

**DISPLAY Elektronik GmbH**

**DATA SHEET**

**LCD MODULE**

**DEM 16102 SBH-PW-N**

*Product Specification*

*Version : 1*

**15.06.2007**

# GENERAL SPECIFICATION

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MODULE NO. :

## DEM 16102 SBH-PW-N

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	08.02.2007
1	ADD VERSION	15.06.2007

PREPARED BY: ZWY

DATE: 15/06/2007

APPROVED BY: MH

DATE: 17.08.2007

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**1.FUNCTIONS & FEATURES**

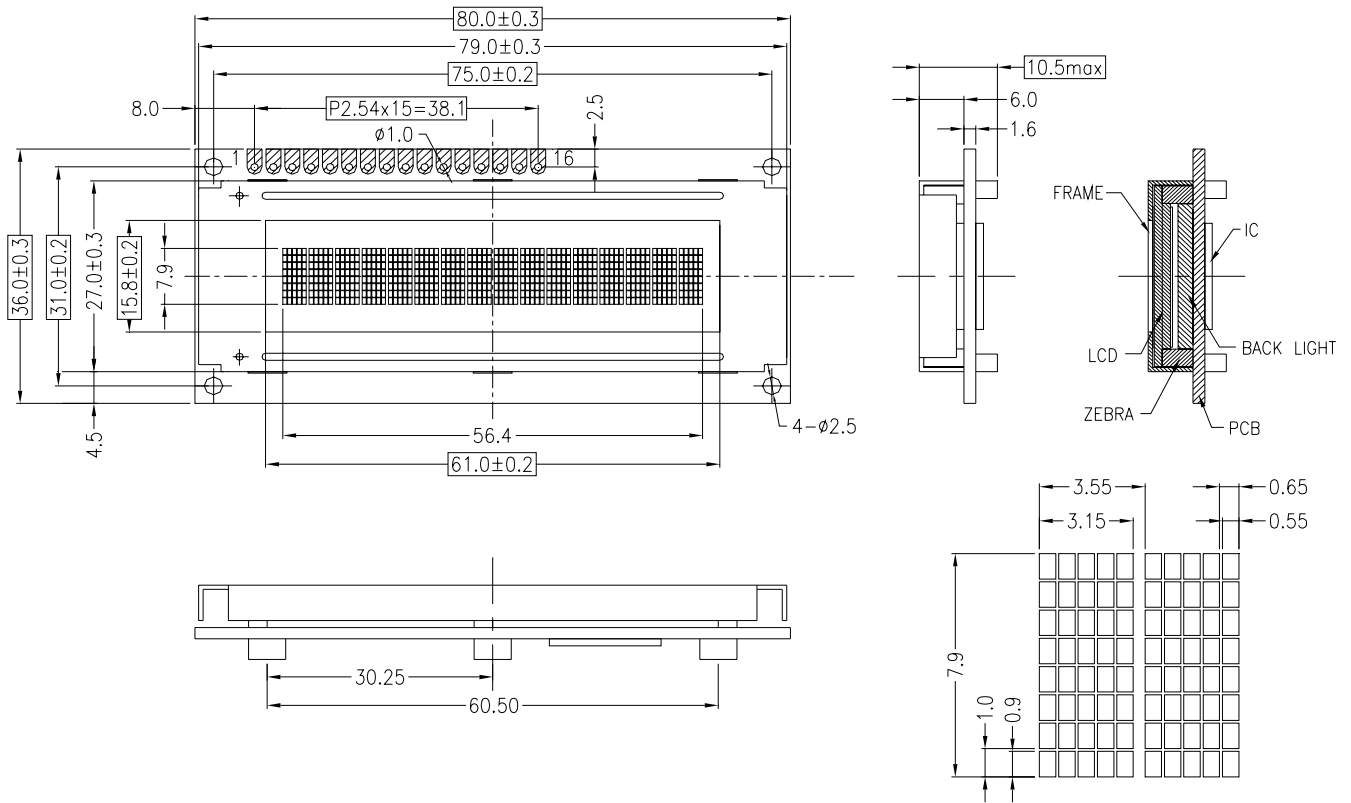
MODULE	LCD TYPE
DEM 16102 SBH-PW-N	STN Blue Transmissve Negative Mode

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Backlight : LED, Lightguide, White
- Power Supply Voltage : 5.0 Volt (typ.)
- V<sub>LCD</sub> adjustable contrast voltage : 4.5 Volt (typ.)
- Display Format :16x1Characters (5x8 dots, Format: 208 Kinds )
- Internal Memory : CGROM (10,080 bits )  
: CGRAM (64 x 8 bits )  
: DDRAM (80 x 8 bits for Digits)
- Interface : Easy Interface with a 4-bit or 8-bit MPU
- Operating Temperature : -20°C to +70°C
- Storage Temperature : -25°C to +80°C

**2. MECHANICAL SPECIFICATIONS**

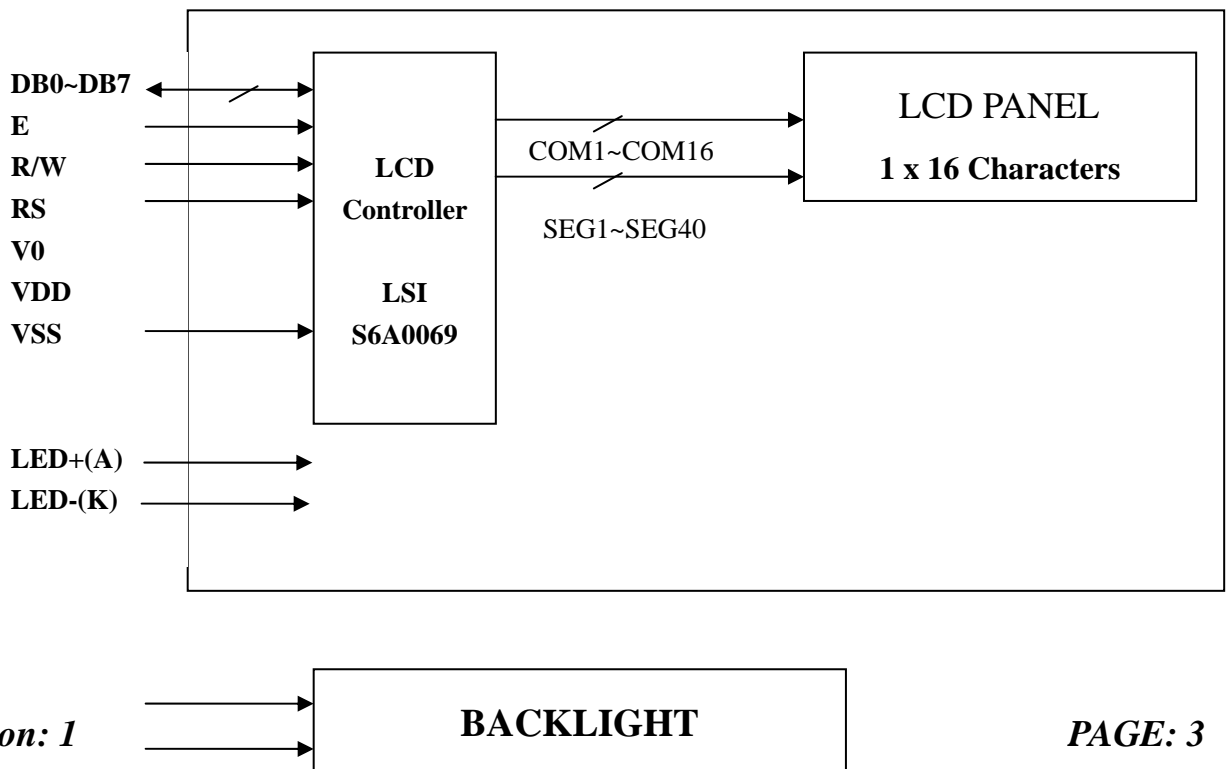
- Module Size : 80,00 x 36.00 x 10.5 mm
- Character Pitch : 3.55 x 7.90 mm
- Character Size : 3.15 x 7.90 mm
- Character Font : 5 x 8 dots
- Dot Pitch : 0.65 x 1.0 mm
- Dot Size : 0.55 x 0.90 mm
- Dot Gap : 0.10 mm

**3. EXTERNAL DIMENSIONS**



UNLESS TOLERANCE IS ±0.4  
THE MATERIAL IS LEAD-FREE

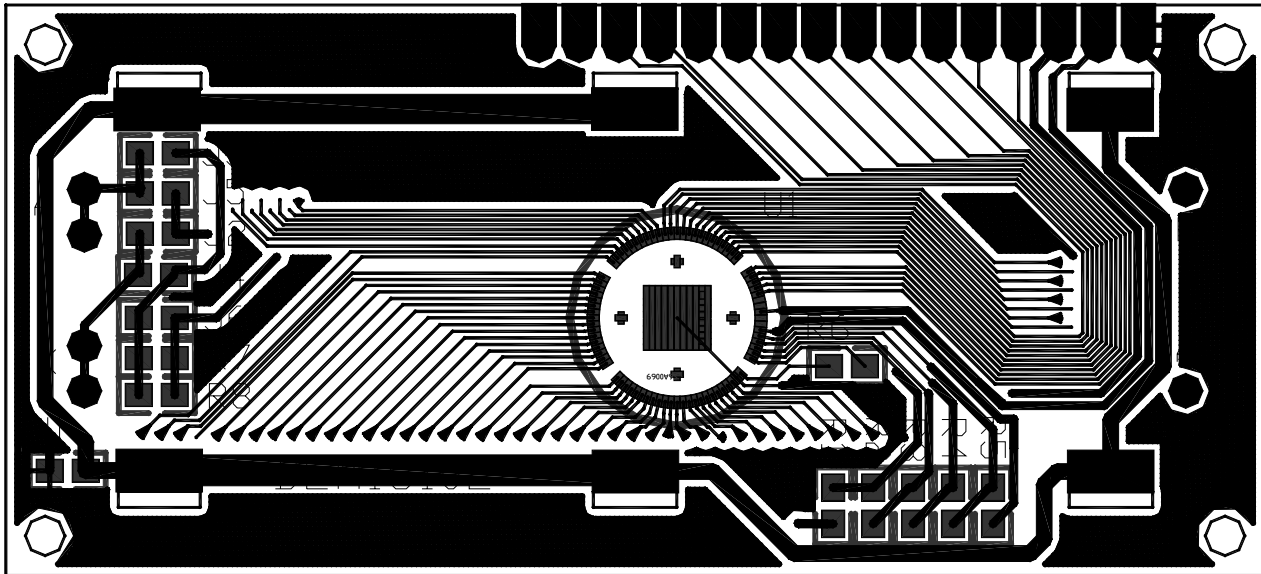
**4. BLOCK DIAGRAM**



**5. PIN ASSIGNMENT**

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Supply terminal of module +5V
3	V0	Power Supply for Liquid Crystal Drive
4	RS	Select Display Data ("1") or Instructions ("0")
5	R/W	Read or Write Select Signal
6	E	Read/Write Enable Signal
7	DB0	Display Data Signal
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED- (K)	Please also refer to 6.1 PCB drawing and description
16	LED+ (A)	

**6. PCB DRAWING AND DESCRIPTION**



**6.1 DESCRIPTION:**

**6.1.1 The polarity of the pin 15 and the pin 16:**

LED Polarity(1)	
15 Pin	16Pin
Anode	Cathode
J2=J3=open J4=J5=closed	

LED Polarity(2)	
15 Pin	16 Pin
Cathode	Anode
J2=J3= closed J4=J5= open	

Note: In application module, J4=J5= open and J2=J3=0 Ohm

**6.1.2 The metal-bezel is set be on ground when the J1 is closed**

Note: In application module, J1=0 Ohm

**6.1.3. The LED resistor on board are used when J6 is open.**

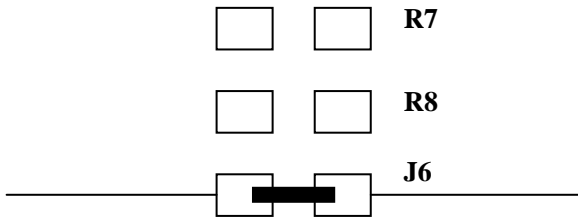
Note: In application module, J6=open

**6.1.4 The R7 and the R8 are the LED resistor.**

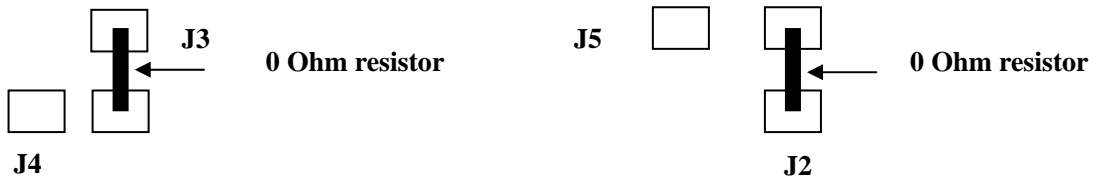
Note: In application module, R7=33 Ohm, R8=open.

**6.2 Example application**

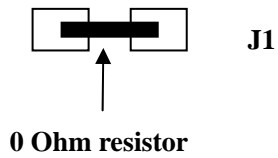
6-2-1. The LED resistors on board can be disabled when J6 is closed.



6-2-2. The 15 pin is the cathode and the 16 pin is the anode as following.



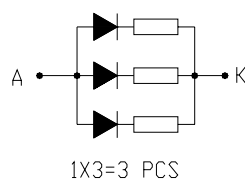
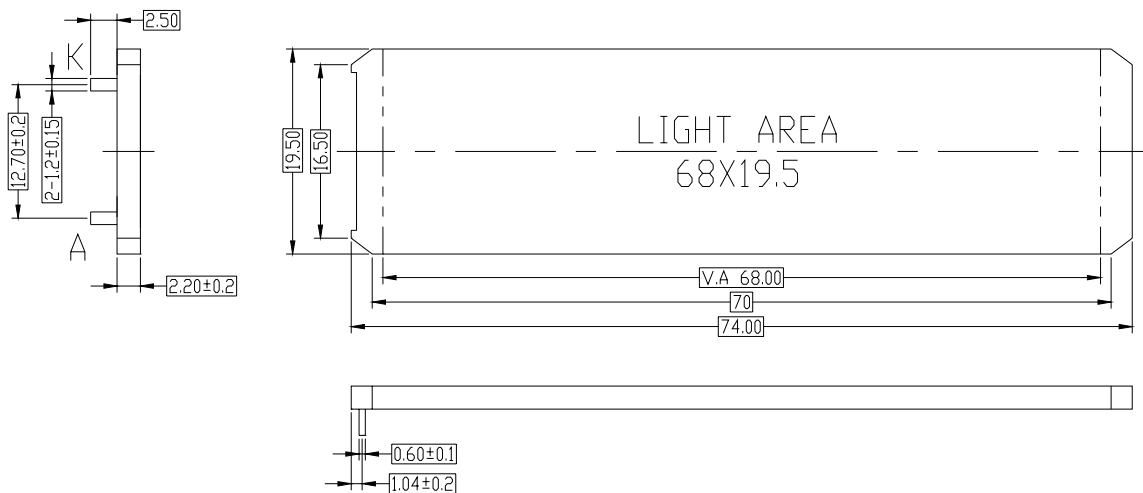
6-2-3. The metal-bezel is on ground as following.





**7. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATION**

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNTI	CONDITIONS
Forward Voltage	Vf		4.0	4.2	V	If=45mA
Forward Current	If		45		mA	
Power Disipation	Pd				W	If=45mA
Reverse Voltage	VR		4.0		V	
Reverse Current	IR		0.4		mA	
Luminous Intensity	Iv		60		cd/m <sup>2</sup>	If=45mA
Emission Wave Length	$\lambda_p$		White		nm	If=15mA TA=25°C
Spectral Rang	$\Delta \lambda$		20		nm	Each chip



REMARKS:  
 1,UNMARKED TOLERANCE IS ±0.3,  
 2,THE MATERIAL COMPLY WITH ROHS.

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

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	← Display Position
FIRT LINE	00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47	← DDRAM Address

**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>LCD</sub>	V <sub>DD</sub> -13.5~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>	-30~+85	°C

**10. ELECTRICAL CHARACTERISTICS**

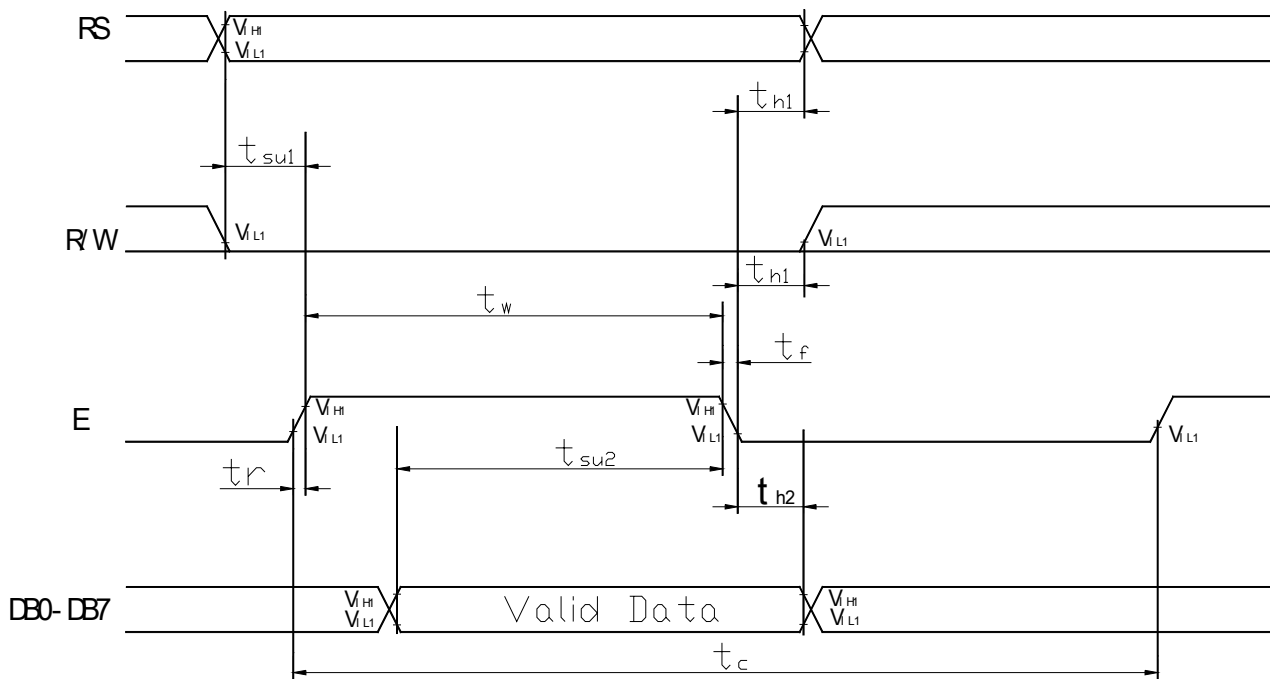
**10-1 DC Characteristics(VDD=4.5V~5.5V)**

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V <sub>DD</sub>	4.5	5	5.5	-----	V
Supply Current	I <sub>DD</sub>	----	0.35	0.6	VDD=5V,fosc=270kHz	mA
LCD Driving Voltage	V <sub>LCD</sub>	3.0	4.5	13.0	VDD-V0	V

**10-2 AC Characteristics(VDD=4.5V~5.5V)**

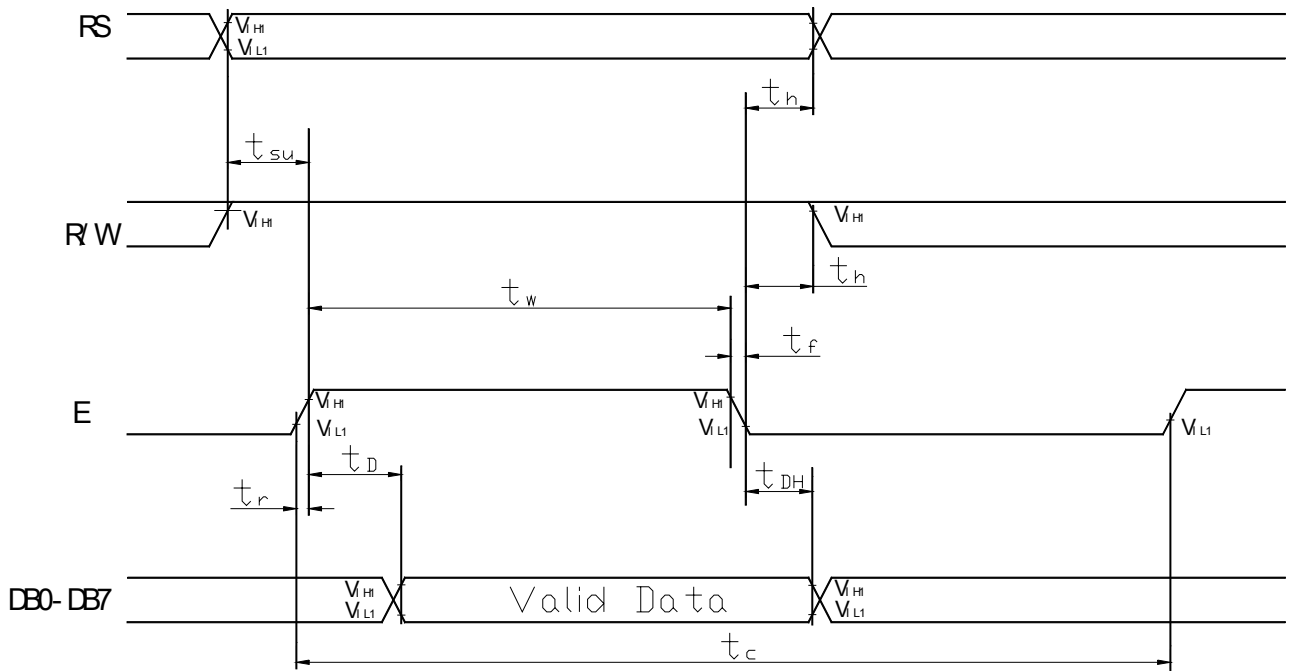
**10-2-1 Write mode**

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	t <sub>C</sub>	500	---	---	ns	E
E Rise Time	t <sub>R</sub>	---	---	20	ns	E
E Fall Time	t <sub>F</sub>	---	---	20	ns	E
E Pulse width (High,Low)	t <sub>W</sub>	230	---	---	ns	E
R/W and RS Set-up Time	t <sub>SU1</sub>	40	---	---	ns	R/W,RS
R/W and RS Hold Time	t <sub>H1</sub>	10	---	---	ns	R/W,RS
Data Set-up Time	t <sub>SU2</sub>	80	---	---	ns	DB0~DB7
Data Hold Time	t <sub>H2</sub>	10	---	---	ns	DB0~DB7



10-2-2 Read mode

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	$t_C$	500	---	---	ns	E
E Rise Time	$t_R$	---	---	20	ns	E
E Fall Time	$t_F$	---	---	20	ns	E
E Pulse width (High, Low)	$t_W$	230	---	---	ns	E
R/W and RS Set-up Time	$t_{SU}$	40	---	---	ns	R/W,RS
R/W and RS Hold Time	$t_H$	10	---	---	ns	R/W,RS
0Data Output Delay Time	$t_D$	---	---	120	ns	DB0~DB7
Data Hold Time	$t_{DH2}$	5	---	---	ns	DB0~DB7



11. CONTROL AND DISPLAY COMMAND

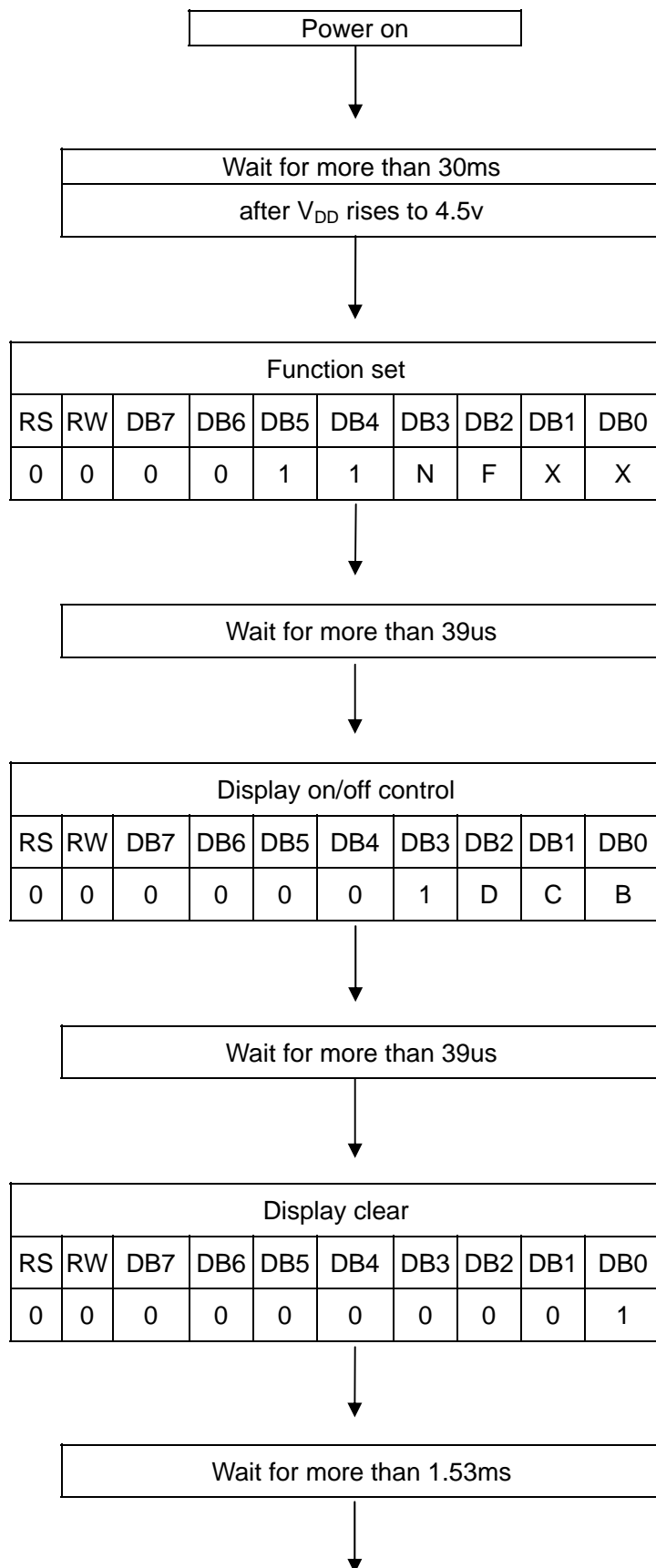
Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Executi on time (fosc=2 70KHz)	Remark																		
clear Display	L	L	L	L	L	L	L	L	L	H	1.53ms	Write "20H" to DDRAM and set DDRAM address to "00H" from AC																		
Return home	L	L	L	L	L	L	L	L	H	---	1.53ms	Cursor move to first digit																		
Entry mode set	L	L	L	L	L	L	L	H	I/D	SH	39us	I/D: set cursor move direction <table border="1"> <tr> <td>I/D</td> <td>H</td> <td>Increase</td> </tr> <tr> <td>I/D</td> <td>L</td> <td>Decrease</td> </tr> </table> SH: Specifies shift of display <table border="1"> <tr> <td>SH</td> <td>H</td> <td>Display is shifted</td> </tr> <tr> <td>SH</td> <td>L</td> <td>Display is not shifted</td> </tr> </table>	I/D	H	Increase	I/D	L	Decrease	SH	H	Display is shifted	SH	L	Display is not shifted						
I/D	H	Increase																												
I/D	L	Decrease																												
SH	H	Display is shifted																												
SH	L	Display is not shifted																												
Display on/off control	L	L	L	L	L	L	H	D	C	B	39us	Display <table border="1"> <tr> <td>D</td> <td>H</td> <td>Display on</td> </tr> <tr> <td>D</td> <td>L</td> <td>Display off</td> </tr> </table> Cursor <table border="1"> <tr> <td>C</td> <td>H</td> <td>Cursor on</td> </tr> <tr> <td>C</td> <td>L</td> <td>Cursor off</td> </tr> </table> Blinking <table border="1"> <tr> <td>B</td> <td>H</td> <td>Blinking on</td> </tr> <tr> <td>B</td> <td>L</td> <td>Blinking off</td> </tr> </table>	D	H	Display on	D	L	Display off	C	H	Cursor on	C	L	Cursor off	B	H	Blinking on	B	L	Blinking off
D	H	Display on																												
D	L	Display off																												
C	H	Cursor on																												
C	L	Cursor off																												
B	H	Blinking on																												
B	L	Blinking off																												
Cursor or Display Shift	L	L	L	L	L	H	S/C	R/L	---	---	39us	<table border="1"> <tr> <td>SC</td> <td>H</td> <td>Display shift</td> </tr> <tr> <td>SC</td> <td>L</td> <td>Cursor move</td> </tr> </table> <table border="1"> <tr> <td>R/L</td> <td>H</td> <td>Right shift</td> </tr> <tr> <td>R/L</td> <td>L</td> <td>Left shift</td> </tr> </table>	SC	H	Display shift	SC	L	Cursor move	R/L	H	Right shift	R/L	L	Left shift						
SC	H	Display shift																												
SC	L	Cursor move																												
R/L	H	Right shift																												
R/L	L	Left shift																												
function Set	L	L	L	L	H	DL	N	F	---	---	39us	<table border="1"> <tr> <td>DL</td> <td>H</td> <td>8bits interface</td> </tr> <tr> <td>DL</td> <td>L</td> <td>4bits interface</td> </tr> </table> <table border="1"> <tr> <td>N</td> <td>H</td> <td>2 line display</td> </tr> <tr> <td>N</td> <td>L</td> <td>1 line display</td> </tr> </table> <table border="1"> <tr> <td>F</td> <td>H</td> <td>5 x 11 dots</td> </tr> <tr> <td>F</td> <td>L</td> <td>5 x 8 dots</td> </tr> </table>	DL	H	8bits interface	DL	L	4bits interface	N	H	2 line display	N	L	1 line display	F	H	5 x 11 dots	F	L	5 x 8 dots
DL	H	8bits interface																												
DL	L	4bits interface																												
N	H	2 line display																												
N	L	1 line display																												
F	H	5 x 11 dots																												
F	L	5 x 8 dots																												
Set CGRAM address	L	L	L	H	AC5	AC4	AC3	AC2	AC1	AC0	39us	CGRAM data is sent and received after this setting																		
Set DDRAM address	L	L	H	AC6	AC5	AC4	AC3	AC2	AC1	AC0	39us	DDRAM data is sent and received after this setting																		
Read busy flag& address	L	H	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	<table border="1"> <tr> <td>BF</td> <td>H</td> <td>Busy</td> </tr> <tr> <td>BF</td> <td>L</td> <td>Ready</td> </tr> </table> -Reads BF indication internal operating is being performed -Reads address counter contents	BF	H	Busy	BF	L	Ready												
BF	H	Busy																												
BF	L	Ready																												
Write data to RAM	H	L	D7	D6	D5	D4	D3	D2	D1	D0	43us	Write data into DDRAM or CGRAM																		
Read data from RAM	H	H	D7	D6	D5	D4	D3	D2	D1	D0	43us	Read data from DDRAM or CGRAM																		

12. STANDARD CHARACTER PATTERN (S6A0069-00)

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

13. LCM INITIALIZING BY INSTRUCTION

13-1 8-bit Interface Mode



Condition : fosc=270khz

N	0	1-line mode
	1	2-line mode

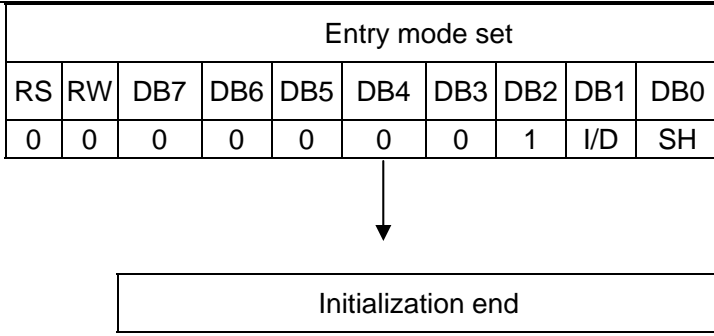
F	0	5 x 8 font
	1	5 x 11 font

D	0	display off
	1	display on

C	0	cursor off
	1	cursor on

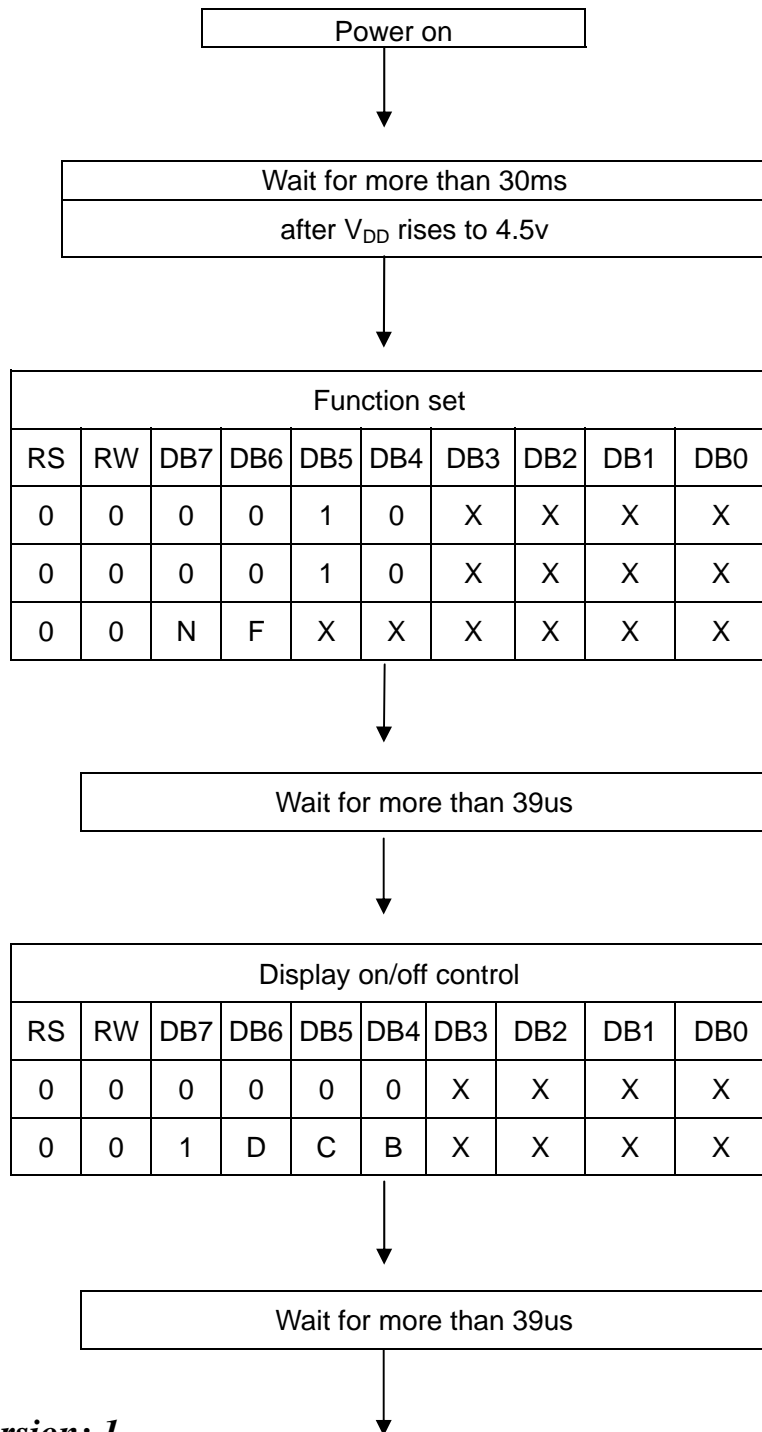
B	0	blink off
	1	blink on

I/D	0	decrement mode
	1	increment mode



SH	0	entire shift off
	1	entire shift on

**13-2 4-bit Interface Mode**



Condition : fosc=270khz

N	0	1-line mode
	1	2-line mode
F	0	5 x 8 font
	1	5 x 11 font

D	0	display off
	1	Display on
C	0	cursor off
	1	cursor on
B	0	blink off
	1	blink on



Display clear									
RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	X	X	X	X
0	0	0	0	0	1	X	X	X	X



Wait for more than 1.53ms



Entry mode set									
RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	X	X	X	X
0	0	0	1	I/D	SH	X	X	X	X



Initialization end

I/D	0	decrement mode
	1	increment mode
SH	0	entire shift off
	1	entire shift on

## **14. 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.

## **15. 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

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[NL12880BC20-05BD](#) [NL12880BC20-05D](#) [NL8060BC26-35BA](#)