

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

## **DEM 16221 - SERIES**

*Product Specification*

*Version : 5.1.2.1*

**19/APR/2010**

# GENERAL SPECIFICATION

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MODULE NO. :

## DEM 16221 - SERIES

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	25.01.2001
1	ADD VERSION	30.03.2001
2	ADD VERSION	07.09.2001
3	CHANGE MODULE DRAWING	08.05.2003
4	ADD VERSION	20.04.2005
5	CHANGED MODULE DRAWING	04.05.2006
5.1.2	CHANGE IC	24.10.2008
5.1.2.1	CHANGE DESCRIPTION	19.04.2010

PREPARED BY: HCL

DATE: 24.10.2008

APPROVED BY: MHO

DATE: 19.04.2010

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**1. FUNCTIONS & FEATURES**

MODULE NAME	FFC-CONTACTS	LCD TYPE
DEM 16221 SYH (solder)	For soldering	STN Yellow-Green Reflective Positive Mode
DEM 16221 SYH (solder/tr.)	For soldering	STN Yellow-Green Transflective Positive Mode
DEM 16221 SYH (FFCF)	Front	STN Yellow-Green Reflective Positive Mode
DEM 16221 SYH (FFCF/tr.)	Front	STN Yellow-Green Transflective Positive Mode
DEM 16221 SYH (FFCR)	Rear	STN Yellow-Green Reflective Positive Mode
DEM 16221 SYH (FFCR/tr.)	Rear	STN Yellow-Green Transflective Positive Mode

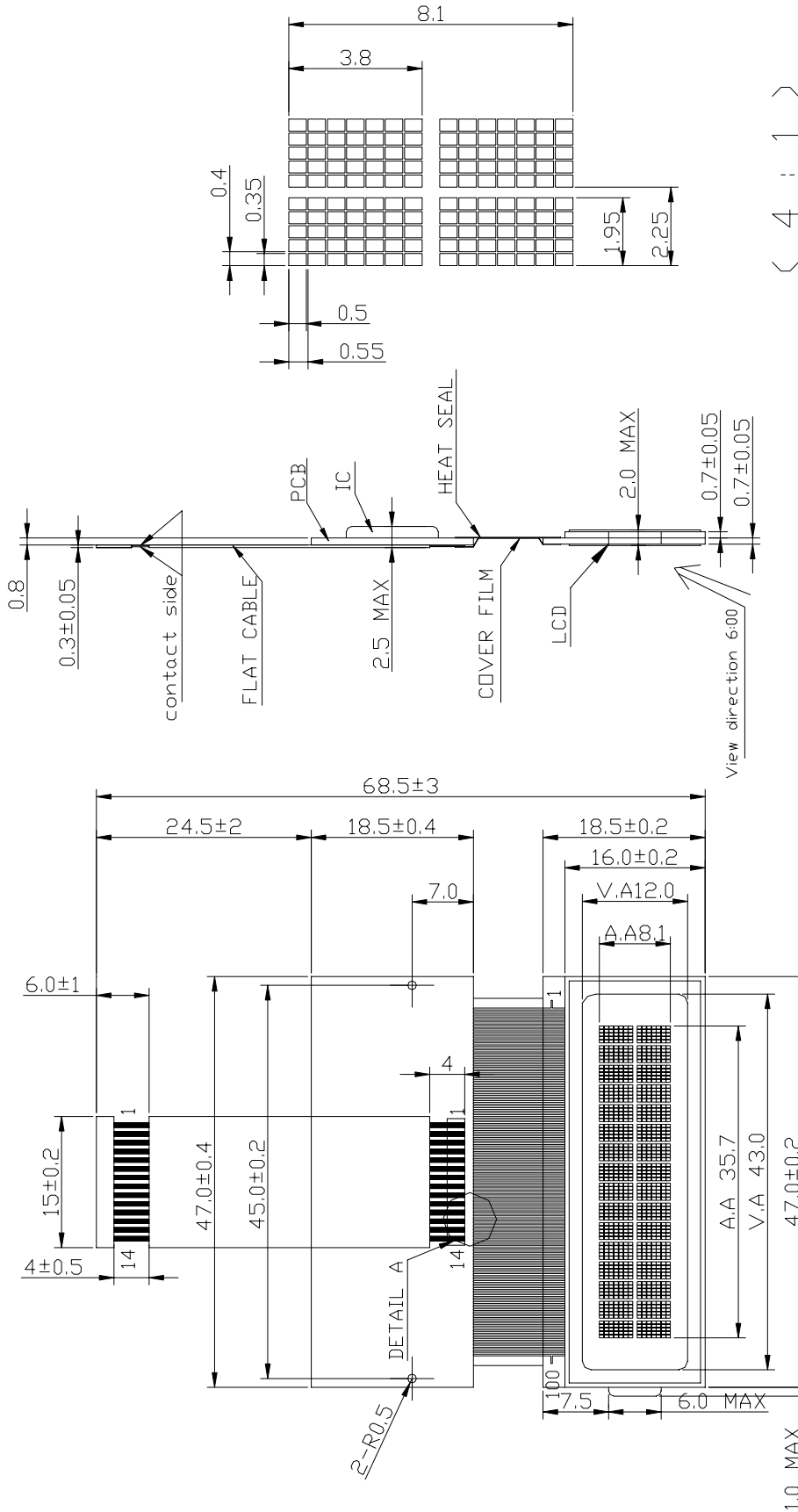
- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- VLCD Adjustable For Best Contrast : 4.5 Volt (typ.)
- Display contents : 16x2 Characters
- Internal Memory : CGROM (10,880 bits )  
: CGRAM (512 bits )  
: DDRAM (80 x 8 bits for Digits)
- 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**

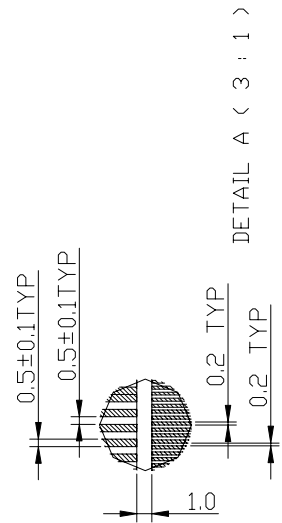
- Module Size : 47.00 x 44.00 x 2.50 mm
- Character Pitch : 2.25 x 4.30 mm
- Character Size : 1.95 x 3.80 mm
- Character Font : 5 x 7 dots
- Dot Size : 0.35 x 0.50 mm
- Dot Pitch : 0.40 x 0.55 mm

## 3. EXTERNAL DIMENSIONS

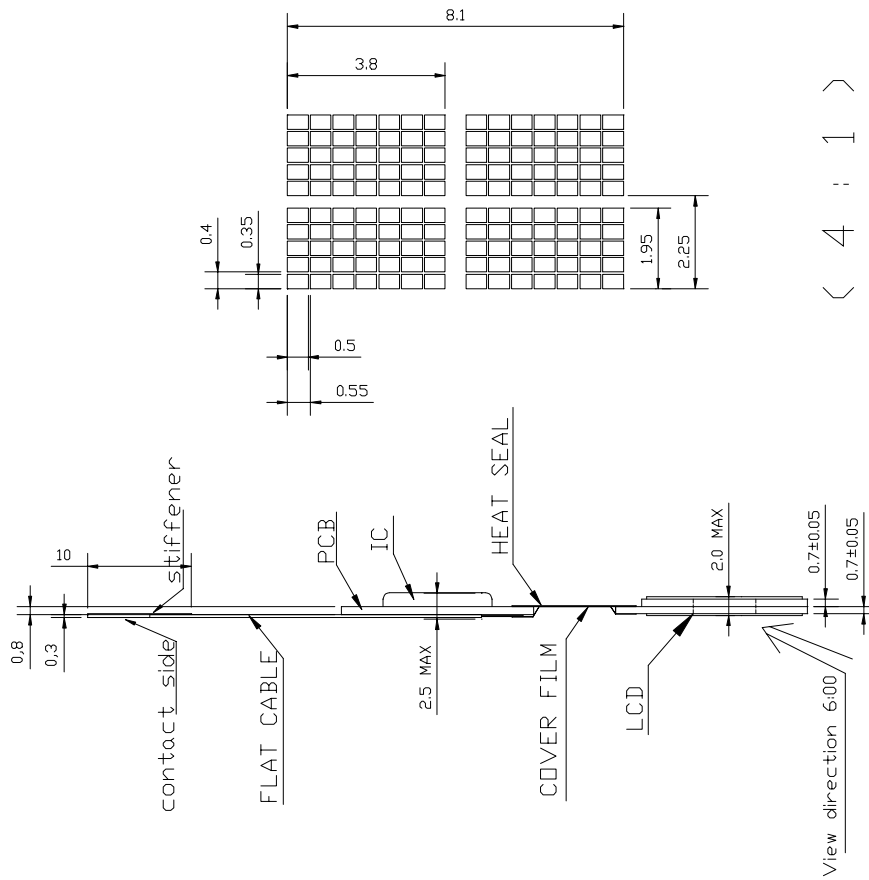
### 3.1 DEM 16221 SYH (soldering) + DEM 16221 SYH (soldering/tr.)



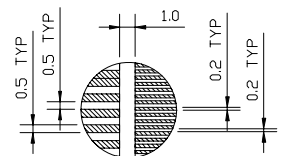
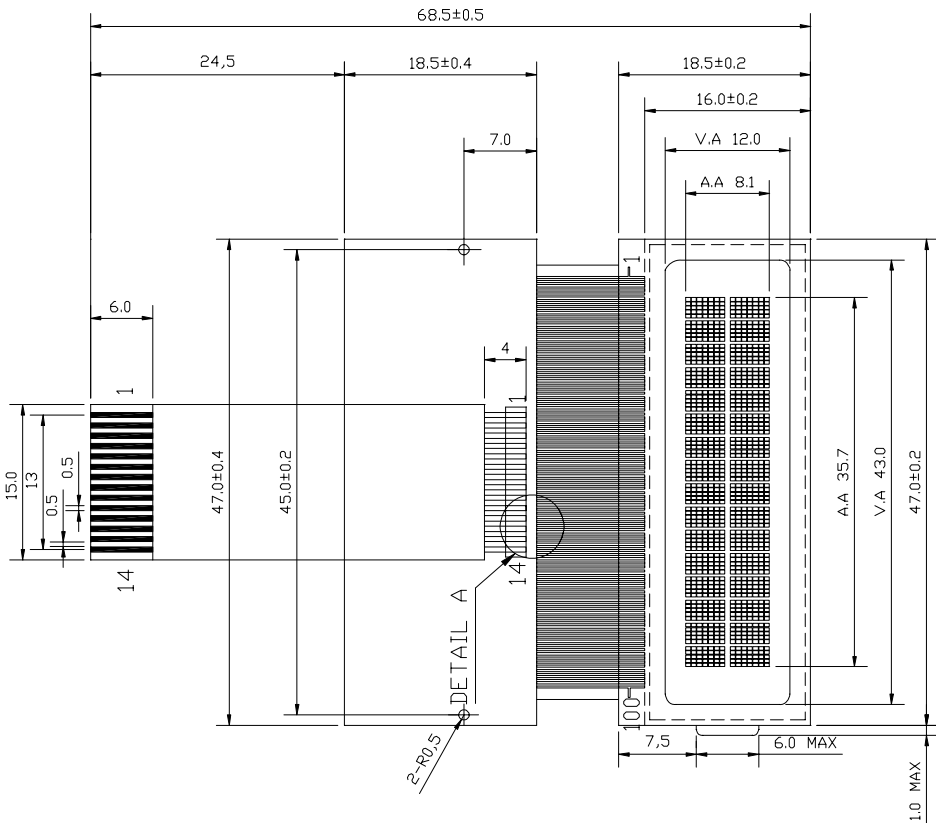
- Remarks:
- 1, Unmarked tolerance is  $\pm 0.3$ ,
  - 2, The material comply with RoHS,
  - 3, open contacts for soldering process



**3.2 DEM 16221 SYH (FFCF) + DEM 16221 SYH (FFCF/tr.)**

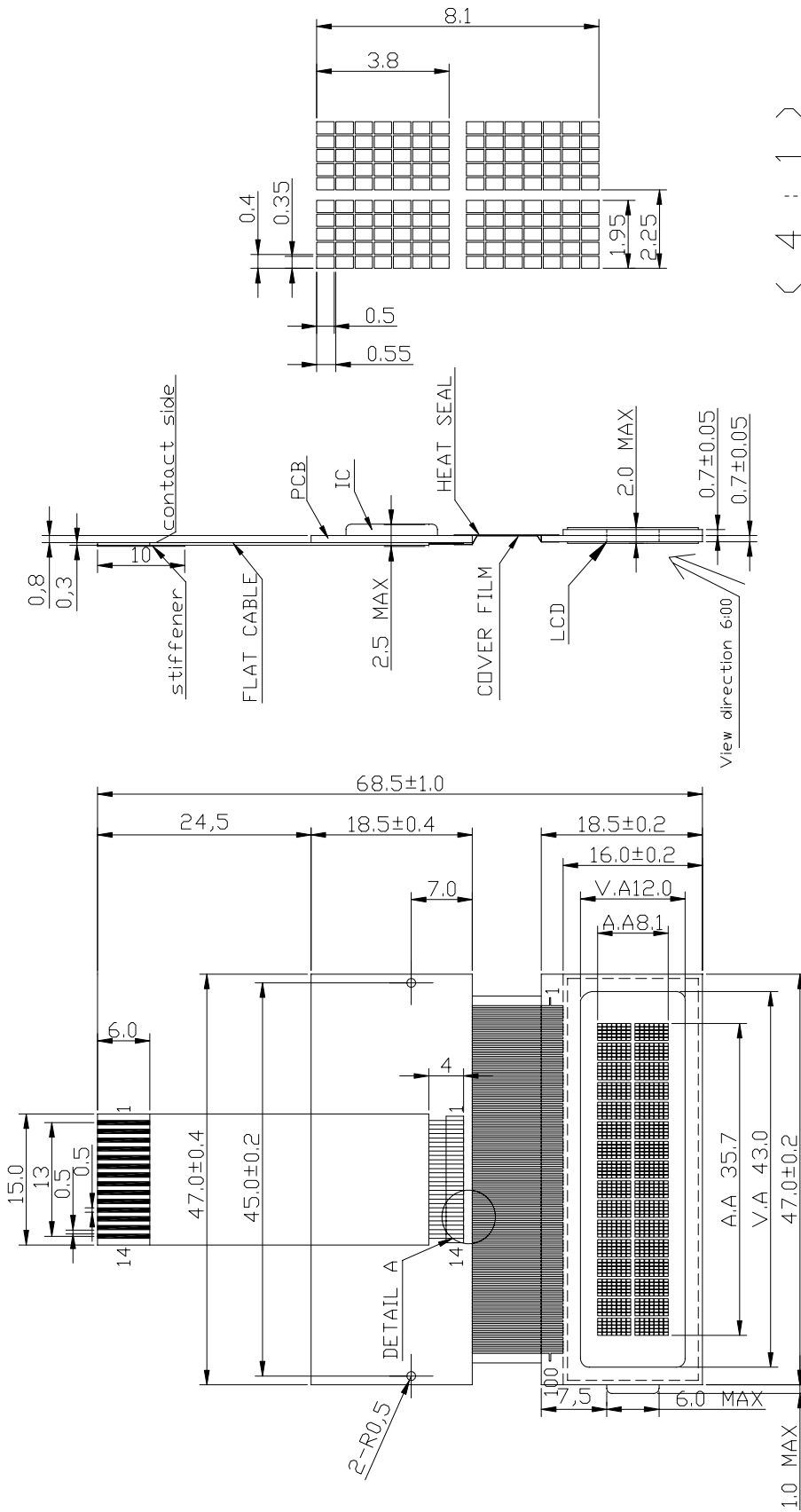


UNLISTED TOLERANCE IS ±0.3  
THE MATERIAL IS LEAD-FREE.



DETAIL A ( 3 : 1 )

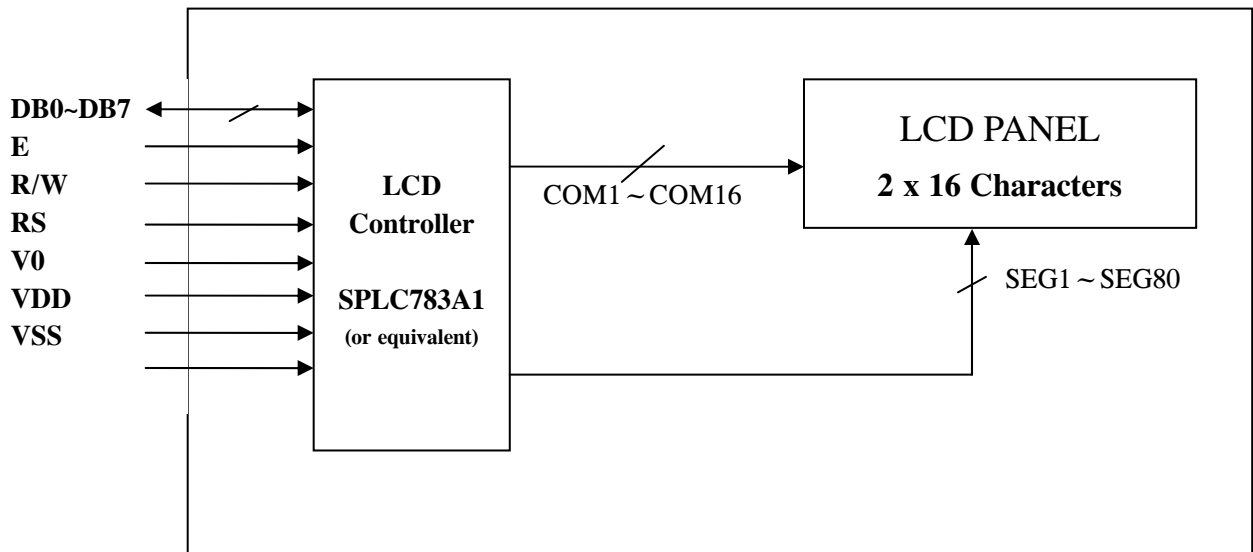
**3.3 DEM 16221 SYH (FFCR) + DEM 16221 SYH (FFCR/tr.)**



UNLISTED TOLERANCE IS ±0.3  
THE MATERIAL IS LEAD-FREE.

DETAIL A < 3 : 1 >

**4. BLOCK DIAGRAM**

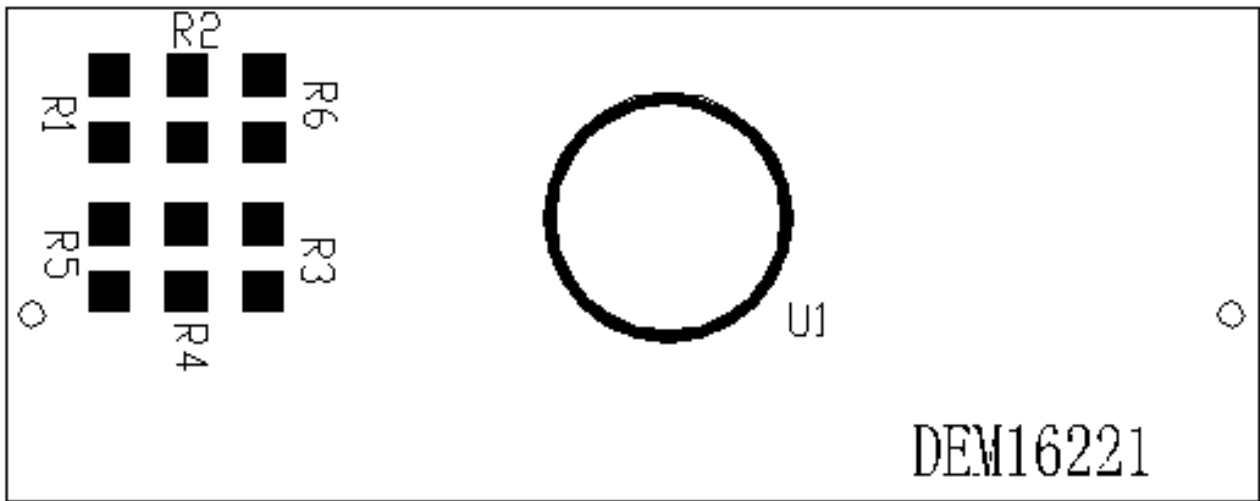


**5. PIN ASSIGNMENT**

Pin No.	Symbol	Function
1	V <sub>SS</sub>	Ground terminal of module
2	V <sub>DD</sub>	Supply terminal of module 5.0 V
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	A start signal for reading or writing data
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	



**6. PCB DRAWING AND DESCRIPTION**



**7. 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	

**8. 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> -12.0~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

**9. DC CHARACTERISTICS**

(V<sub>DD</sub>=5.0V,  
Ta=25°C)

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V <sub>DD</sub>	4.7	5	5.3	-----	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	----	-----	mA

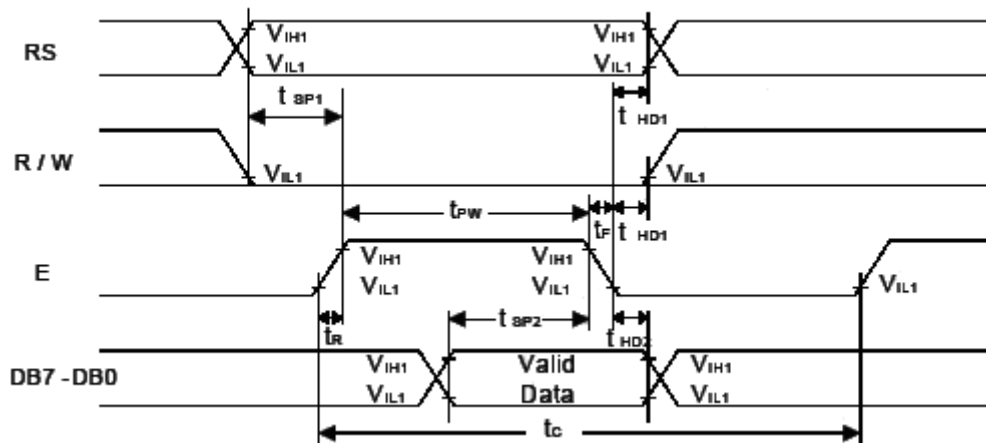
\*Note: F<sub>OSC</sub> = 270KHZ, V<sub>DD</sub> = 5.0V, pin E = .L., RS, R/W, DB0 - DB7 are open, all outputs are no loads.

**10. AC CHARACTERISTICS**

Write mode (writing data from MPU to SPLC783A1)

( $V_{DD}=5.0V$  ,  $T_a=25^{\circ}C$ )

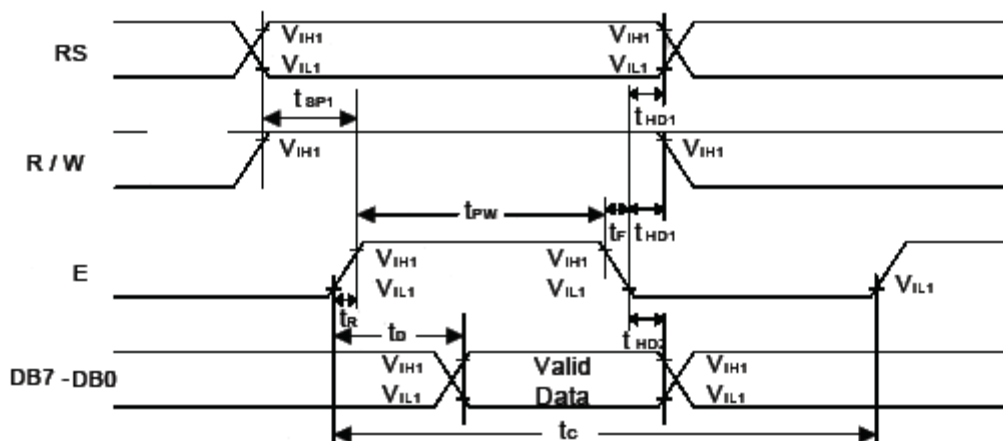
Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	$t_c$	500	-	-	ns	Pin E
E Pulse Width	$t_{PW}$	220	-	-	ns	Pin E
E Rise/Fall Time	$t_r, t_f$	-	-	25	ns	Pin E
Address Setup Time	$t_{SP1}$	40	-	-	ns	Pins: RS, R/W, E
Address Hold Time	$t_{HD1}$	10	-	-	ns	Pins: RS, R/W, E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



Read mode (Reading data from SPLC783A1 to MPU)

( $V_{DD}=5.0V$  ,  $T_a=25^{\circ}C$ )

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. CHARACTER GENERATOR ROM (SPLC783A1-001B)**

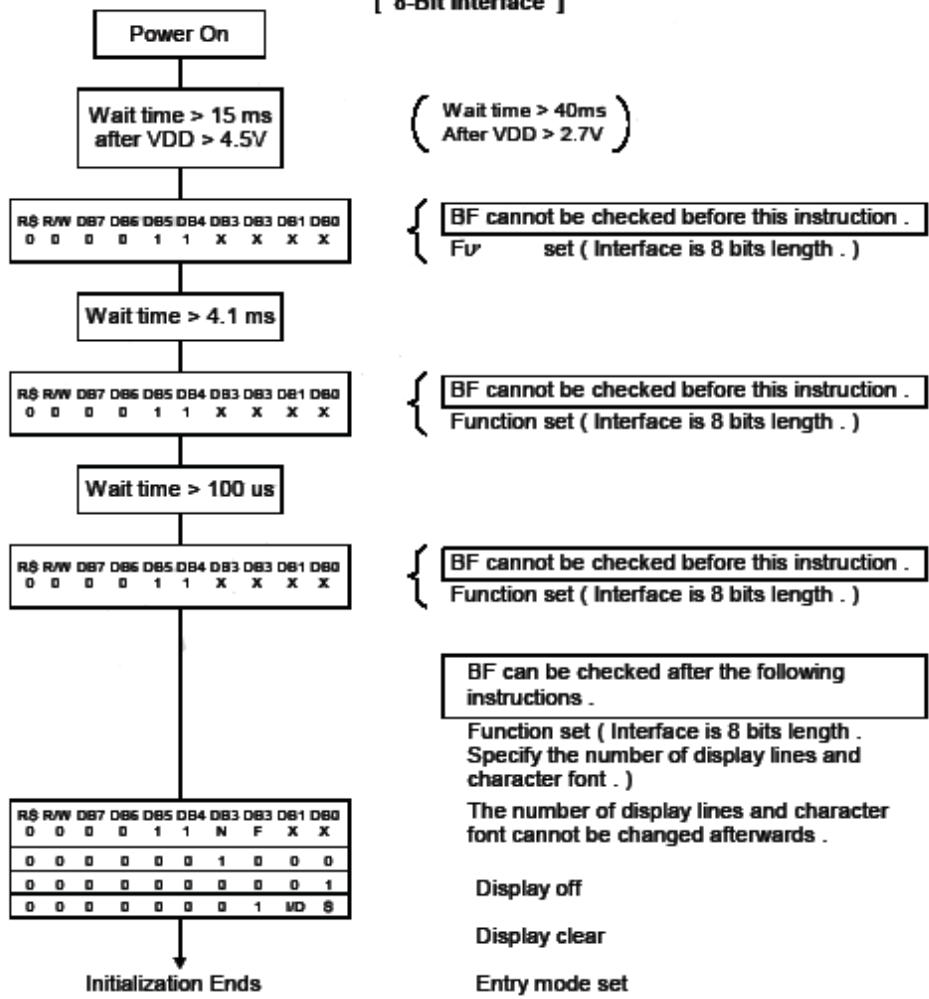
Upper(4bit) \ Lower(4bit)		LLLL	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HLLL	HHLH	HHLH	HHHL	HHHH
		CGRAM (1)															
LLLL	(1)																
LLHH	(2)																
LLHL	(3)																
LLHH	(4)																
LHLL	(5)																
LHLH	(6)																
LHHL	(7)								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

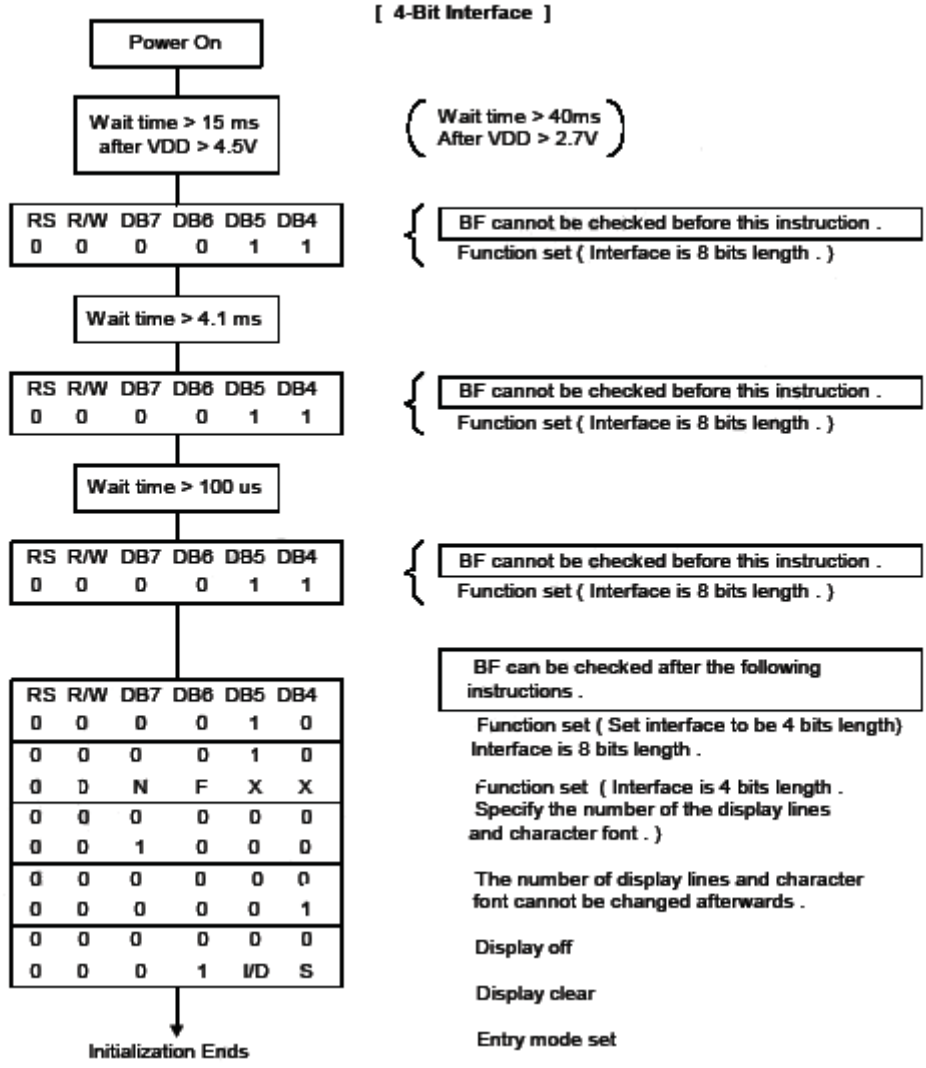
**12. INSTRUCTION TABLE**

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

13. RESET FUNCTION





( Wait time > 40ms  
After VDD > 2.7V )

{ BF cannot be checked before this instruction .  
Function set ( Interface is 8 bits length . )

{ BF cannot be checked before this instruction .  
Function set ( Interface is 8 bits length . )

{ BF cannot be checked before this instruction .  
Function set ( Interface is 8 bits length . )

BF can be checked after the following instructions .

Function set ( Set interface to be 4 bits length )  
Interface is 8 bits length .

Function set ( Interface is 4 bits length .  
Specify the number of the display lines  
and character font . )

The number of display lines and character  
font cannot be changed afterwards .

Display off

Display clear

Entry mode set

**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](#)