

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 16224 SYH

Product Specification

Version : 2.1.1

24/Oct/2008

GENERAL SPECIFICATION

MODULE NO. :

DEM 16224 SYH

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	26.03.2001
1	UPDATE MODULE DRAWING AND CHARACTER GENERATOR ROM	04.04.2001
2	ADD VERSION	14.04.2003
2.1.1	CHANGE IC	24.10.2008

PREPARED BY : HCL

DATE: 24.10.2008

APPROVED BY: MH

DATE: 24.10.2008

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1. FUNCTIONS & FEATURES

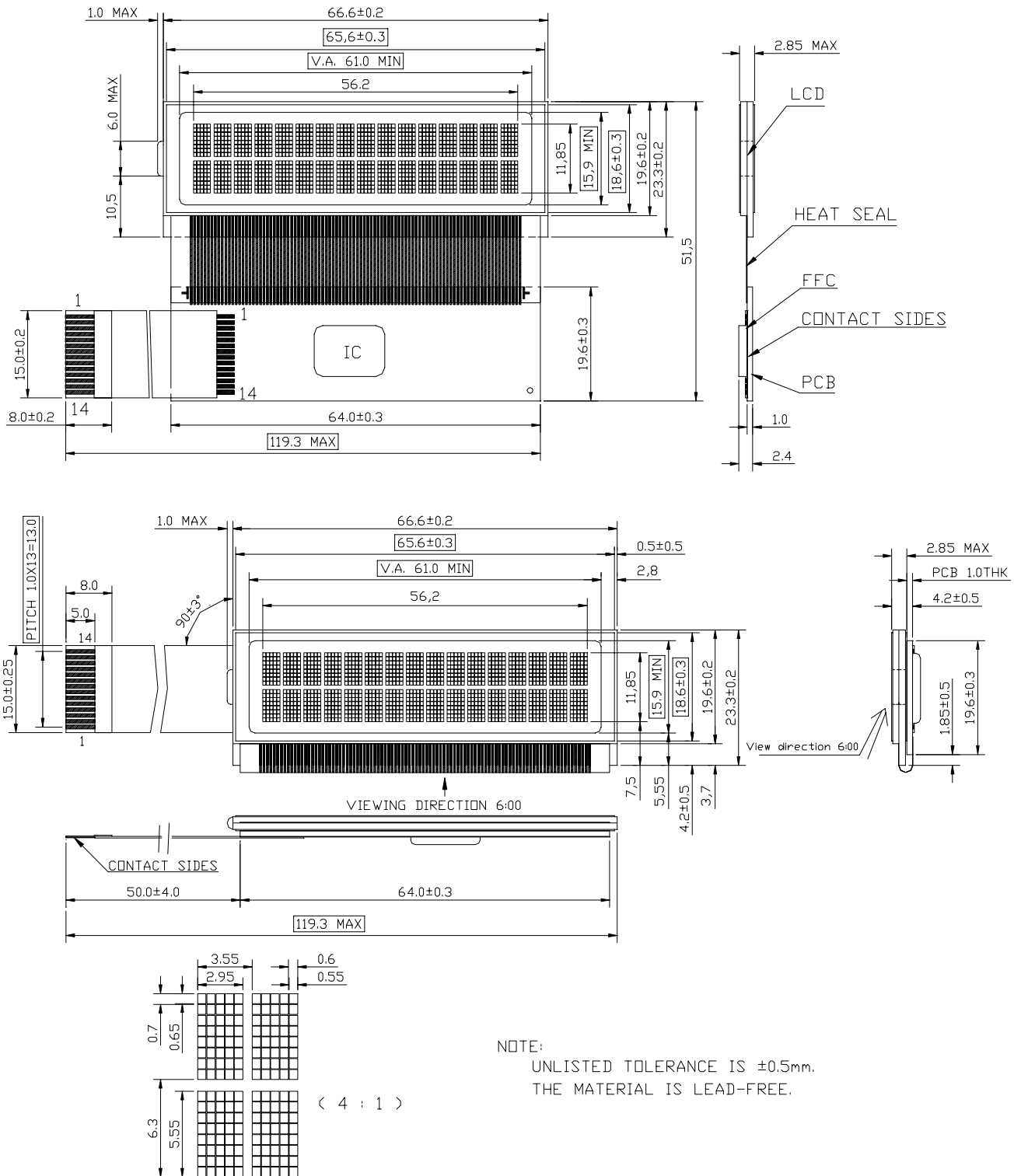
MODULE NAME	LCD TYPE
DEM 16224 SYH	STN Yellow Green Reflective Positive Mode

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- V_{LCD} (VDD-V0) : 4.5 Volt (typ.)
- Display Format : 16x2 Characters
- Internal Memory : CGROM (10,880 bits)
: CGRAM (64 x 8 bits)
: DDRAM (80 x 8 bits for Digits)
- CGROM : CGROM of the SPLC783A1 (Sunplus)
- Interface : Easy Interface with a 4-bit or 8-bit MPU
- Operating Temperature : -20°C to +70°C
- Storage Temperature : -25°C to +75°C

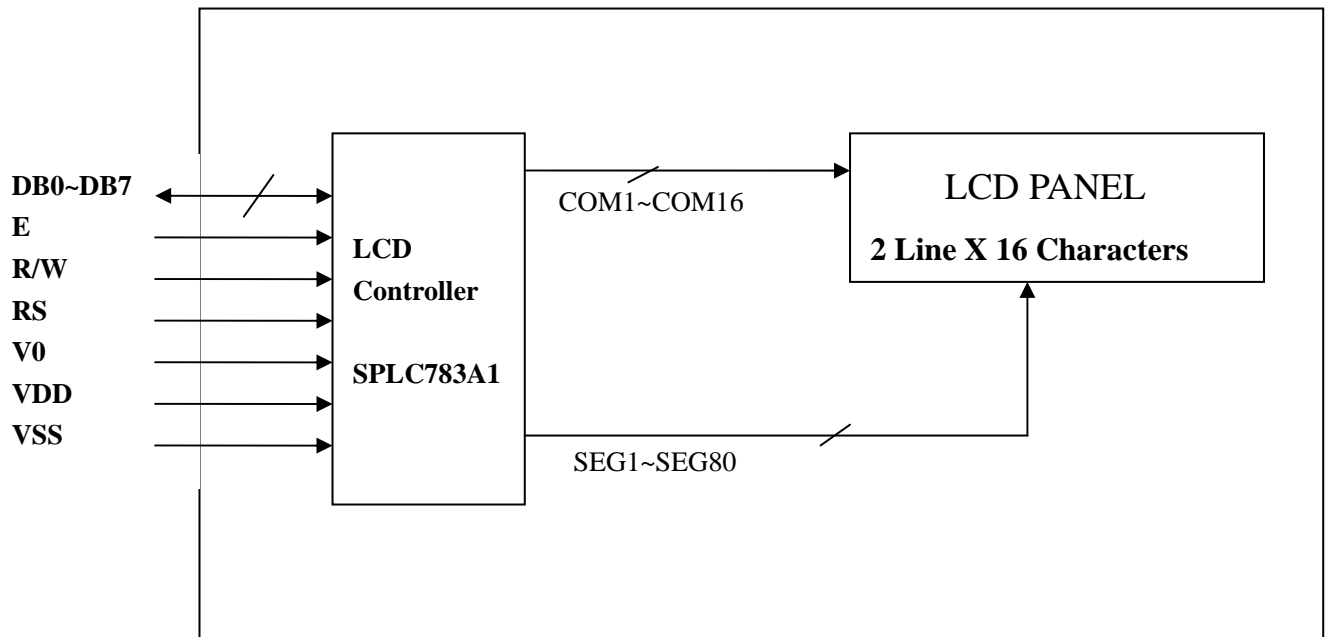
2. MECHANICAL SPECIFICATIONS

- Module Size : 66.60 x 23.30 x 2.85 mm
- Character Pitch : 3.55 x 6.30 mm
- Character Size : 2.95 x 5.55 mm
- Character Font : 5 x 8 dots
- Dot Size : 0.55 x 0.65 mm
- Dot Pitch : 0.60 x 0.70 mm

3. EXTERNAL DIMENSIONS



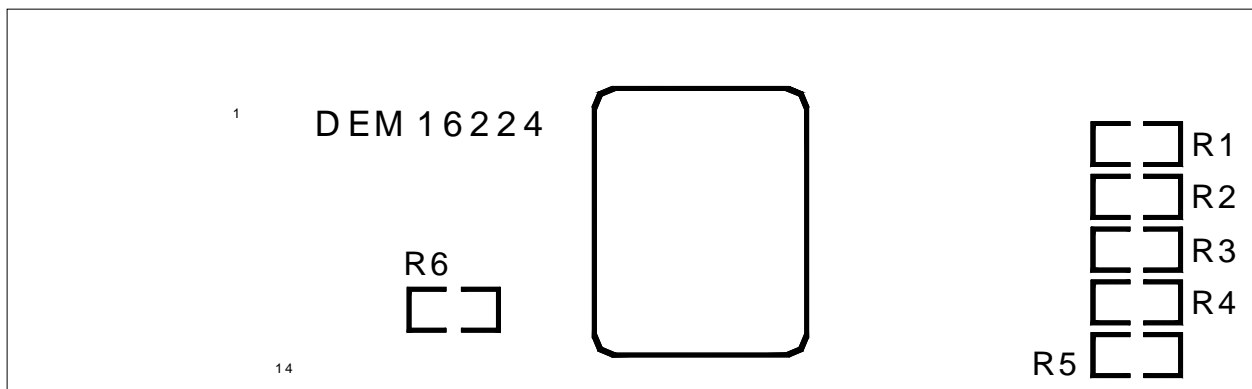
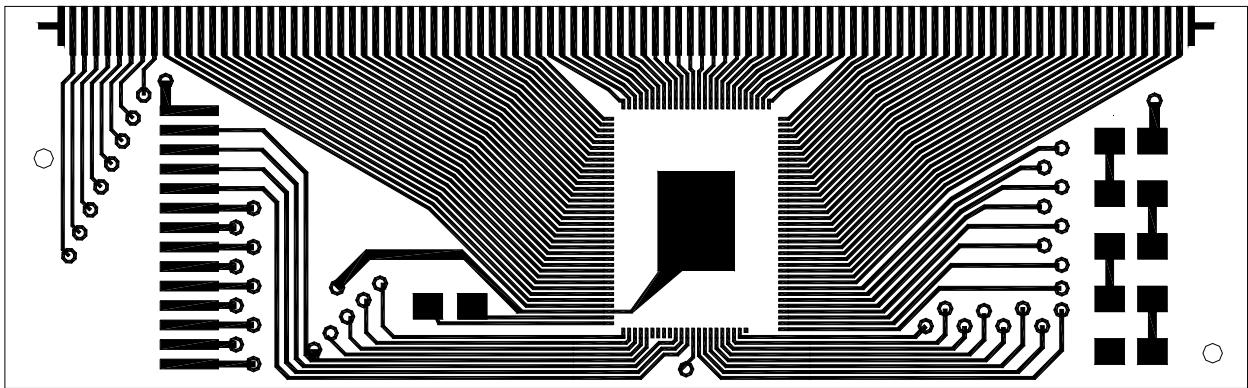
4. BLOCK DIAGRAM



5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	V _{DD}	Supply terminal of module 5.0 V
2	V ₀	Power Supply for Liquid crystal Drive
3	RS	Register select RS = 0...Instruction register RS = 1...Data register
4	R/W	Read /Write R/W = 1...Read R/W = 0...Write
5	E	A start signal for reading or writing data
6	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.
7	DB1	
8	DB2	
9	DB3	
10	DB4	
11	DB5	
12	DB6	
13	DB7	
14	V _{SS}	Ground terminal of module

6. PCB DRAWING



7. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	Standard Value	Unit
Power supply voltage(1)	V_{DD}	-0.3~+7.0	V
Power supply voltage(2)	V_{LCD}	$V_{DD}-12.0\sim V_{DD}+0.3$	V
Input voltage	V_{IN}	-0.3~ $V_{DD}+0.3$	V
Operating temperature	T_{opr}	-20~+70	°C
Storage temperature	T_{stg}	-25~+75	°C

8. ELECTRICAL CHARACTERISTICS

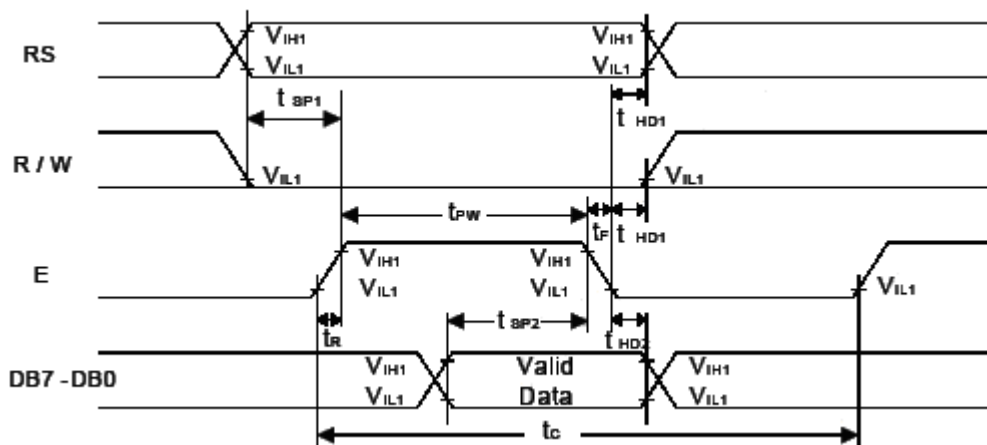
8-1. DC Characteristics ($V_{DD}=4.5V\sim 5.5V, T_a= -20 \sim +70^{\circ}C$)

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	4.7	5	5.3	-----	V
LCD Driving Voltage	V_{LCD}	4.2	4.5	4.8	$V_{DD}-V_0$	V
Supply Current	I_{DD}	----	TBD	----	-----	mA

8-2 AC Characteristics ($V_{DD}=4.5V\sim 5.5V$, $T_a=-20\sim +70^{\circ}C$)

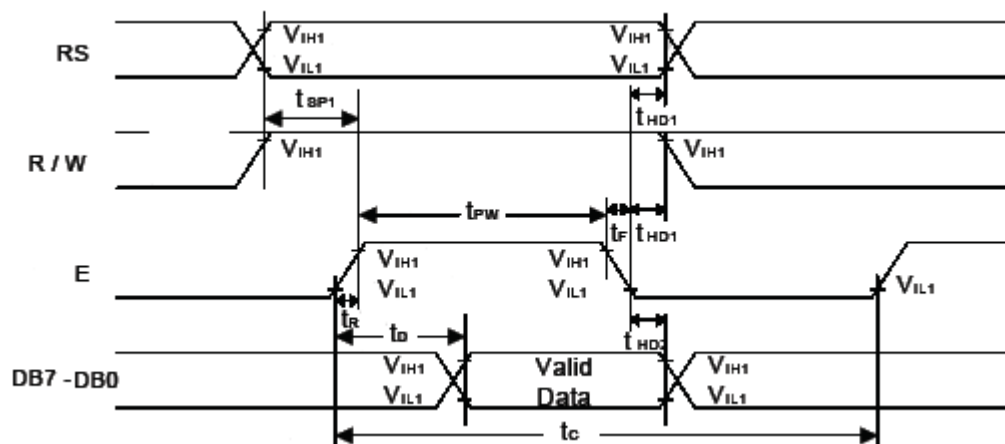
8-2-1 Write mode (writing data from MPU to module Series)

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



8-2-2 Read mode (Reading data from module Series 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



9. DISPLAY DATA RAM (DDRAM)

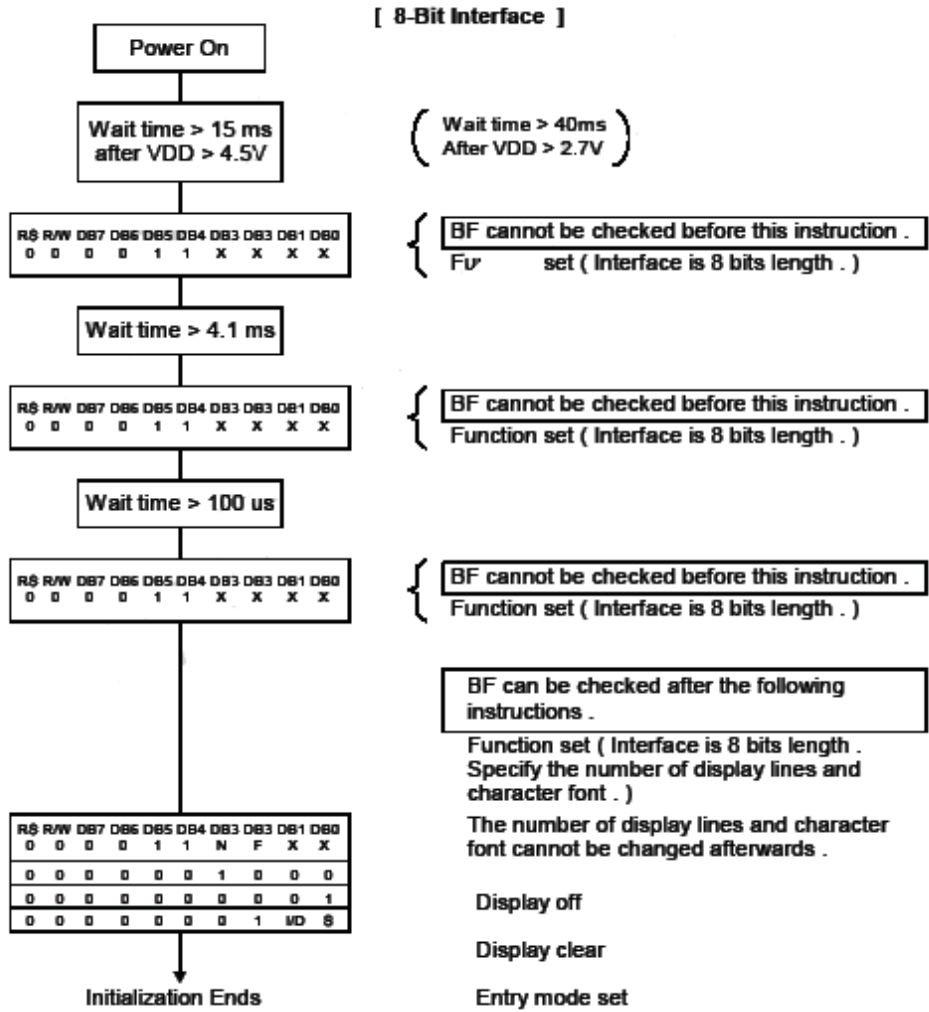
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	← DISPLAY POSITION
FIRST LINE	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	← DDRAM ADDRESS
SECOND LINE	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

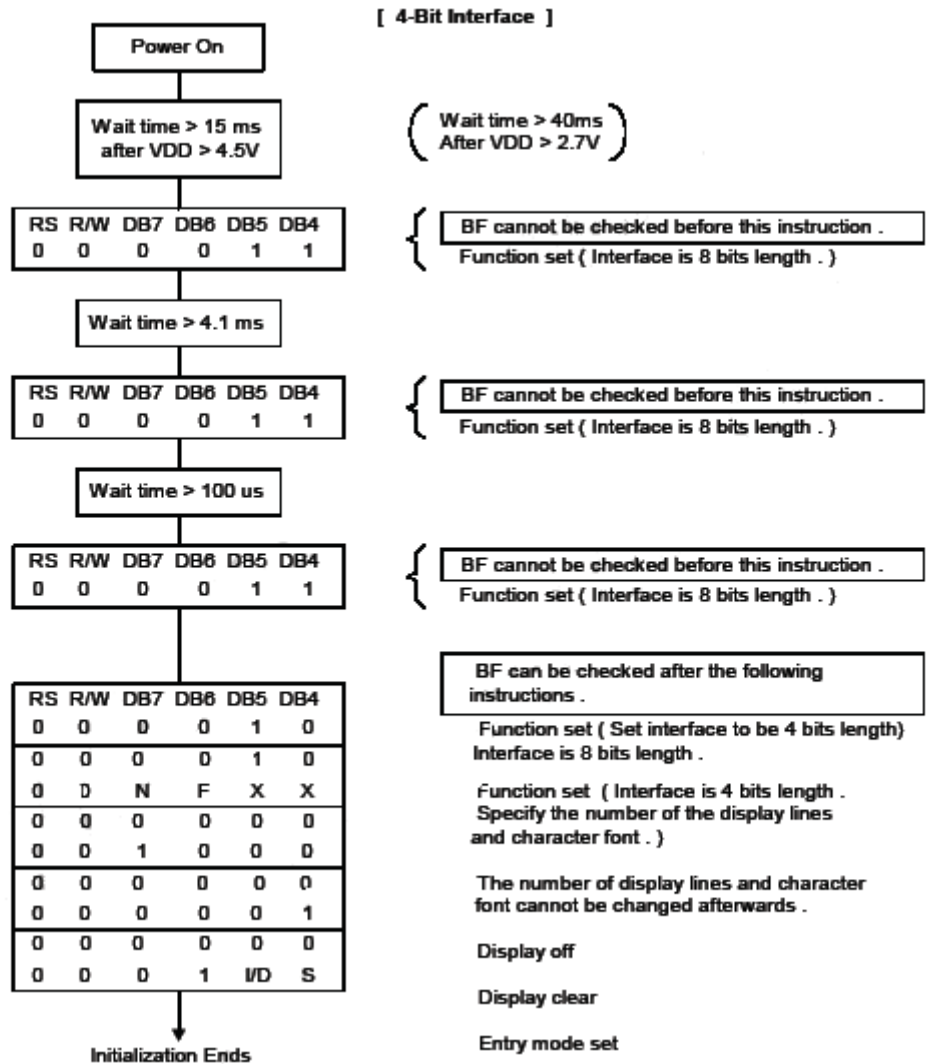
10. INSTRUCTION TABLE

Instruction	Instruction Code										Description	Execution time (fosc=270kHz)	
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC.	1.52 ms
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	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display.	38us
Display ON/OFF Control	0	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor(C), and blinking of cursor (B) on/off control bit.	38us
Cursor or Display shift	0	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.	38us
Function set	0	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL:4-bit/8-bit), numbers of display line (N:1-line/2-line, display font type (F: 5×10 dots/5×8 dots)	38us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	38us	
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	38us	
Read busy flag and address	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.	0us	
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38us	
Read data to RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data into internal RAM (DDRAM/CGRAM).	38us	

NOTE: "-" don't care

11. LCM INITIALIZING BY INSTRUCTION





12. CHARACTER GENERATOR ROM

Upper(4bit) \ Lower(4bit)		Upper(4bit)															
		LLLL	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH	
LLLL	CGRAM (1)																
	(2)																
	(3)																
	(4)																
	(5)																
	(6)																
	(7)																
	(8)																
HLLL	(1)																
	(2)																
	(3)																
	(4)																
	(5)																
	(6)																
	(7)																
	(8)																

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.