DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 16101 SYH-LY

Product specification ***Version : 2***

07/Sept./2004

GENERAL SPECIFICATION

MODULE NO. :

DEM 16101 SYH-LY

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	**DATE**
0	ORIGINAL VERSION	2004/04/02
1	CHANGED PCB DRAWING AND DESCRIPTION& STANDARD CHARACTER PATTERN	2004/04/15
2	CHANGED PCB DRAWING AND DESCRIPTION &MODULE DRAWING	2004/08/17

PREPARED BY: CHJ DATE: 17/08/2004
APPROVED BY: MH DATE: 26/08/2004

CONTENTS

1. FUNCTIONS & FEATURES ---------- 2
2. MECHANICAL SPECIFICATIONS ---------- 2
3. BLOCK DIAGRAM ---------- 2
4. EXTERNAL DIMENSIONS ---------- 3
5. PIN ASSIGNMENT ---------- 3
6.1 PCB DRAWING AND DESCRIPTION ---------- 4
6.2 EXAMPLE APPLICATION ---------- 5
6.3 THE MODULE NO. IS PRINTED ON THE PCB ---------- 6
7. DISPLAY DATA RAM ---------- 6
8. BACKLIGHT AND SWITCH ---------- 7
9. MAXIMUM ABSOLUTE RATINGS ---------- 7
10. ELECTRICAL CHARACTERISTICS ---------- 8
11. CONTROL AND DISPLAY COMMAND ---------- 10
12. STANDARD CHARACTER PATTERN ---------- 11
13. LCM INITIALIZING BY INSTRUCTION ---------- 12
13-1 8-BIT INTERFACE MODE ---------- 12
13-2 4-BIT INTERFACE MODE ---------- 13
14. LCD MODULES HANDLING PRECAUTIONS ---------- 14
15. OTHERS ---------- 14

1.FUNCTIONS & FEATURES

- DEM 16101 SYH-LY :

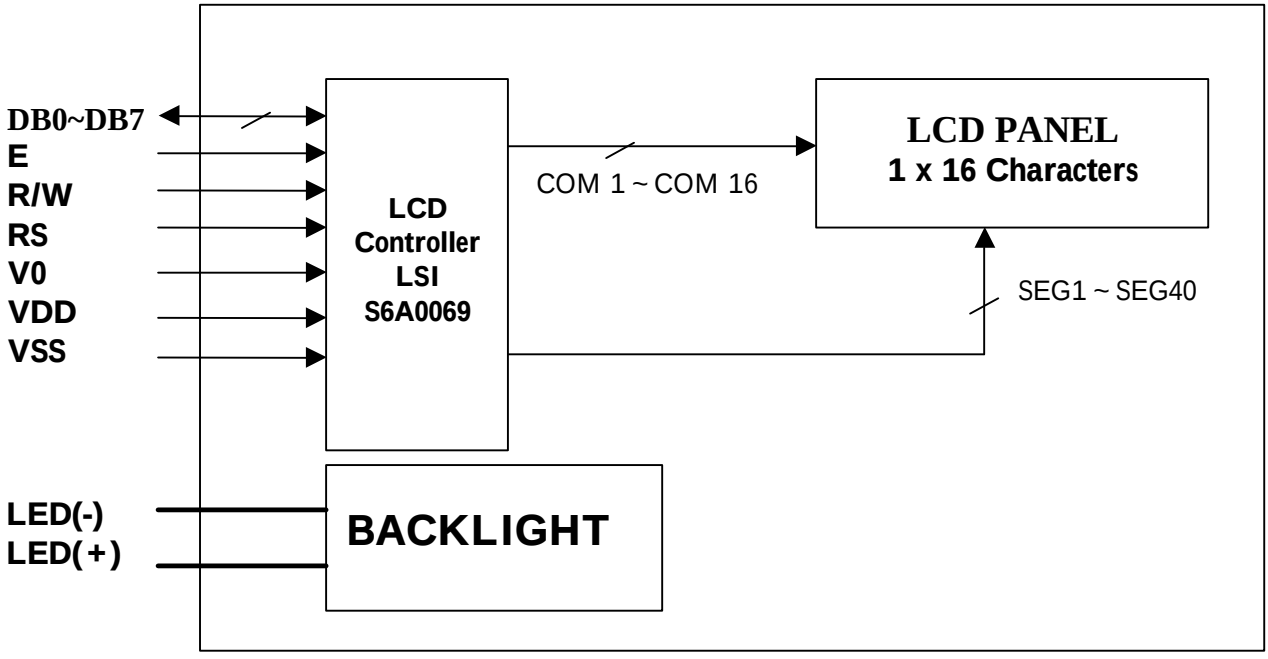
MODULE	LCD MODEL	LCD TYPE
DEM 16101 SYH-LY	STN Yellow-Green	Transflective Positive Mode

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt
- V_{LCD} Adjustable For Best Contrast : 4.5 Volt
- Backlight : Yellow-Green (Lightbox)
- Display Contents : 16 x 1Characters (5 x 8 dots, Format: 208 Kids)
- 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

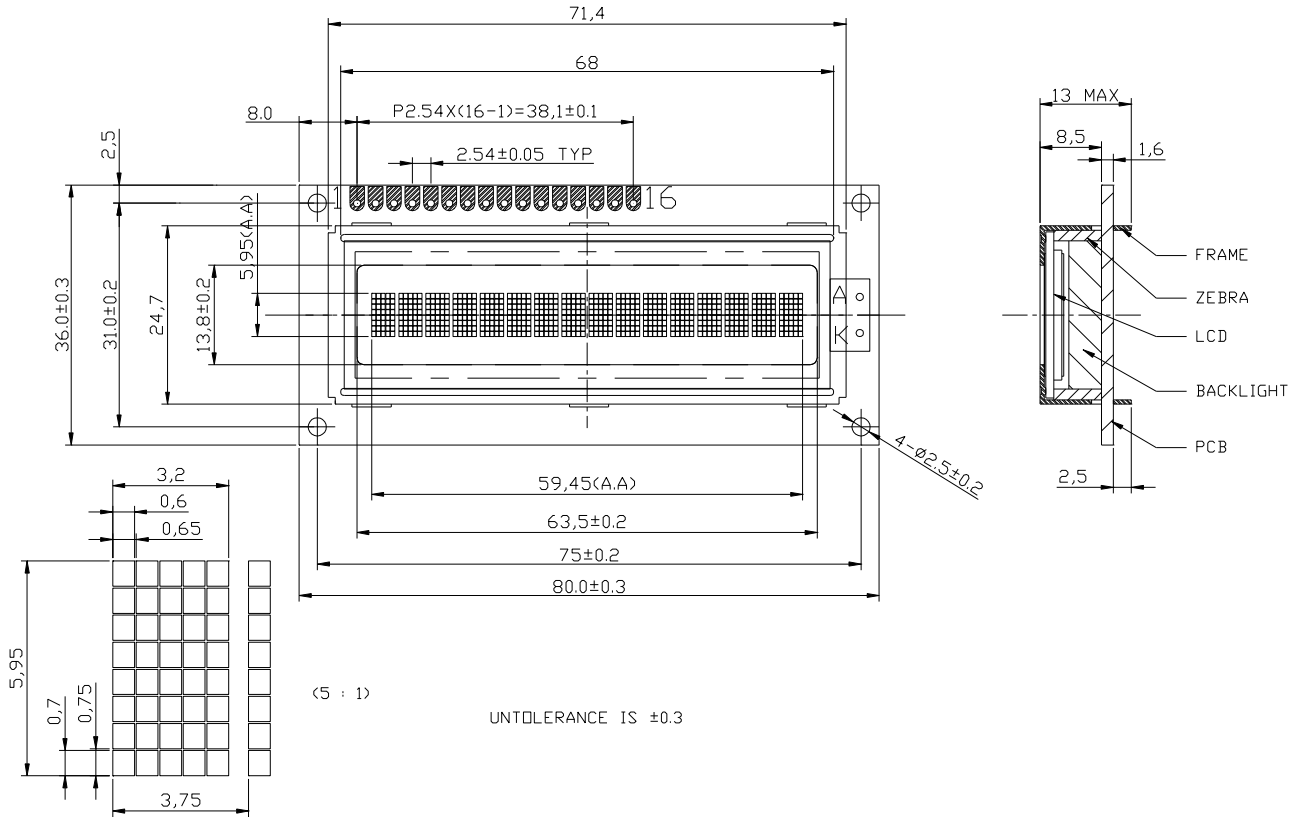
2. MECHANICAL SPECIFICATIONS

- Module Size : 80 x 36 x 13 mm (max.)
- Character Pitch : 3.75 mm
- Character Size : 3.20 x 5.95 mm
- Character Font : 5 x 8 dots
- Dot Size : 0.60 x 0.70 mm
- Dot Pitch : 0.65 x 0.75 mm

3. BLOCK DIAGRAM



4. EXTERNAL DIMENSIONS

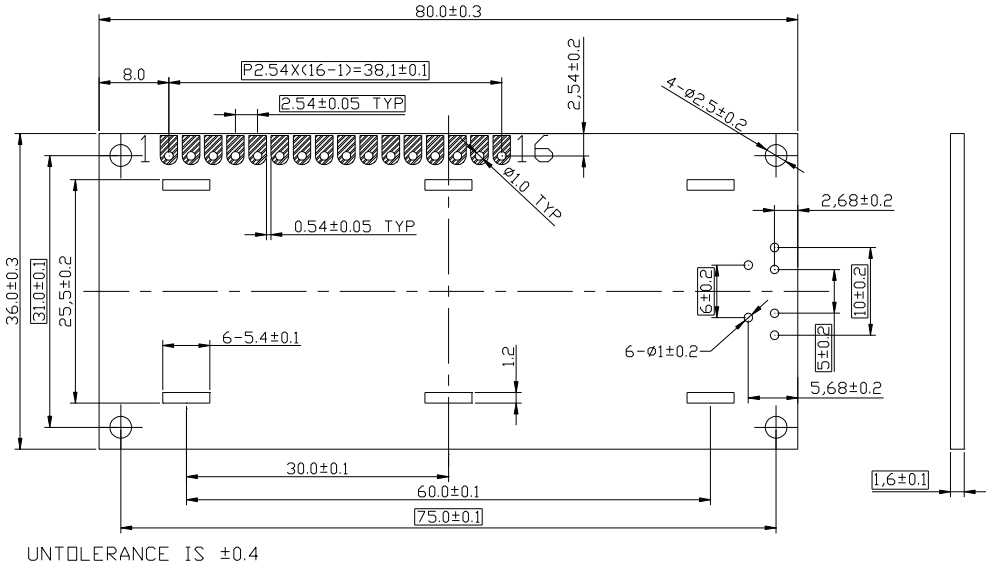


5. PIN ASSIGNMENT

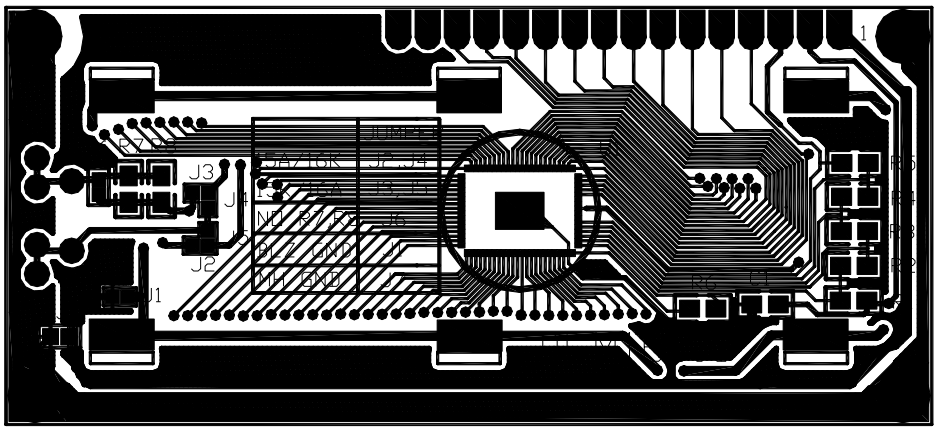
Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Power supply (+5.0V)
3	V_0	Power Supply for LCD(+4.5V)
4	RS	Select Display Data ("H") or Instructions ("L")
5	R/W	Read or Write Select Signal
6	E	Read/Write Enable Signal
7	DB0	Display Data Signal
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED- (K)	Please also refer to 6.1 PCB drawing and description.
16	LED+ (A)	

6.1 PCB DRAWING AND DESCRIPTION

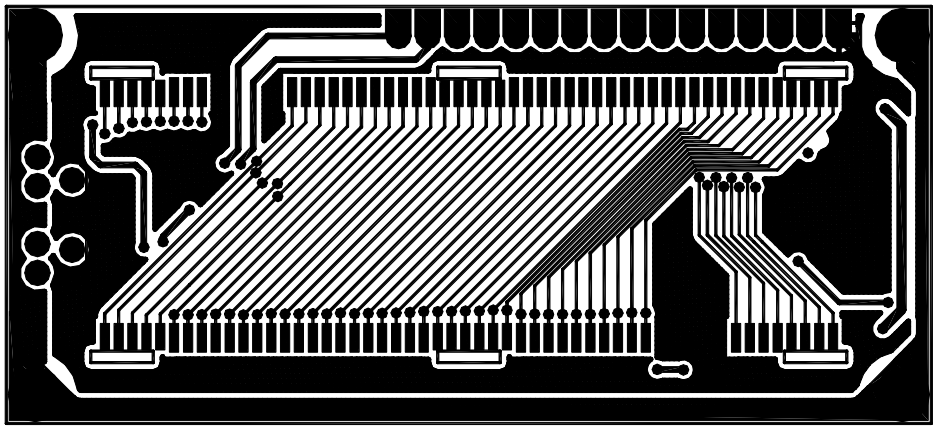
PCB Drawing



Top Layer



Bottom Layer



Note: on application module, R1 ~ R5 = 4.7 kW, R6 = 91 kW

DESCRIPTION:

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

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: on application module, J3=J5= closed, J2=J4=open

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

The mounting holes are set on ground when J7 is closed.

Note: on application module, J1=J7=closed

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

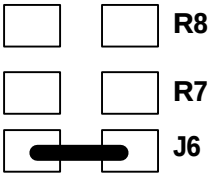
Note: on application module, J6=open

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

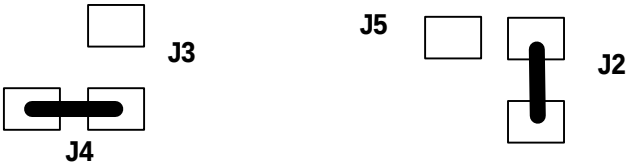
Note: R7=10Ω, R8=open.

6.2 Example application

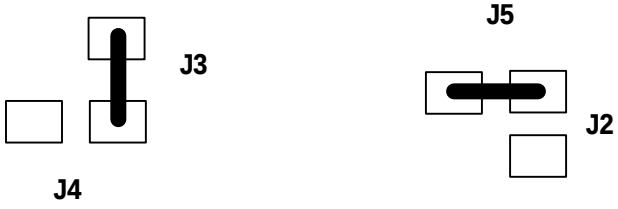
6-2-1. The LED resistor should be bridged as following.



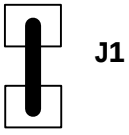
6-2-2. The 15 pin is the anode and the 16 pin is the cathode as following.



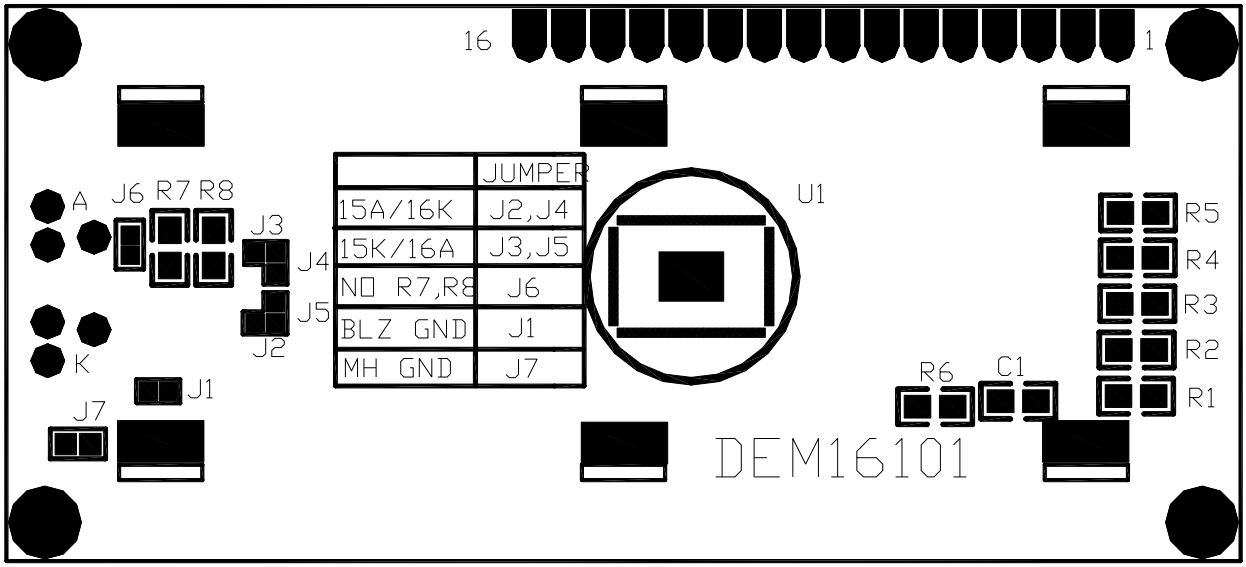
6-2-3.The 15 pin is the cathode and the 16 pin is the anode as following.



6-2-4. The metal-bezel is on ground as following.



6.3 The Module No. DEM16101 is printed on the PCB.

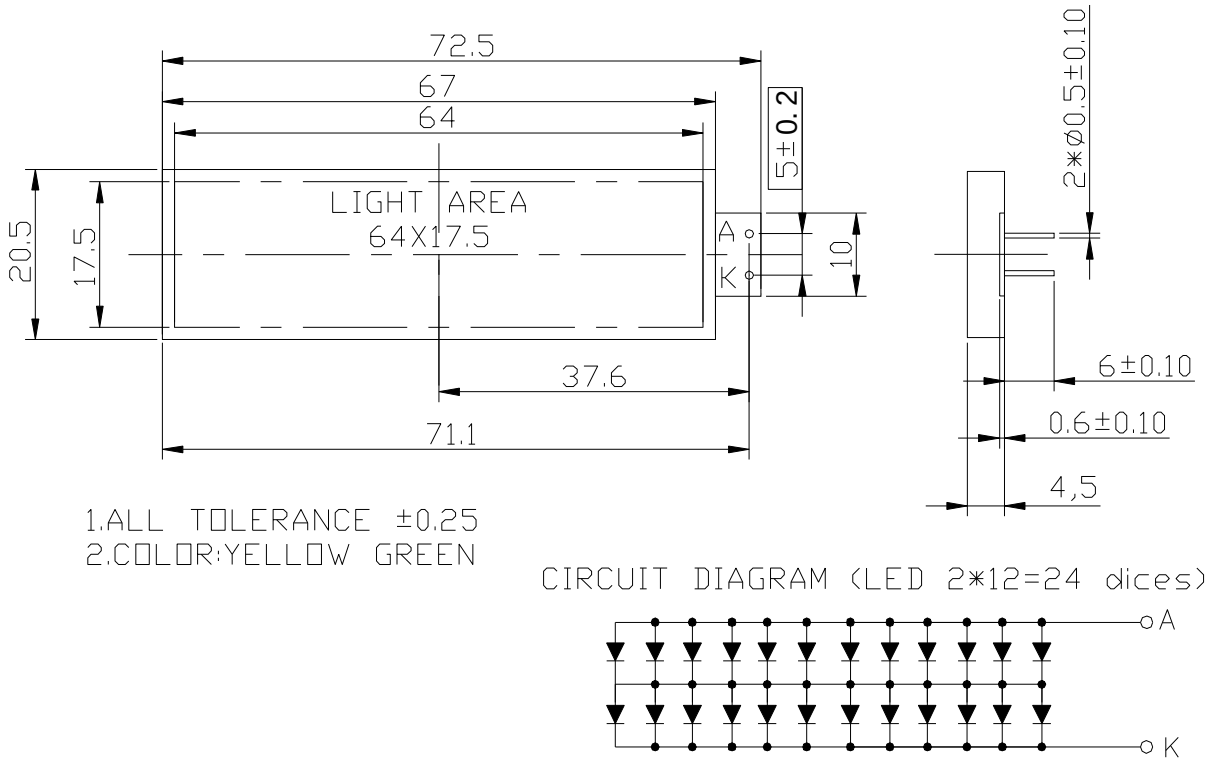


7. DISPLAY DATA RAM (DDRAM)

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

8. BACKLIGHT AND SWITCH

Item	Symbol	MIN	TYP	MAX	Unit	CONDITIONS
Backlight Voltage	Vr	---	4.2	4.6	V	If=150mA
Backlight Current	If	---	150	240	mA	
Power Dissipation	Pd	---	0.63	---	W	If=150mA
Reverse Voltage	V_R	---	10.0	---	V	
Reverse Current	I_R	---	0.200	---	mA	
Luminous Intensity	I_V	---	250	---	cd/m^2	If=150mA
Emission wavelength	λp	---	570	---	nm	If=150mA
Spectral Range	Δλ	---	30	---	nm	Ta=25°C
Backlight Color	Yellow Green					



9. MAXIMUM ABSOLUTE RATINGS

Item	Symbol	Standard value	Unit
Power supply voltage (1)	V_{DD}	-0.3 ~ +7.0	V
Power supply voltage (2)	V_0	V_{DD}-13.5 ~ 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

*****Voltage greater than above may damage to the Circuit.
VDD > V1 >V2 > V3 > V4 > V5

10. ELECTRICAL CHARACTERISTICS

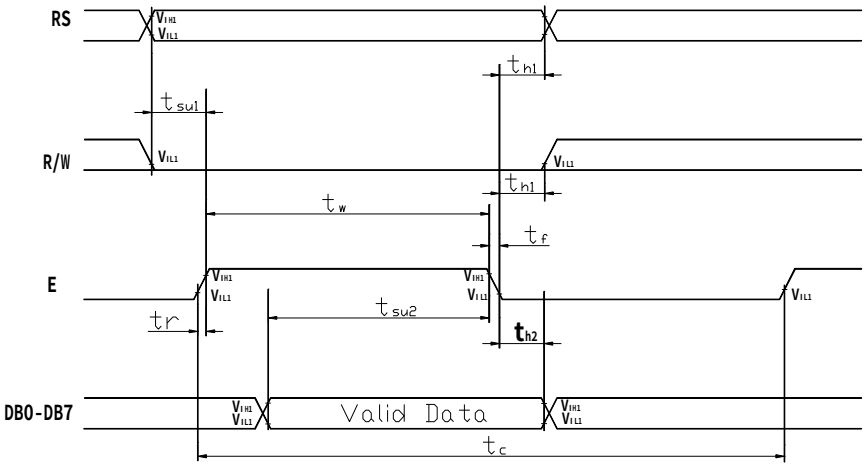
10-1 DC Characteristics (VDD = 4.5V ~ 5.5V, Ta = -20 ~ +70°C)

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	4.5	5	5.5	-------	V
Supply Current	I_{DD}	----	0.35	0.6	V_{DD}=5V,fosc=270kHz	mA
Input Voltage (1) (except OSC1)	V_{IL1}	-0.3	--	0.6	--------	V
	V_{IH1}	2.2	--	V_{DD}	---------	
Input Voltage (2) (OSC1)	V_{IL2}	-0.2	--	1.0	---------	V
	V_{IH2}	V_{DD}-1.0	--	V_{DD}	---------	
Output Voltage (1) (DB0 to DB7)	V_{OL1}	---	----	0.4	I_{OL}=1.2mA	V
	V_{OH1}	2.4	---	----	I_{OH}=-0.205mA	
Output Voltage (2) (except DB0 to DB7)	V_{OL2}	------	---	0.1V_{DD}	I_{OL}=40uA	V
	V_{OH2}	0.9V_{DD}	---	-----	I_{OH}=-40uA	
Voltage Drop	Vd_{COM}	-----	---	1	I_O=±0.1 mA	V
	Vd_{SEG}	------	---	1		
Input Leakage Current	I_{IKG}	-1	---	1	V_{IN}=0 V to V_{DD}	uA
Input Low Current	I_{IL}	-50	-125	-250	V_{IN}=0V,V_{DD}=5V(pull up)	uA
Internal Clock (external Rf)	f_{OSC1}	190	270	350	Rf = 91k ± 2% (V_{DD}=5V)	kHz
External Clock	f_{OSC}	125	270	410	----	kHz
	Duty	45	50	55	----	%
	t_R,t_F	---	---	0.2	----	us
LCD Driving Voltage	V_{LCD}	3.0	---	13.0	V_{DD}-V_5 (1/5,1/4 Bias)	V

10-2 AC Characteristics (VDD = 4.5V ~ 5.5V, Ta = -20 ~ +70°C)

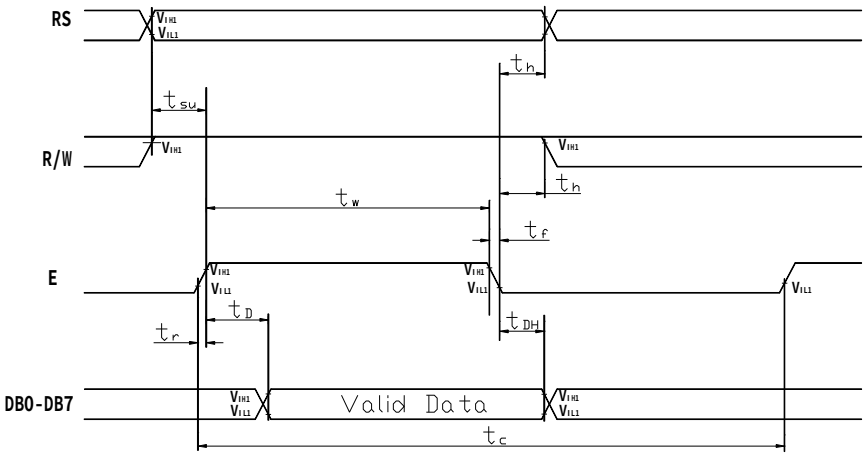
10-2-1 Write mode (writing data from MPU to module)

Characteristic	Symbol	Min	Typ.	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_{SU1}	40	---	---	ns	R/W,RS
R/W and RS Hold Time	t_{H1}	10	---	---	ns	R/W,RS
Data Set-up Time	t_{SU2}	80	---	---	ns	DB0~DB7
Data Hold Time	t_{H2}	10	---	---	ns	DB0~DB7



10-2-2 Read Mode (Reading Data from module to MPU)

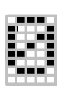
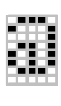
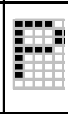
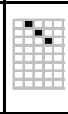
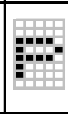
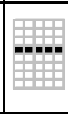
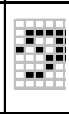
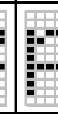
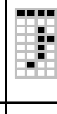
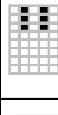
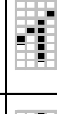
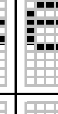
Characteristic	Symbol	Min	Typ.	Max	Unit	Test PIN
E Cycle Time	t_C	500	---	---	ns	E
E Rise Time	t_R	---	---	20	ns	E
E Fall Time	t_F	---	---	20	ns	E
E Pulse width (High, Low)	t_W	230	---	---	ns	E
R/W and RS Set-up Time	t_{SU}	40	---	---	ns	R/W,RS
R/W and RS Hold Time	t_H	10	---	---	ns	R/W,RS
Data Output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



11. CONTROL AND DISPLAY COMMAND

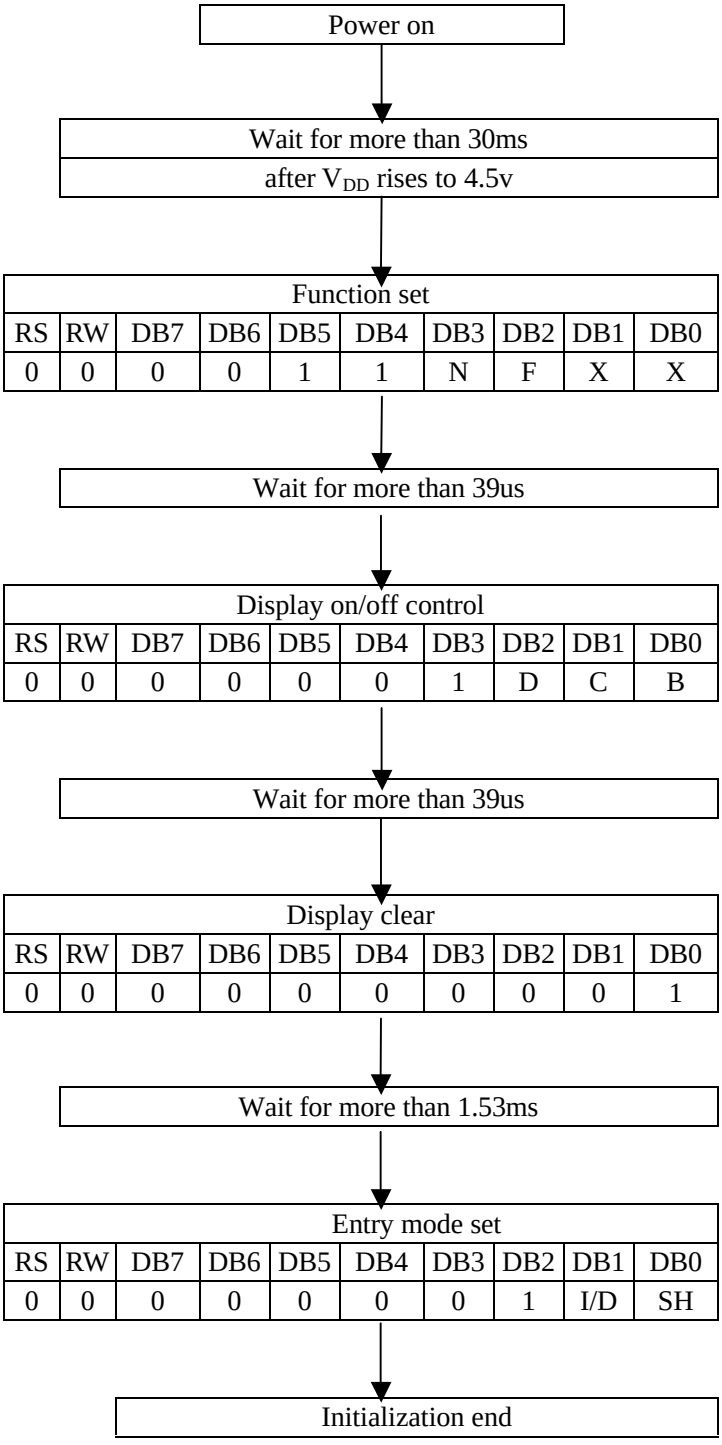
Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Execution time (fosc=270KHz)	Remark
clear Display	L	L	L	L	L	L	L	L	L	H	1.53ms	Write "20H" to DDRAM and set DDRAM address to "00H" from AC
Return home	L	L	L	L	L	L	L	L	H	---	1.53ms	Cursor move to first digit
Entry mode set	L	L	L	L	L	L	L	H	I/D	SH	39us	I/D:set cursor move direction I/D: H Increase; l Decrease SH:Specifies shift of display SH: H Display is shifted; L Display is not shifted
Display on/off control	L	L	L	L	L	L	H	D	C	B	39us	Display D: H Display on; L Display off Cursor C: H Cursor on; L Cursor off Blinking B: H Blinking on; L Blinking off
Cursor or Display Shift	L	L	L	L	L	H	S/C	R/L	---	---	39us	SC: H Display shift; L Cursor move R/L: H Right shift; L Left shift
function Set	L	L	L	L	H	DL	N	F	---	---	39us	DL: H 8bits interface; L 4bits interface N: H 2 line display; L 1 line display F: H 5 x 11 dots; 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	BF: H Busy; L Ready -Reads BF indication internal operating is being performed -Reads address counter contents
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)

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

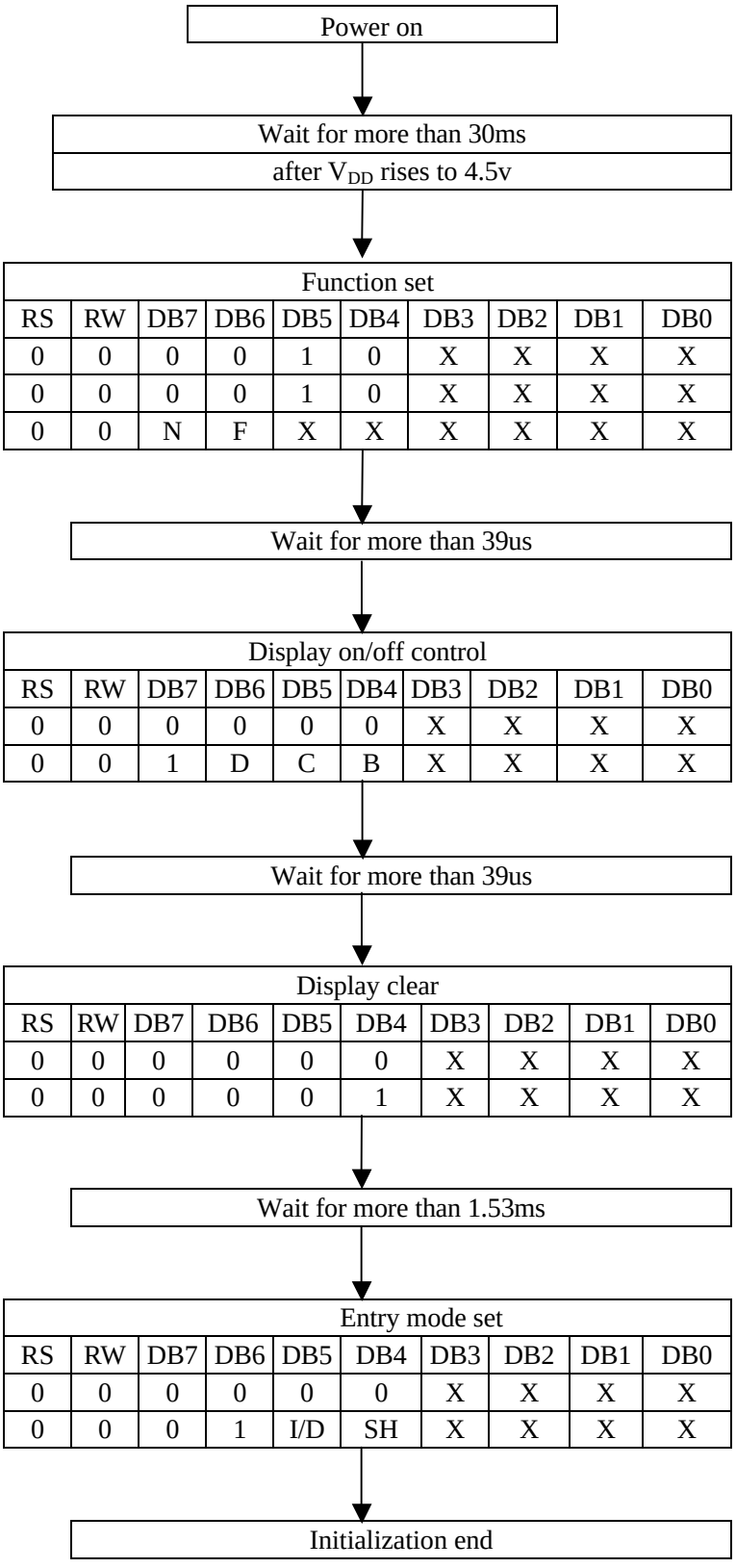
13-1 8-Bit Interface Mode



Condition : fosc=270khz

N	0	1-line mode
	1	2-line mode
F	0	5 x 8 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	display off
	1	display on

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