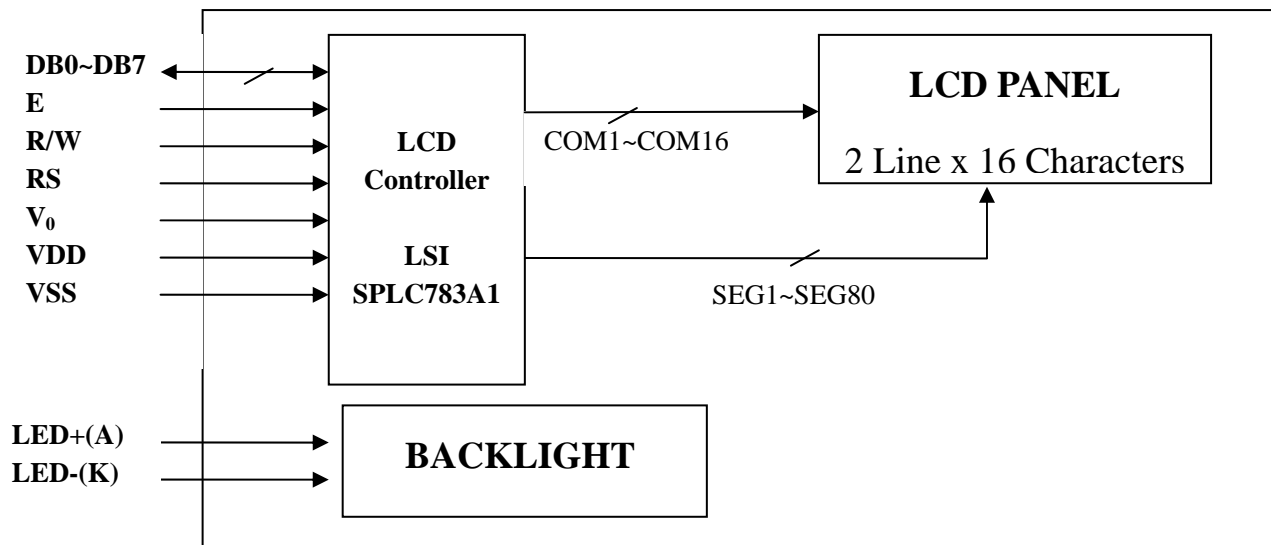
**2. MECHANICAL SPECIFICATIONS**

- Module Size : 84.00 x 44.00 x 8.50 mm
- Viewing Area : 61.00 x 15.80 mm
- Active Area : 56.20 x 11.5 mm
- Dot Size : 0.55 x 0.65 mm
- Dot Pitch : 0.60 x 0.70 mm
- Dot Gap : 0.05 mm

3. EXTERNAL DIMENSIONS



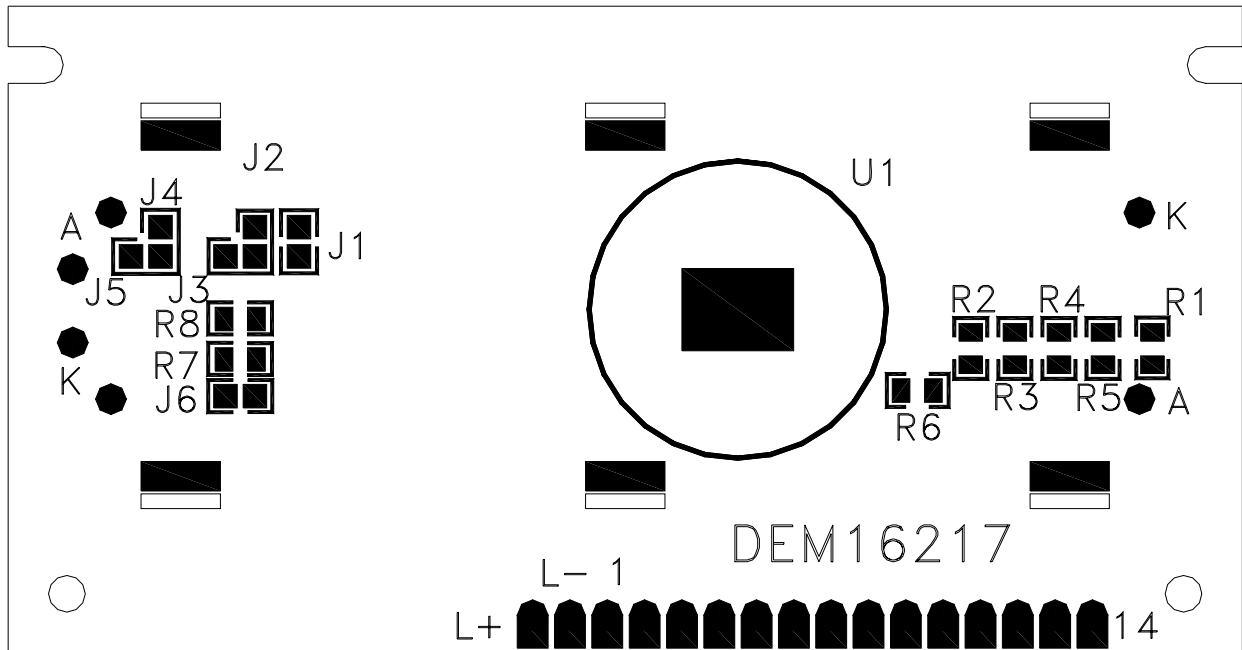
### 4. BLOCK DIAGRAM



### 5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground terminal of module.
2	VDD	Supply terminal of module 5.0V.
3	V <sub>0</sub>	Power Supply for liquid crystal drive.
4	RS	Register select RS = 0 (Instruction register) RS = 1 (Data register)
5	R/W	Read /Write R/W = 1 (Read) R/W = 0 (Write)
6	E	Enable
7	DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, Thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
LED+	LED + (A)	Backlight operating power supply (Anode)
LED-	LED - (K)	Backlight operating power supply (Cathode)

6. PCB DRAWING AND DESCRIPTION



Note: In application module, R1~R5=4.7kΩ , R6=91kΩ

DESCRIPTION:

6-1-1.The polarity of the pin 15 and the pin 16:

J3,J5	J2, J4	LED Polarity	
		LED- Pin	LED+ Pin
Each open	Each closed	Anode	Cathode
Each closed	Each open	Cathode	Anode

Note: In application module, J3=J5=closed, J2=J4=open

6-1-2. The metal-bezel is set on ground when the J1 is closed.

Note: In application module, J1=closed

6-1-3.The LED resistor should can be bridged when the J6 is open

Note: In application module, J6=open

6-1-4.The R7 and the R8 are the LED resistor.

Note: In application module, R8=8.2Ω , R7=open

7. BACKLIGHT ELECTRICAL/OPTICAL CHARACTERISTICS

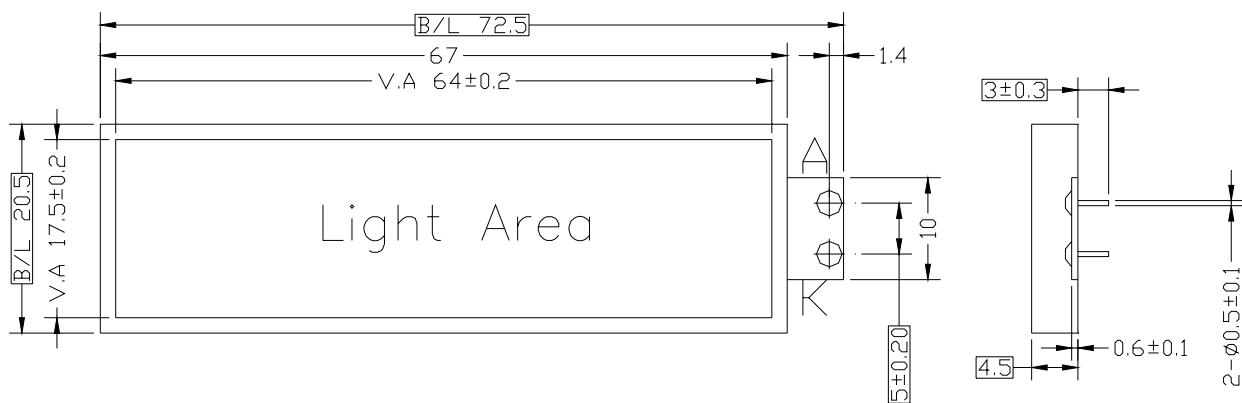
ELECTRICAL–OPTICAL CHARACTERISTICS

Item	Symbol	min.	typ.	max.	Unit	Condition
Forward Voltage	Vf		4.2	4.6	V	If= 120 mA
Power Dissipation	Pd	-	-	0.552	mW	If= 120 mA
Luminous Uniformity	$\Delta Lv$	70			%	MIN/MAX*100%
Luminance	Lv	45	70		cd/m <sup>2</sup>	If= 10 mA T=25°C
Color Coordinate	X Y					
Emission Wavelegth	$\lambda P$	585	590	595		

The LCD Surface Luminance

Item	Symbol	Min.	TYP	Max.	Unit	Remark
Luminance	Lv	15	25		cd/m <sup>2</sup>	-

\*Note: This is only for the reference. The exact value of the luminance please refer to the approval sample.





**8. DISPLAY DATA RAM (DDRAM)**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	← DISPLAY POSITION
FIRST LINE	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	← DDRAM ADDRESS
SECOND LINE	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

**9. MAXIMUM ABSOLUTE POWER RATINGS (Ta=25°C)**

Item	Symbol	Standard Value	Unit
Power supply voltage(1)	V <sub>DD</sub>	-0.3~+7.0	V
Power supply voltage(2)	V <sub>0</sub>	V <sub>DD</sub> -10.0~V <sub>DD</sub> +0.3	V
Input voltage	V <sub>IN</sub>	-0.3~V <sub>DD</sub> +0.3	V
Operating temperature	T <sub>opr</sub>	-20~+70	°C
Storage temperature	T <sub>stg</sub>	-25~+75	°C

\*Voltage greater than above may damage to the Circuit.

$$V_{DD} > V_1 > V_2 > V_3 > V_4 > V_5$$

**10. ELECTRICAL CHARACTERISTICS**

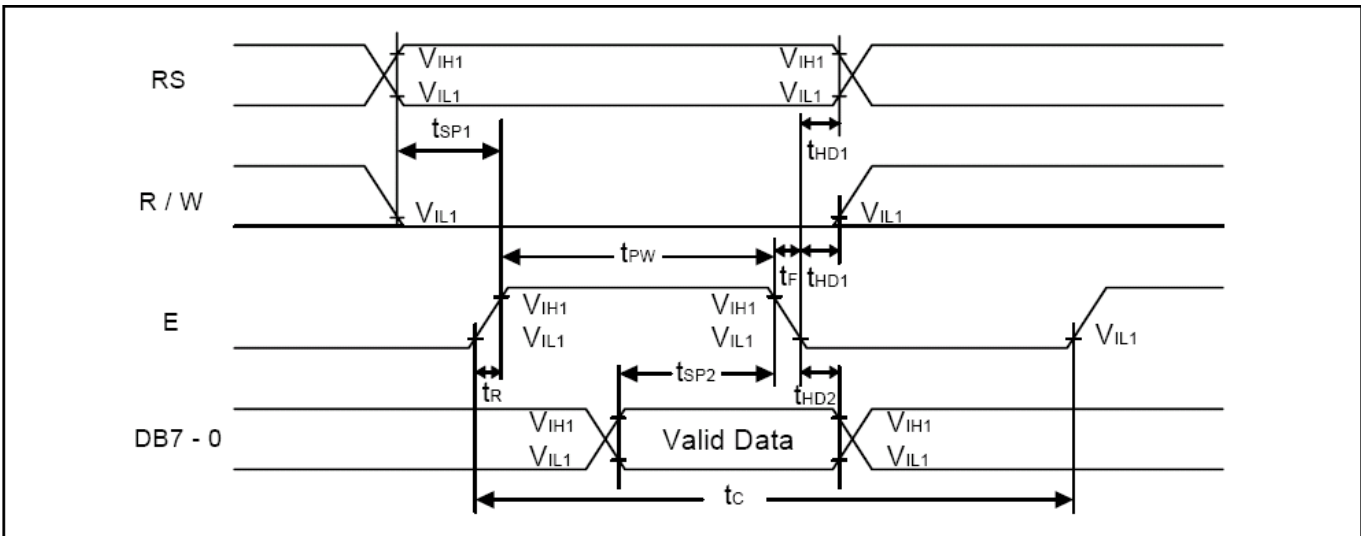
**10-1 DC Characteristics (V<sub>DD</sub>=5.0V, Ta=-20~+70°C)**

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V <sub>DD</sub>	4.5	5	5.5	-----	V
LCD Driving Voltage	V <sub>LCD</sub>	4.2	4.5	4.8	V <sub>DD</sub> -V <sub>0</sub>	V
Supply Current	I <sub>DD</sub>	---	TBD	---	V <sub>DD</sub> =5V	mA

10-2 AC Characteristics ( $V_{DD}=5.0V$ ,  $T_a=-20\sim+70^{\circ}C$ )

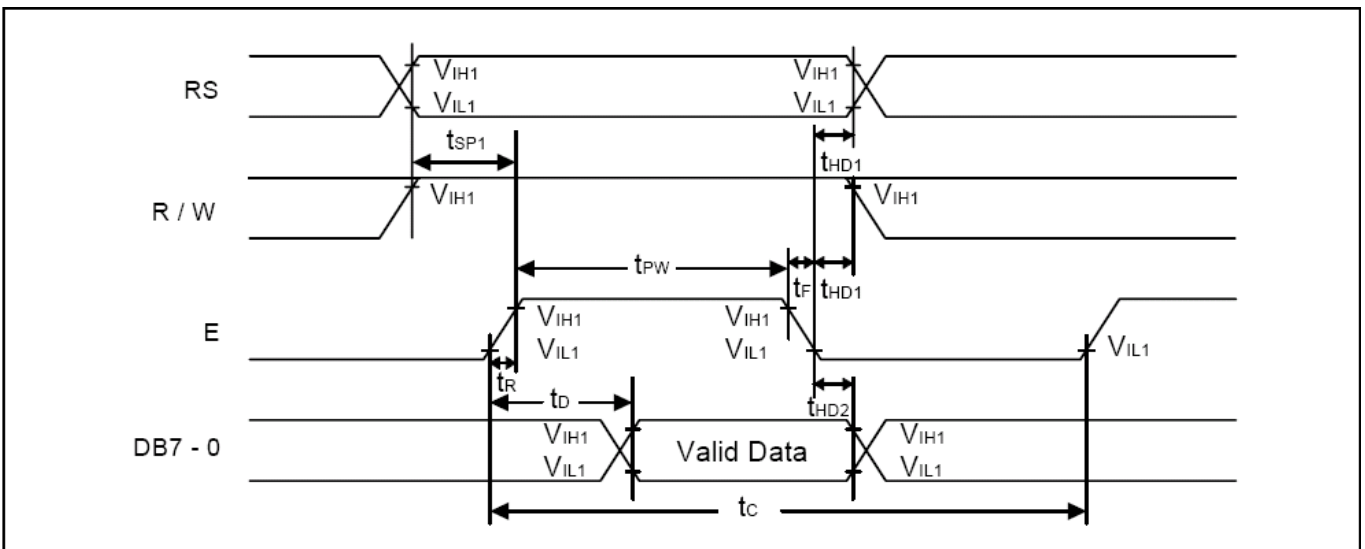
10-2-1 Write mode (writing data from MPU to module)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	$t_c$	500	-	-	ns	Pin E
E Pulse Width	$t_{PW}$	220	-	-	ns	Pin E
E Rise/Fall Time	$t_R, t_F$	-	-	25	ns	Pin E
Address Setup Time	$t_{SP1}$	40	-	-	ns	Pins: RS, R/W, E
Address Hold Time	$t_{HD1}$	10	-	-	ns	Pins: RS, R/W, E
Data Setup Time	$t_{SP2}$	60	-	-	ns	Pins: DB0 - DB7
Data Hold Time	$t_{HD2}$	10	-	-	ns	Pins: DB0 - DB7



10-2-2 Read mode (Reading data from module to MPU)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	$t_c$	500	-	-	ns	Pin E
E Pulse Width	$t_w$	220	-	-	ns	Pin E
E Rise/Fall Time	$t_R, t_F$	-	-	25	ns	Pin E
Address Setup Time	$t_{SP1}$	40	-	-	ns	Pins: RS, R/W, E
Address Hold Time	$t_{HD1}$	10	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	$t_D$		-	120	ns	Pins: DB0 - DB7
Data Hold Time	$t_{HD2}$	20	-	-	ns	Pins: DB0 - DB7



11. INSTRUCTION TABLE

Instruction	Instruction Code										Description	Execution time (fosc=270KHz)	
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.52ms	
Return Home	0	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display	38μs	
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off control bit.	38μs	
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	38μs	
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	38μs	
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	38μs	
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in counter	38μs	
Read Busy Flag and Address Counter	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.		
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38μs	
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	38μs	

Note: "-": don't care

12. CHARACTER GENERATOR ROM

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HCHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL				0	1	2	3	4				一	夕	三	四	五
LLLH			!	1	0	3	4				。	ア	キ	シ	ツ	フ
LLHL			"	2	R	B	r				「	イ	ウ	×	フ	ロ
LLHH			#	3	C	S	C	3			」	ウ	テ	モ	シ	フ
LHLL			\$	4	D	T	d	t			、	エ	ト	ナ	ハ	ク
LHLH			%	5	E	U	e	u			・	オ	大	工	区	ウ
LHHL			&	6	F	V	f	v			ヲ	加	ニ	ヨ	ロ	区
LHHH			'	7	G	W	g	w			ア	キ	又	ヲ	グ	ル
HLLL			(	8	H	X	h	x			イ	夕	ネ	リ	ル	又
HLLH			)	9	I	Y	i	y			ウ	ケ	ル	ル	ル	又
HLHL			*	:	J	Z	j	z			エ	コ	ン	ル	ル	又
HLHH			+	:	K	L	k	l			オ	サ	ル	ル	ル	又
HHLL			,	<	L	羊	l	羊			カ	シ	フ	ク	ル	又
HHLH			-	=	M	I	m	i			ユ	又	ル	ル	ル	又
HHHL			.	>	N	^	n	^			ヨ	セ	ル	ル	ル	又
HHHH			/	>	O	l	o	l			ウ	ウ	又	ル	ル	又

### **13. LCD MODULES HANDLING PRECAUTIONS**

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD module.
  - Tools required for assembly, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions  
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

### **14. OTHERS**

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections