

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

**DEM 20485 SBH-PW-N**

*Product Specification*

*Version : 5.1.0*

**14/July/2008**

# GENERAL SPECIFICATION

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MODULE NO. :

# DEM 20485 SBH-PW-N

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	17.12.2002
1	ADDING VERSION	27.07.2003
2	ADDING VERSION	04.11.2003
3	ADDING VERSION	26.04.2005
4	MODIFY DESCRIPTION	19.06.2006
5	MODIFY DESCRIPTION	11.04.2007
5.1.0	CHANGE IC	14.11.2007

PREPARED BY: LSY

DATE: 14.11.2007

APPROVED BY: MH

DATE: 14.07.2008

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**1. FUNCTIONS & FEATURES**

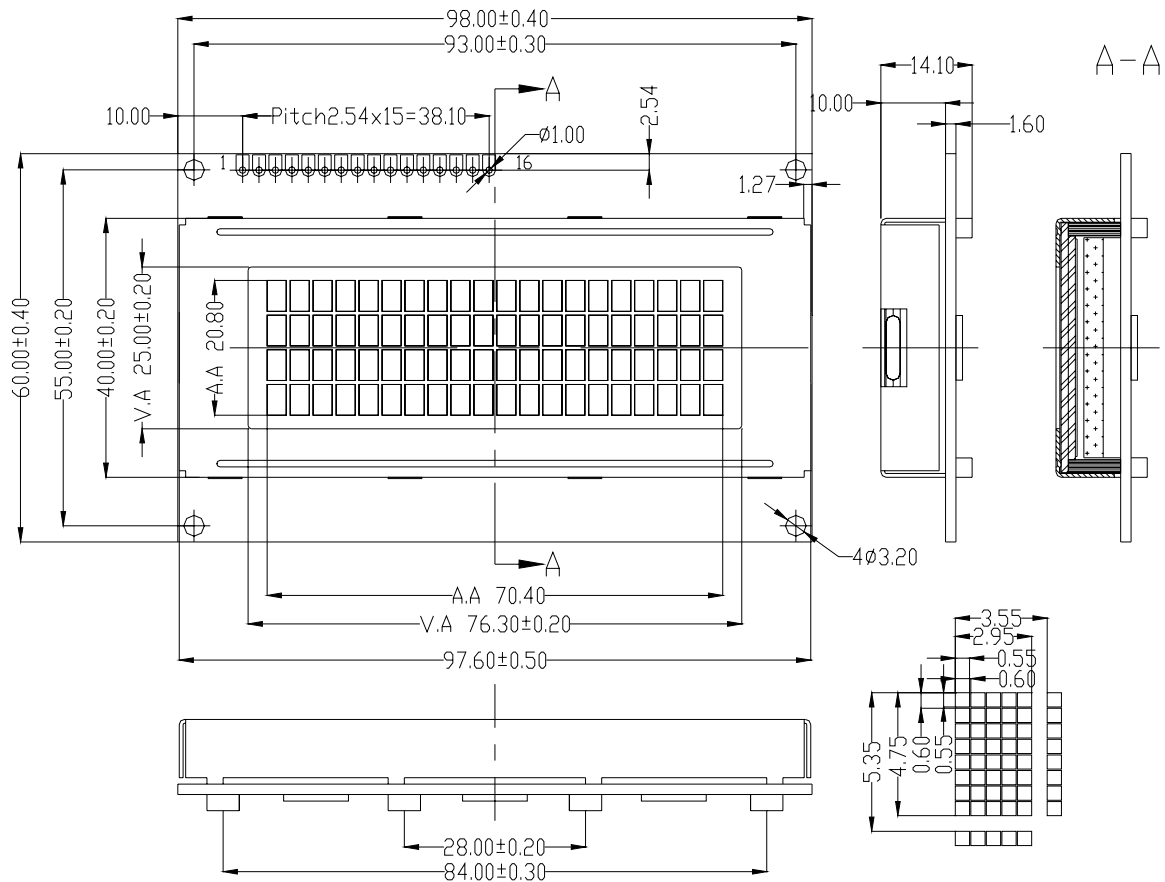
MODULE NAME	LCD TYPE	Remark
DEM 20485 SBH-PW-N	STN Blue Transmissive Negative Mode	RoHS Conformed

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- Backlight Color : LED, White, Lightguide
- $V_{LCD}$  Adjustable For Best Contrast : 4.5 Volt (typ.,  $V_{DD}-V5$ )
- Display contents : 20 x 4 Characters (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 +75°C

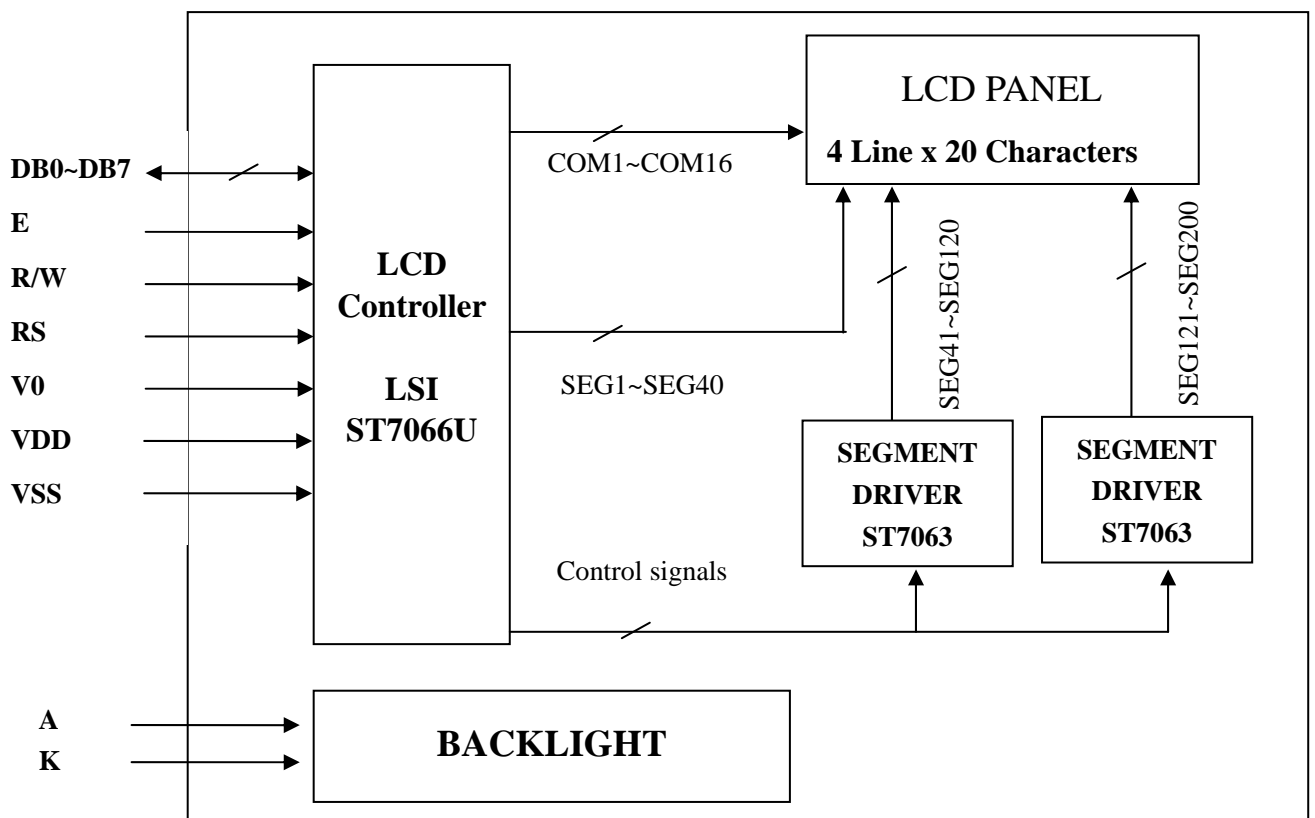
**2. MECHANICAL SPECIFICATIONS**

- Module Size : 98.00 x 60.00 x 14.10 mm
- Character Pitch : 3.55 x 5.35 mm
- Character Size : 2.95 x 4.75 mm
- Character Font : 5 x 8 dots
- Dot Size : 0.55 x 0.55 mm
- Dot Pitch : 0.60 x 0.60 mm
- Dot Gap : 0.05 mm

**3. EXTERNAL DIMENSIONS**



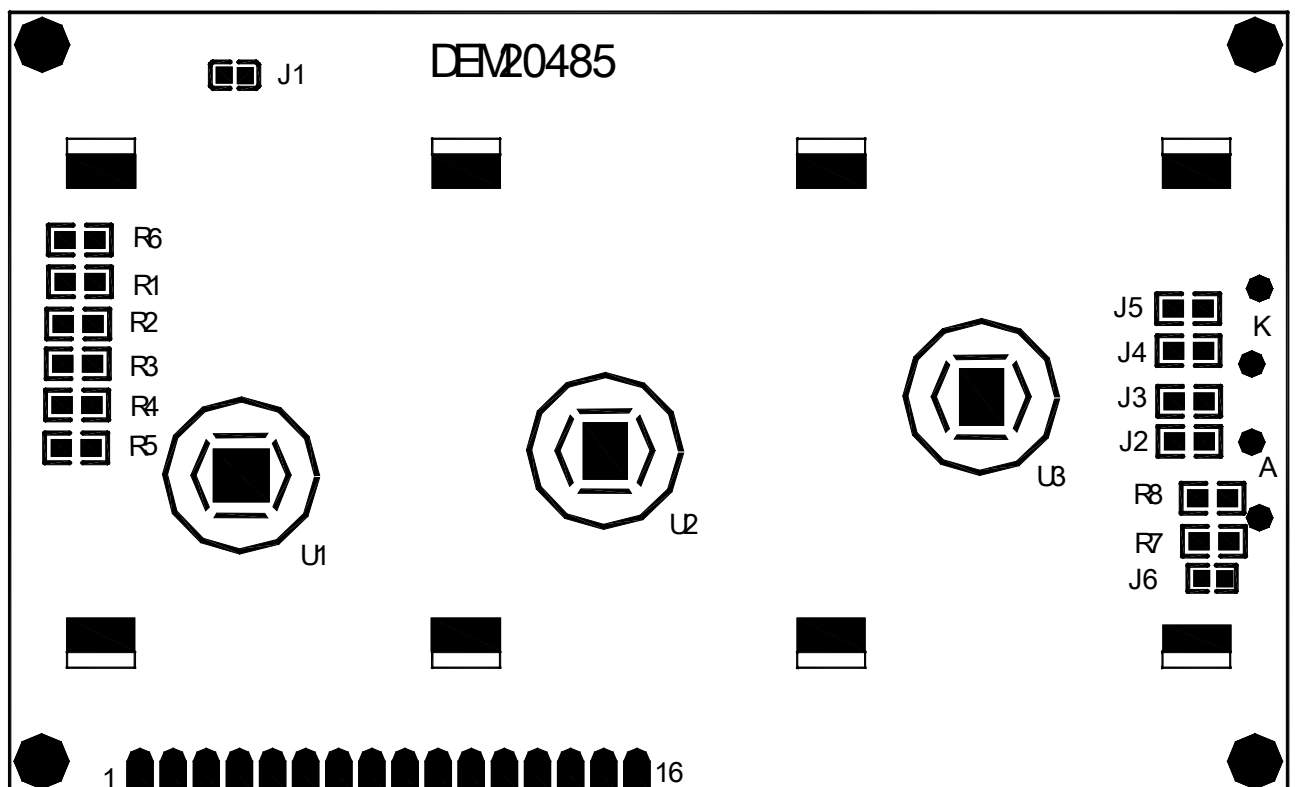
**4. BLOCK DIAGRAM**



**5. PIN ASSIGNMENT**

Pin No.	Symbol	Function
1	VSS	Ground terminal of module
2	VDD	Power supply of module +5V
3	V0	Power Supply for LCD
4	RS	Register Select RS=0 (Instruction Register) RS=1 (Data Register)
5	R/W	Read or Write R/W=1 (Read) R/W=0 (Write)
6	E	Enable signal
7	DB0	Bi-directional Data Bus, Data Transfer is performed Once, thru DB0~DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4~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	
15	LED-(K)	Place also refer to 6.1 PCB Drawing and description
16	LED-(A)	Place also refer to 6.1 PCB Drawing and description

**6. PCB DRAWING AND DESCRIPTION**



**6.1 DESCRIPTION:**

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

symbol	symbol state	J3,J5	J2, J4	LED Polarity	
				15 Pin	16 Pin
J2,J4	Each solder-bridge	Each open	Each closed	Anode	Cathode
J3,J5	Each solder-bridge	Each closed	Each open	Cathode	Anode

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

**6-1-2. The metal-bezel is set be on ground when the J1=0 Ohm**

Note: In application module, J1=0 Ohm

**6-1-3. The LED resistor on board are used when J6 is open**

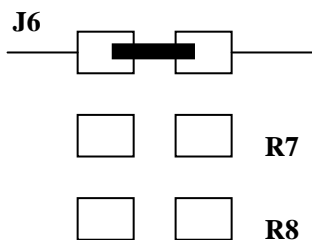
Note: In application module, J6=open

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

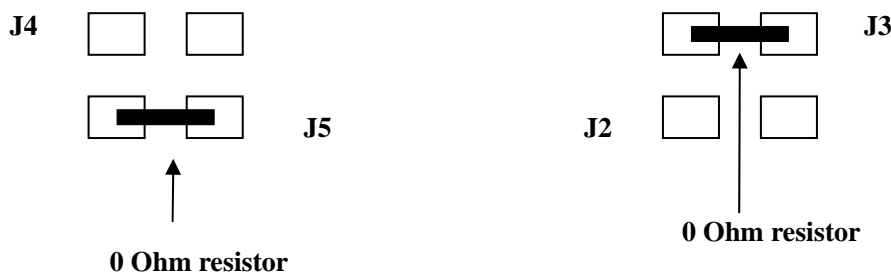
Note: In application module, R7=12 Ohm, R8=open

**6.2 Example application**

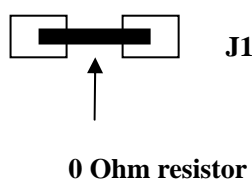
**6-2-1. The LED resistor should be bridged as following. Then customer needs to use internal resistors**



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

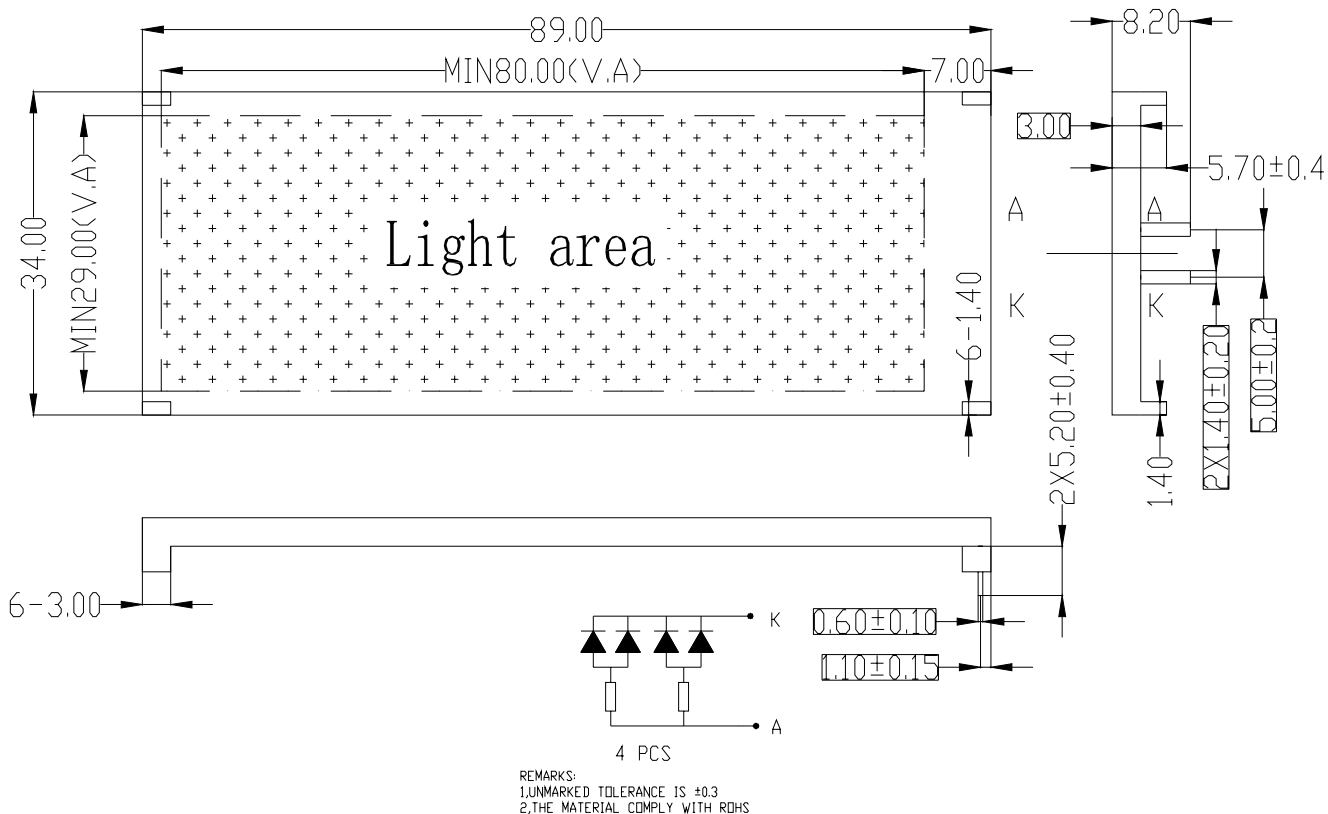


**6-2-3. The metal-bezel is on ground as following.**



**7. BACKLIGHT VOLTAGE AND CURRENT**

Item	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Forward Voltage	$V_f$		4.0	-	V	
Forward Current	$I_f$	40	60	80	mA	$V_f=4.0V$
Power Dissipation	$P_d$		0.24		W	$V_f=4.0V$
Reverse Voltage	$V_R$		4.0		V	
Reverse Current	$I_R$		-	0.40	mA	
Luminous Intensity	$L_v$	300	450	600	cd/m <sup>2</sup>	$V_f=4.0V$
Luminous Uniformity		70			%	
Chromaticity coordinate		X=0.27 Y=0.27	-	X=0.33 Y=0.33		
Emission Wavelength	$\lambda_p$		White		nm	$I_f=20mA, T_a=25^\circ C$ Each chip



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

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FIRST LINE	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
SECOND LINE	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
THIRD LINE	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
FOURTH LINE	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

DISPLAY POSITION

DDRAM ADDRESS



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

Item	Symbol	Standard value	Unit
Power supply voltage	V <sub>DD</sub>	-0.3 ~ +7.0	V
LCD Driver voltage	V <sub>LCD</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

**10. ELECTRICAL CHARACTERISTICS**

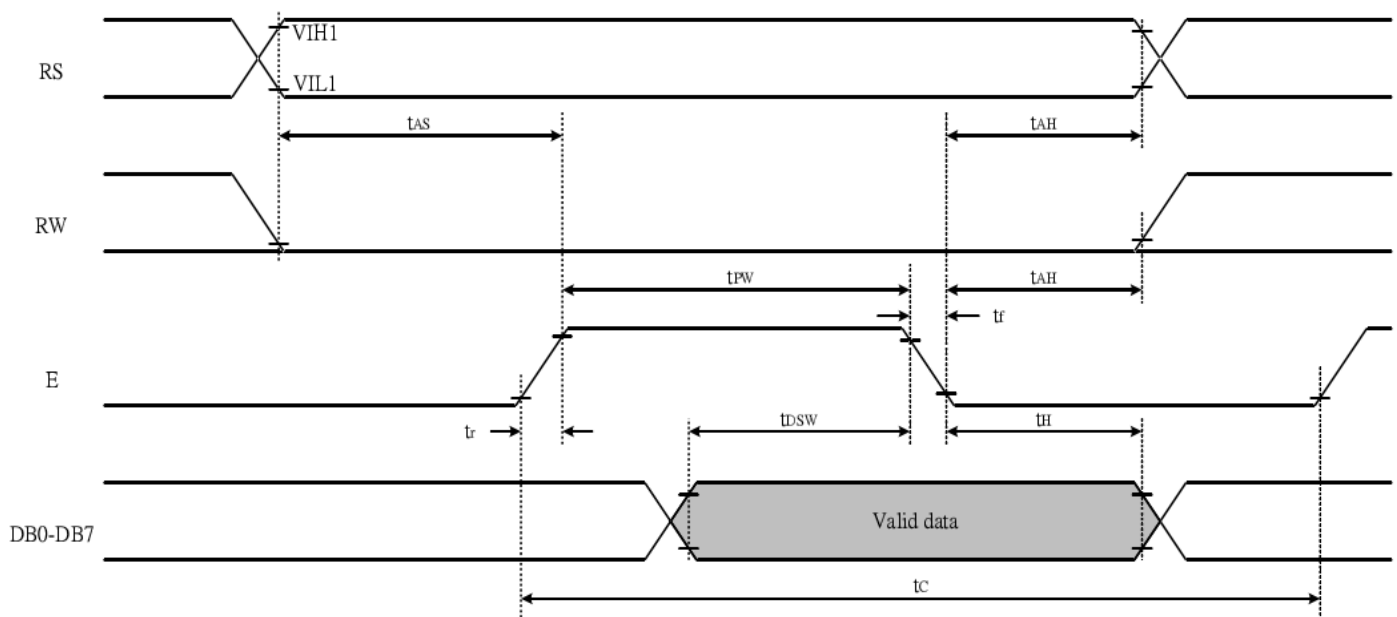
**10-1 DC Characteristics (V<sub>DD</sub>=5.0V, Ta=-20~+70°C)**

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V <sub>DD</sub>	4.5	5	5.5	-----	V
Supply Current	I <sub>DD</sub>	----	0.2	0.5	V <sub>DD</sub> =5V, fosc=270kHz	mA
LCD Driving Voltage	V <sub>LCD</sub>	3.0	---	10.0	V <sub>DD</sub> -V5	V

**10-2 AC Characteristics (V<sub>DD</sub>=5.0V, Ta=-20~+70°C)**

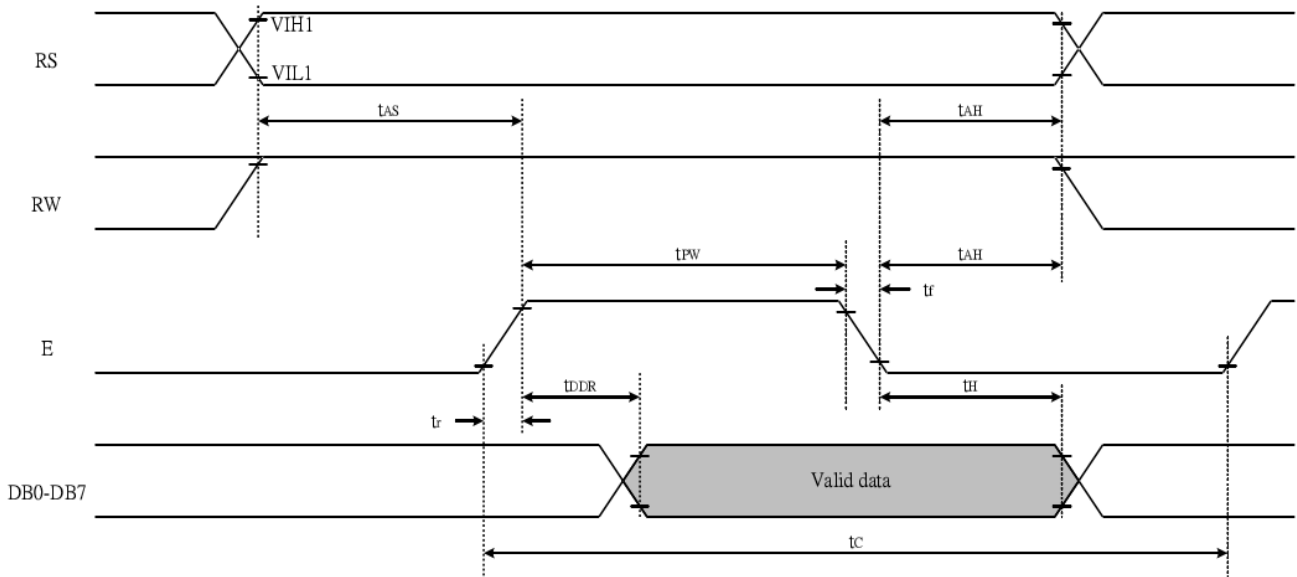
**10-2-1 Write mode**

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
Enable Cycle Time	t <sub>C</sub>	1200	---	---	ns	E
Enable Pulse Time	T <sub>PW</sub>	460	---	---	ns	E
Enable Rise/Fall Time	T <sub>R</sub> , T <sub>F</sub>	---	---	25	ns	E
Address Set-up Time	T <sub>AS</sub>	0	---	---	ns	R/W,RS,E
Address Hold Time	T <sub>AH</sub>	10	---	---	ns	R/W,RS,E
Data Set-up Time	T <sub>DSW</sub>	80	---	---	ns	DB0~DB7
Data Hold Time	T <sub>H</sub>	10	---	---	ns	DB0~DB7



**10-2-2 Read mode**

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
Enable Cycle Time	$t_C$	1200	---	---	ns	E
Enable Pulse Time	$T_{PW}$	480	---	---	ns	E
Enable Rise/Fall Time	$T_R, T_F$	---	---	25	ns	E
Address Set-up Time	$T_{AS}$	0	---	---	ns	R/W,RS,E
Address Hold Time	$T_{AH}$	10	---	---	ns	R/W,RS,E
Data Set-up Time	$T_{DDR}$	---	---	320	ns	DB0~DB7
Data Hold Time	$T_H$	10	---	---	ns	DB0~DB7



**11. CONTROL AND DISPLAY COMMAND**

Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Execution time (fosc=270KHz)	Remark
clear Display	L	L	L	L	L	L	L	L	L	H	1.52ms	Write "20H" to DDRAM and set DDRAM address to "00H" from AC
Return home	L	L	L	L	L	L	L	L	H	---	1.52ms	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
Entry mode Set	L	L	L	L	L	L	L	H	I/D	SH	37us	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.
Display on/off control	L	L	L	L	L	L	H	D	C	B	37us	D=1:entire display on C=1:cursor on B=1:cursor position on
Cursor or Display Shift	L	L	L	L	L	H	S/C	R/L	---	---	37us	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.
function Set	L	L	L	L	H	DL	N	F	---	---	37us	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8 37 us
Set CGRAM address	L	L	L	H	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set CGRAM address in address counter
Set DDRAM address	L	L	H	AC6	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set DDRAM address in address counter
Read busy flag& address	L	H	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	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	H	L	D7	D6	D5	D4	D3	D2	D1	D0	37us	Write data into internal RAM (DDRAM/CGRAM) 37 us
Read data from RAM	H	H	D7	D6	D5	D4	D3	D2	D1	D0	37us	Read data from internal RAM (DDRAM/CGRAM) 37 us

Note:

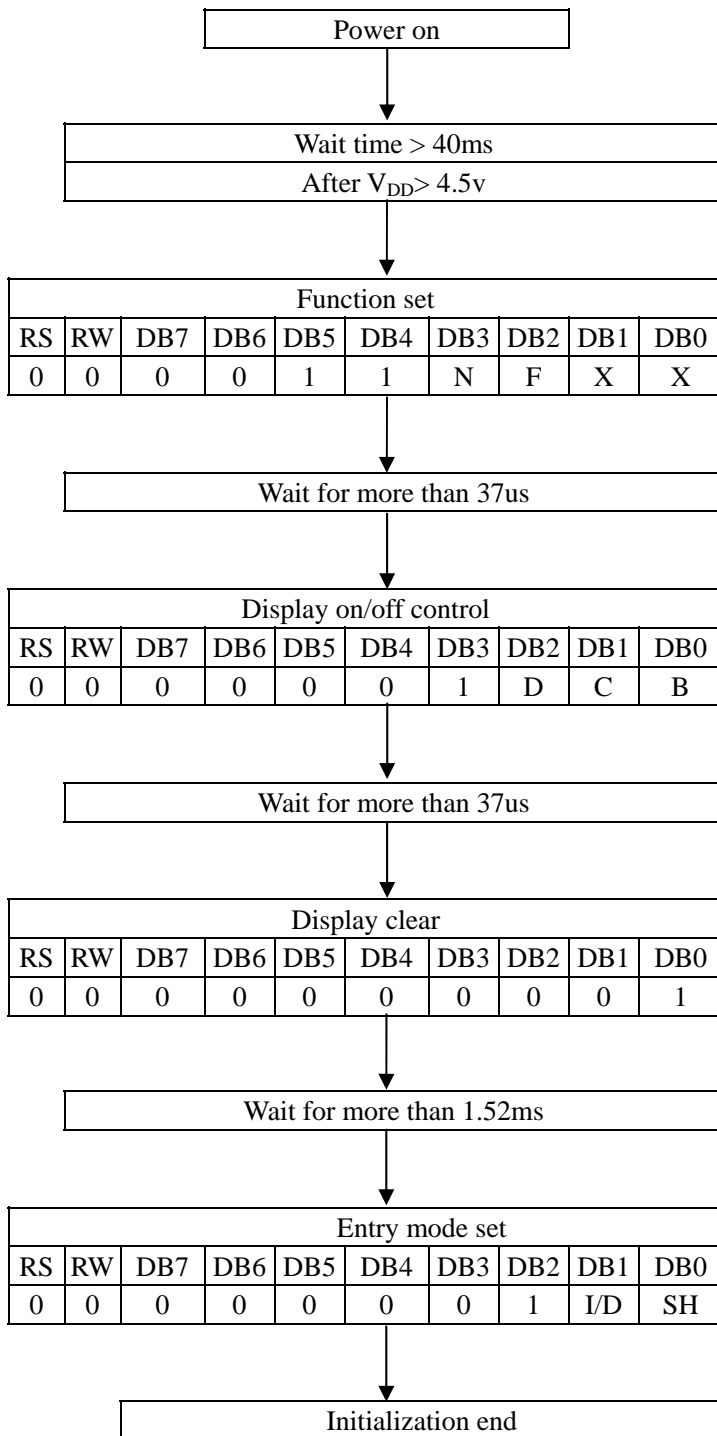
Be sure the ST7066U is not in the busy state(BF=0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

**12. STANDARD CHARACTER PATTERN (ST7066-0A)**

Upper(4bit) Lower(4bit)	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL CG RAM (1)																
LLLH (2)																
LLHL (3)																
LLHH (4)																
LHLL (5)																
LHLH (6)																
LHHL (7)																
LHHH (8)																
HLLL (1)																
HLLH (2)																
HLHL (3)																
HLHH (4)																
HHLL (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 dots
	1	5 x 11 dots

D	0	display off
	1	display on

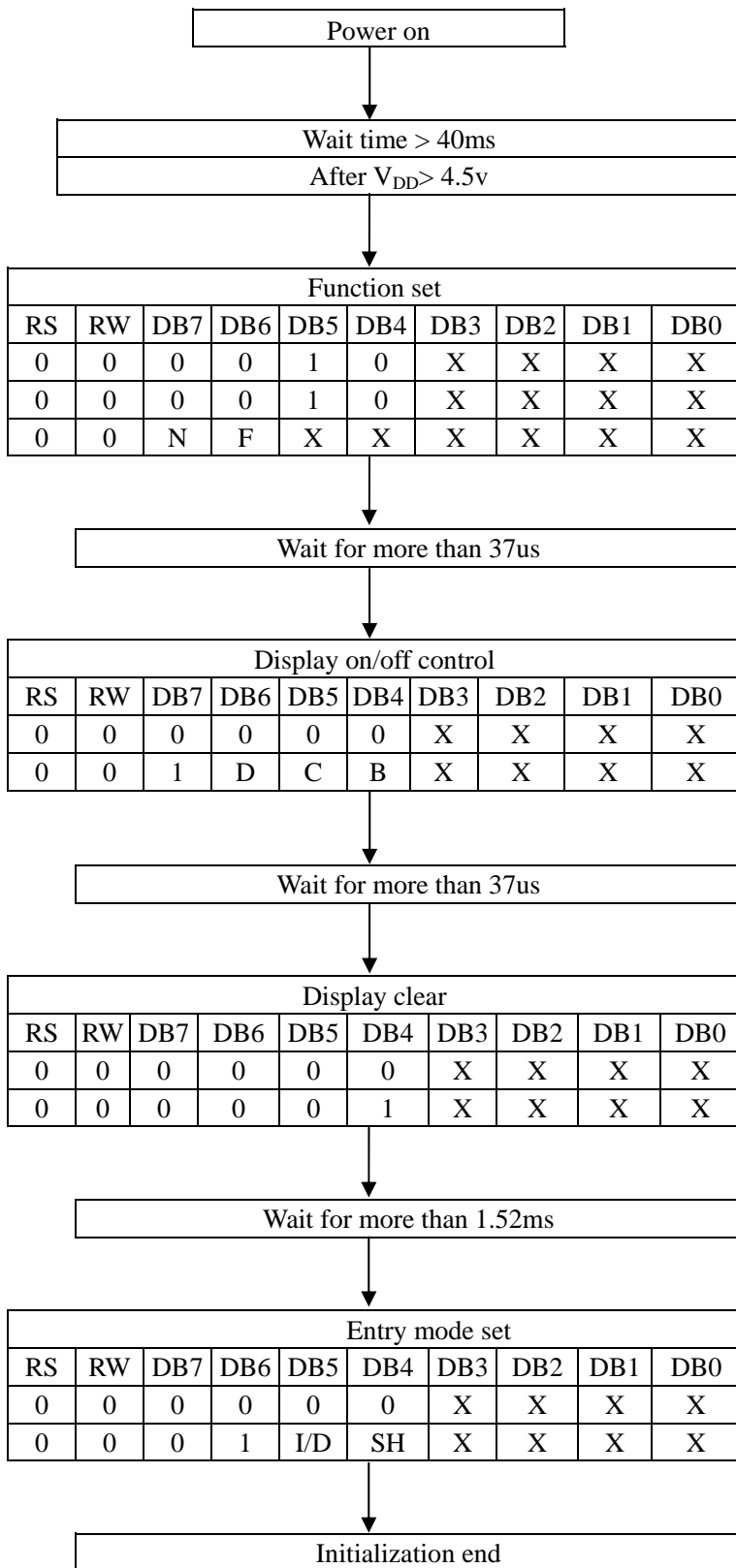
C	0	cursor off
	1	cursor on

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 dots
	1	5 x 11 dots

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

**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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