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TFT | CHARACTER | UWVD | FSC | SEGMENT | CUSTOM | REPLACEMENT

Character Display Module

Part Number

C162LDBSYLG6WT

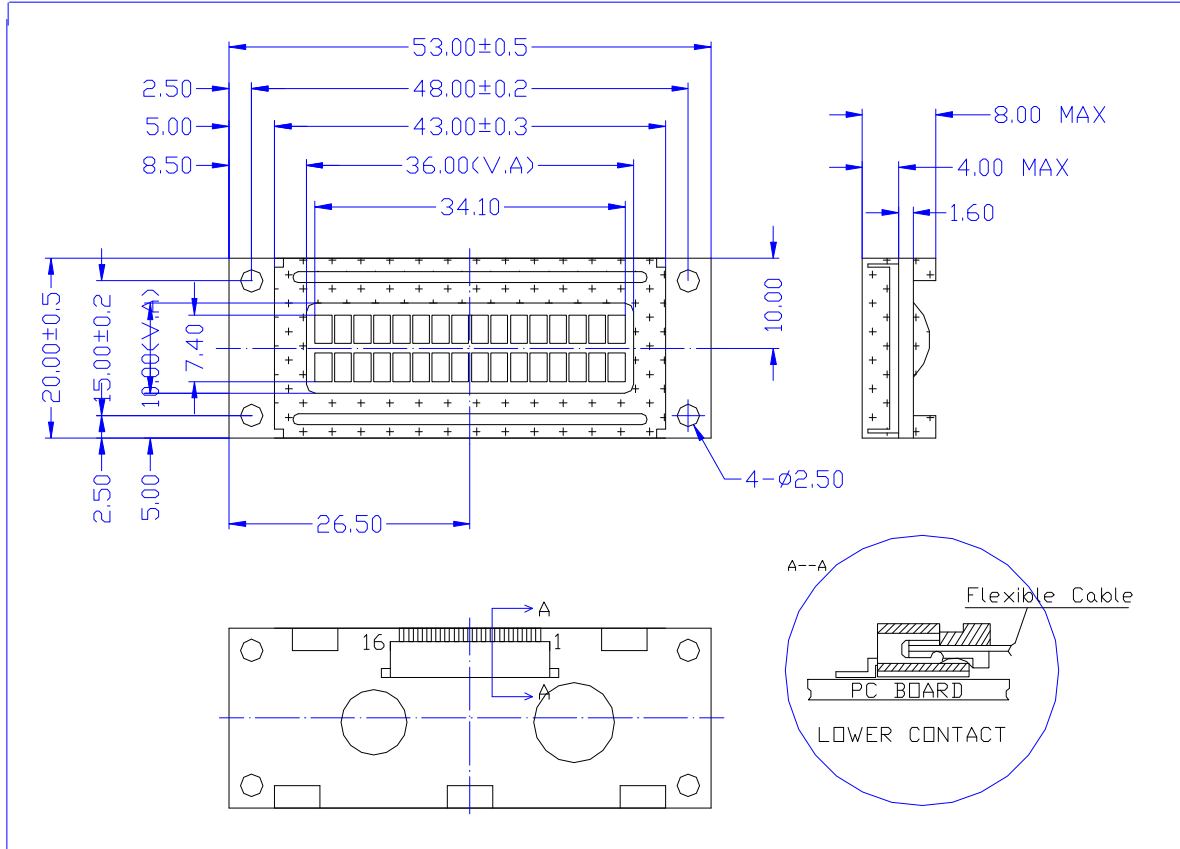
Overview

Character: 16x2(53x20), STN, Yellow background, LED, Yellow/Green backlight, Bottom view, Wide temp, Transflective (positive), Controller=SPLC780D

■ PHYSICAL DATA

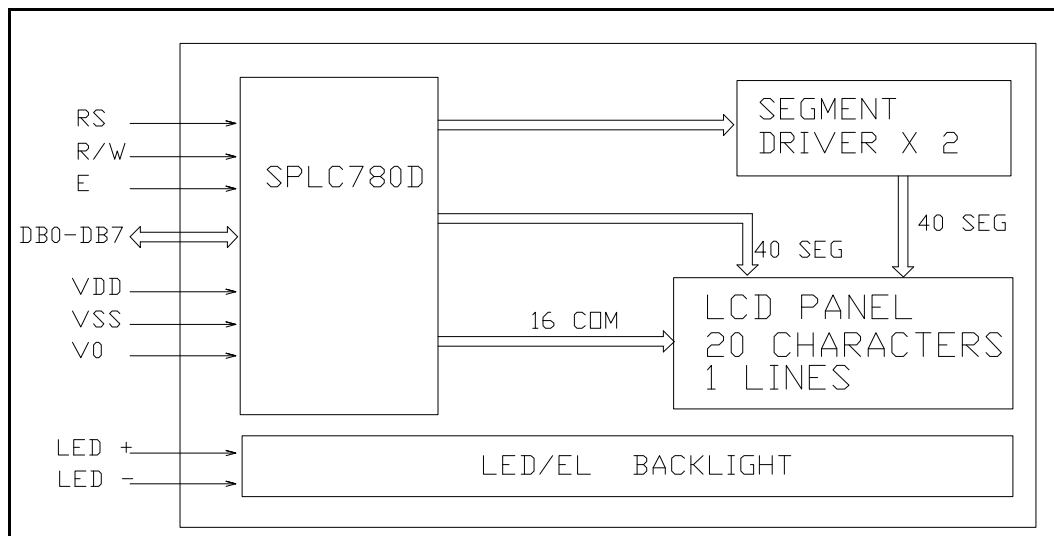
Item	Content	Unit
LCD type	Yellow/green STN, Positive, Transflective	---
LCD duty	1/16	---
LCD bias	1/5	---
Viewing direction	6	o'clock
Module size	53.0 x 20.0 x 8.0 (max)	mm
Viewing area	36.0 x 10.0	mm
Number of characters	16 x 2	dots
Character size	1.85x 3.15	mm
Character pitch	2.15 x 4.25	mm
Character format	5 X 7 dots with cursor	---
Backlight type	Side LED backlight	---
Colour of backlight	Yellow/green	---
Driver IC	SPLC780D	---

■ EXTERNAL DIMENSIONS



■ CIRCUIT BLOCK DIAGRAM

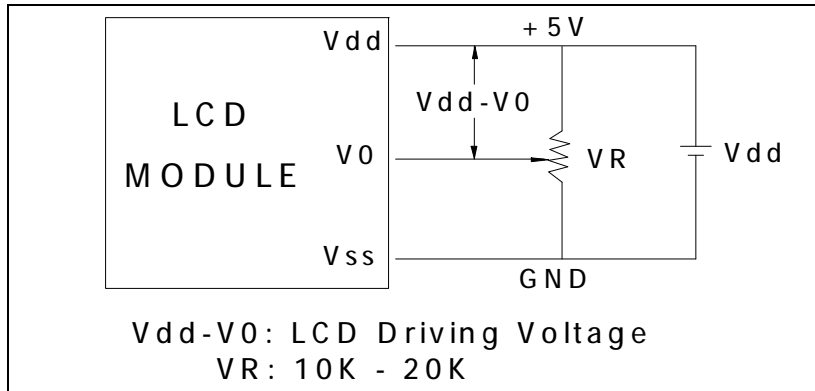
◇ Electrical Block Diagram



◇ Pins Definition

PIN	SYMBOL	LEVEL	FUNCTION
1	V _{SS}	0	Power Supply(GND)
2	V _{DD}	4.7V	Power Supply For Logic(+4.7v)
3	V ₀	—	Input Voltage For LCD
4	RS	H/L	H: Data Signal , L: Instruction Signal
5	R/W	H/L	H: Read mode , L: Write mode
6	E	H,H→L	Enable Signal
7	DB ₀	H / L	Data Bus Lines
8	DB ₁	H / L	
9	DB ₂	H / L	
10	DB ₃	H / L	
11	DB ₄	H / L	
12	DB ₅	H / L	
13	DB ₆	H / L	
14	DB ₇	H / L	
15	A	+4.7V	Power Supply For LED Backlight (+) (4.7V)
16	K	0 V	Power Supply For LED Backlight (-) (0V)

◇ **Power supply**



◇ **Display character address code**

POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
ADDR	LINE1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
	LINE2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

*NOTE: ALL OF THE NUMBERS ARE IN HEX FORMAT

■ **ABSOLUTE MAXIMUM RATINGS**($T_a=25^{\circ}\text{C}$)

◇ **Electrical Absolute Maximum Ratings**

ITEM	SYMBOL	CONDITON	MIN	MAX	UNIT
Supply Voltage For Logic	$V_{dd} - V_{ss}$	-	-0.3	7.0	V
Supply Voltage For LCD	$V_{dd} - V_0$	-	0	13.0	V
Input Voltage	V_i	-	-0.3	$V_{dd} + 0.3$	V

◇ **Environmental Absolute Maximum Ratings**

ITEM	SYMBOL	CONDITON	MIN	MAX	UNIT
Operating temperature	T_{opr}	-Normal temp. version-	-20	70	deg C
Operating temperature	T_{tsg}		-30	80	deg C
Humidity Endurance	RH	no ondensation $T_a \leq 40$ deg	-	95	%
Vibration	-	100-300Hz, X/Y/Z directions, 1 hour	-	4.9m/ss 0.5g	-
Shock	-	10 mS X/Y/Z direction 1 time each	-	29.4m/ss 3.0g	-

■ ELECTRICAL CHARACTERISTICS

◇ DC Characteristics

Electrical Characteristics at Ta=25 deg C, Vdd = 5V + / - 5%

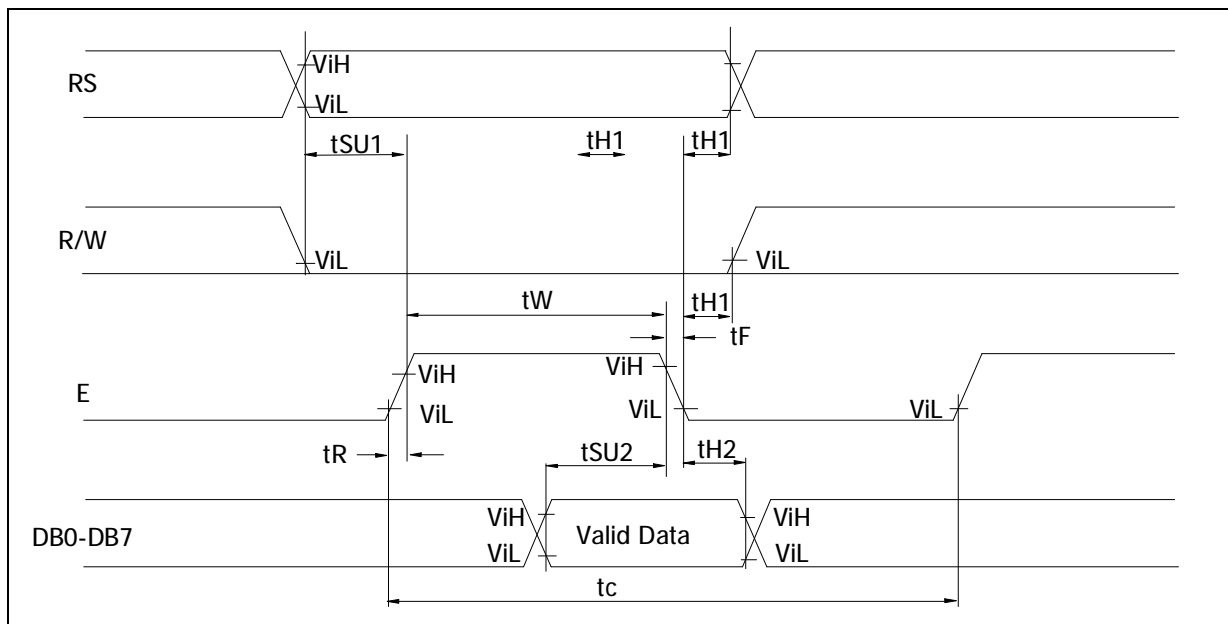
ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage For Logic	Vdd-Vss	-	4.5	4.7	5.5	V
Supply Voltage For LCD	Vdd-V0	Vdd = 5V	-	4.5	-	V
Input Signal Voltage(for RS, DB0-7,R/W,E)	V-ih	“H”level	2.2	-	Vdd	V
	V-il	“L”level	0	-	0.6	V
Supply Current For Logic	Icc	-	-	1	1.2	mA
Supply Current For LCD	Io	-	0.15	0.22	0.27	mA

◇ AC Characteristics

Timing Specification at Ta=25 deg C ,Vdd=5V+/-10% , Vss=0V

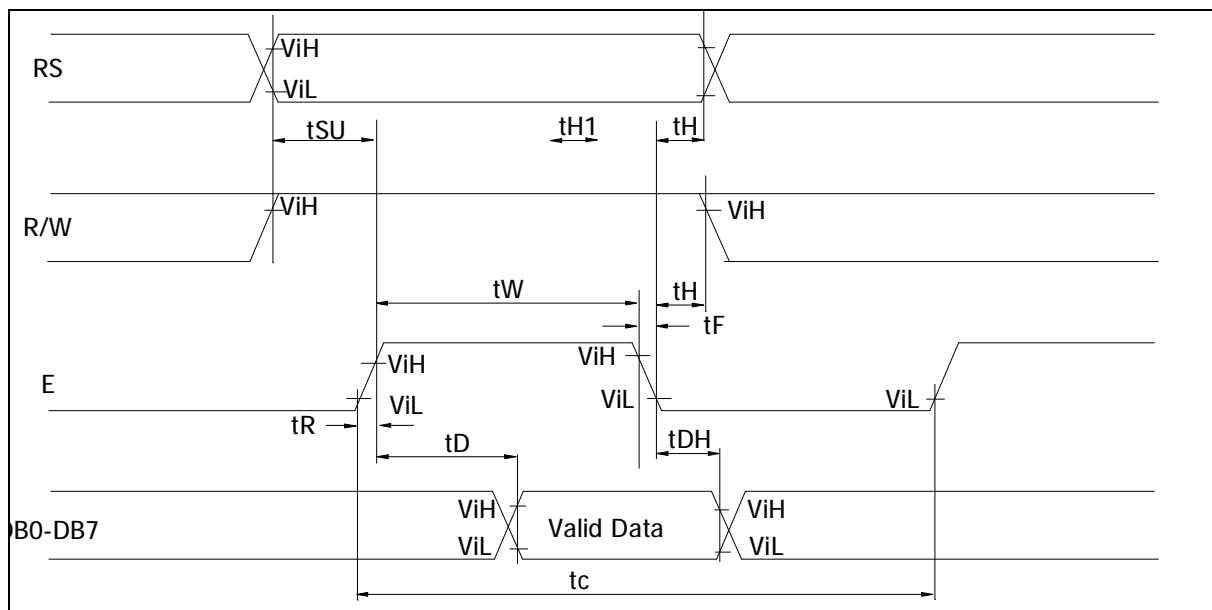
◆ Write mode

ITEM	SYMBOL	TEST PIN	MIN	TYP	MAX	UNIT
E cycle time	tc	E	500	-	-	ns
E rise time	tR	E	-	-	25	ns
E fall time	tF	E	-	-	25	ns
E-pulse width (H, L)	tw	E	220	-	-	ns
R/W and RS set-up time	tsul	R/W,RS	40	-	-	ns
R/W and RS hold time	tH1	R/W,RS	10	-	-	ns
Data set-up time	tsu2	DB0—DB7	60	-	-	ns
Data hold time	tH2	DB0—DB7	10	-	-	ns



◆ Read mode

ITEM	SYMBOL	TEST PIN	MIN	TYP	MAX	UNIT
E cycle time	tc	E	500	-	-	ns
E rise time	tR	E	-	-	25	ns
E fall time	tF	E	-	-	25	ns
E-pulse width (H, L)	tw	E	220	-	-	ns
R/W and RS set-up time	tsu	R/W,RS	40	-	-	ns
R/W and RS hold time	tH	R/W,RS	10	-	-	ns
Data output delay	tD	DB0—DB7	-	-	120	ns
Data hold time	tDH	DB0—DB7	20	-	-	ns



■ BACKLIGHT CHARACTERISTICS

Unless specified, the Ambient temperature $T_a=25\text{ }^\circ\text{C}$

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Supply Voltage	V_f	4.2	4.7	5.0	V	
Forward Current	I_{fm}		20		mA	$V_f=4.7\text{V}$
Reverse Voltage	V_r		1.0		V	
Power Dissipation	P_d				mW	$V_f=4.7\text{V}$
Operation temperature Range	T_{opr}	-10		+50	$^\circ\text{C}$	
Storage temperature Range	T_{stg}	-20		+60	$^\circ\text{C}$	
Peak Wavelength	λ_p				nm	$V_f=4.7\text{V}$
Luminance	L_v	90	120		Cd/m m	$V_f=4.7\text{V}$



LED CIRCUIT DIAGRAM (LED 2X2=4 dies)

■ ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	$25\text{ }^\circ\text{C}$	--	12	--		Note 1
Rise Time	t_r	$25\text{ }^\circ\text{C}$	--	160	240	ms	Note 2
Fall Time	t_f	$25\text{ }^\circ\text{C}$	--	100	150	ms	note 2
Viewing Angle	$\theta_1-\theta_2$	$25\text{ }^\circ\text{C}$	--	--	60	DEG	Note 3
	θ_1, θ_2		-40	--	40		
Frame Frequency	Ff	$25\text{ }^\circ\text{C}$	--	70	--	Hz	note 2

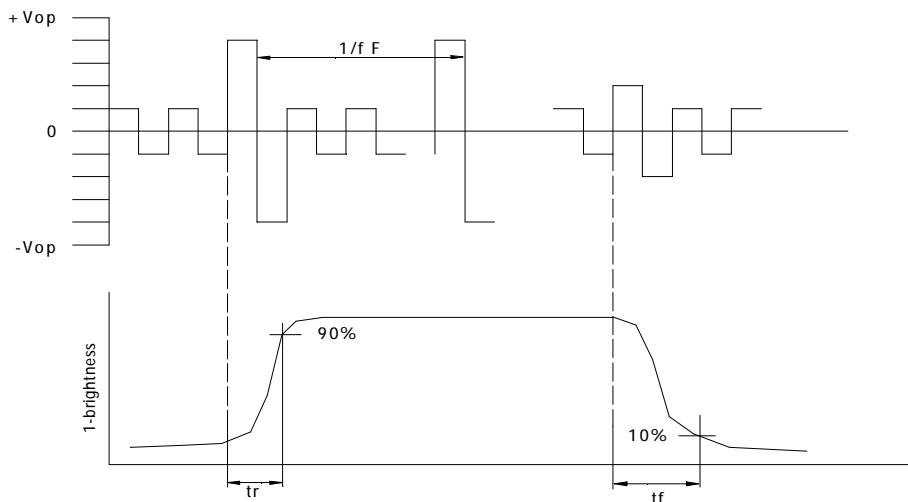
Note(1): Contrast ratio is defined under the following condition:

$$\text{CR} = \frac{\text{brightness of selected condition}}{\text{brightness of non-selected condition}}$$

- Temperature----- $25\text{ }^\circ\text{C}$
- Frame Frequency----- 64Hz
- Viewing angle----- $\theta=0, \theta=0$

(d). Operating Voltage---5.0V

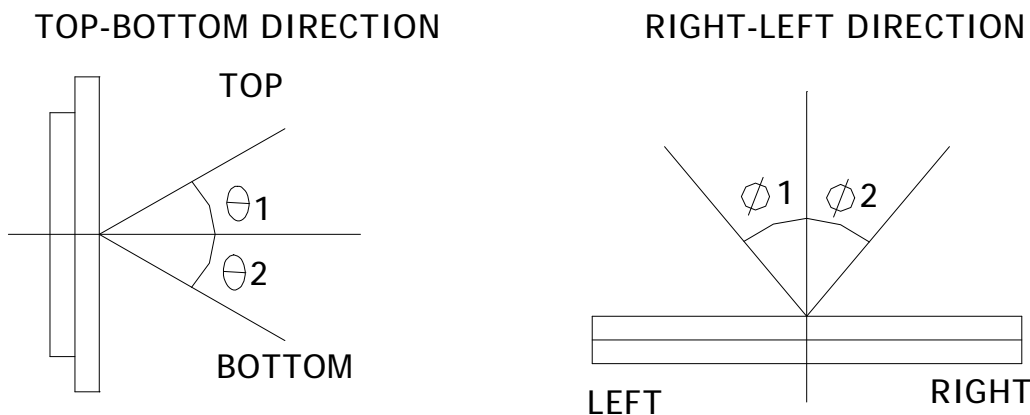
Note(2): definition of response time:



Condition:

- (a). Temperature-----25C
- (b). Frame Frequency-----64Hz
- (c). Viewing angle----- $\theta=0, \phi=0$
- (d). Operating Voltage---5.0V

Note(3): definition of view angle:



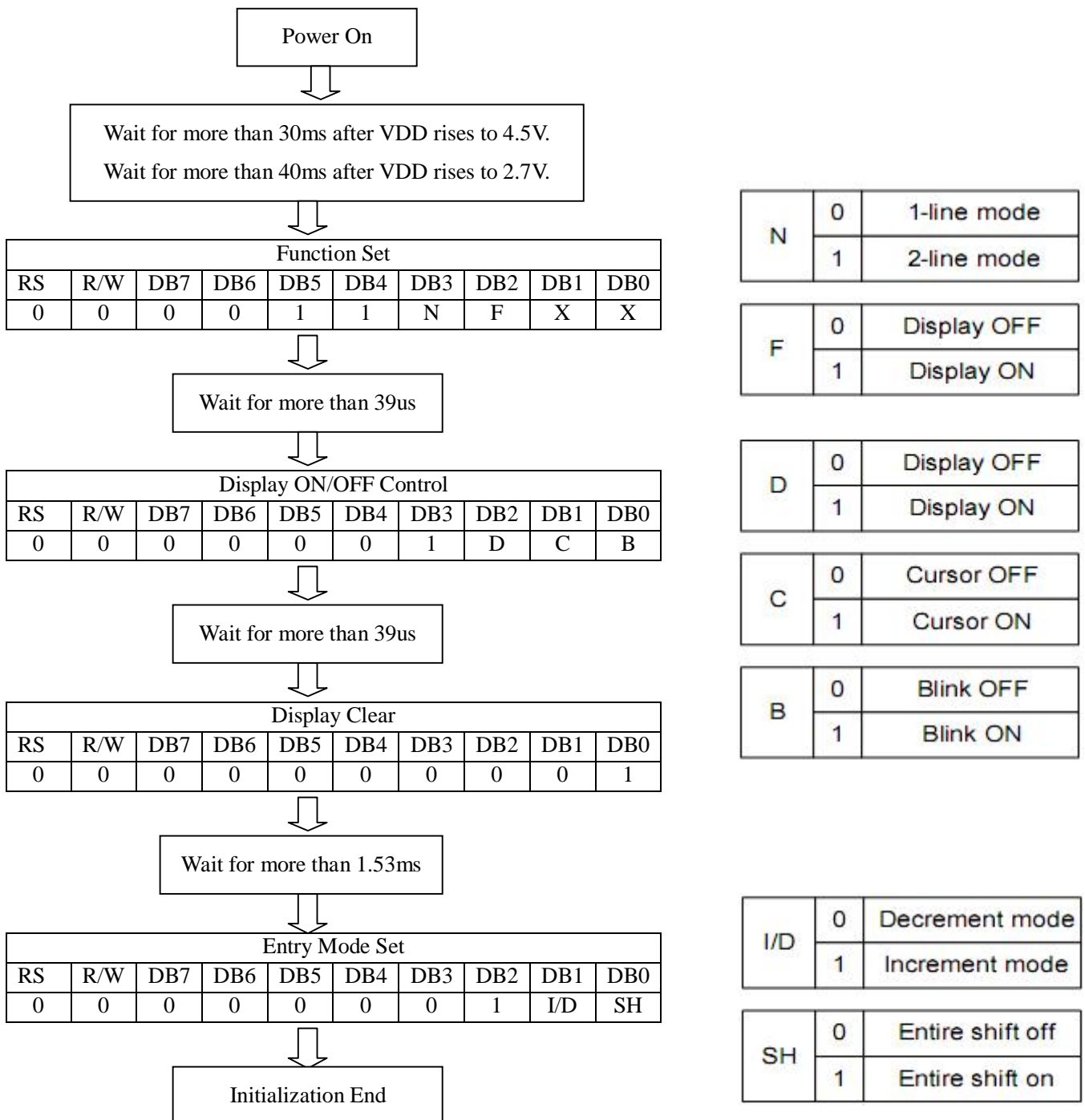
■ INSTRUCTION TABLE

Function	R	RD	DD	DD	DD	DD	DD	DD	DD	Description	Execu Time* (Max)		
	S	W	B	B	B	B	B	B	B				
		7	6	5	4	3	2	1	0				
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display and returns the cursor to home position (address 0)	1.64mS	
Return Home	0	0	0	0	0	0	0	0	0	1	X	Return the cursor to the home position. DD RAM contents remain unchanged. Set DD RAM address to zero.	1.64mS
Entry mode set	0	0	0	0	0	0	0	0	1	1	S	Set cursor moving direction and enable the shift of the display. These operations are performed during data write/read of DD RAM/CG RAM. 1/D=1: increment; 1/D=0: decrement; S=1: whole display shift when data is written.	40μS
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. D=1: display ON; D=0: display OFF. C=1: Cursor ON; C=0: cursor OFF. B=1: Blink ON; B=0, Blink OFF.	40μS
Cursor or Display shift	0	0	0	0	0	1	S	R	X	X	X	Move the cursor and shift the display without changing DDRAM contents. S/C=1: Display Shift; S/C=0: Cursor move. R/L=1: shift to right; R/L=0: shift to left.	40μS
Function Set	0	0	0	0	1	D	N	F	X	X	X	Set interface data length (DL), number of display lines (N) and character font (F). DL=1: 8 bits; DL=0: 4 bits. N=1: 2 lines; N=0: 1 lines. F=1: 5X11 dots; F=0: 5X7 dots.	40μS
Set CG RAM add	0	0	0	1	ACG						Set CG RAM address. CG RAM data is sent and received after this setting.	40μS	
Set DD RAM Add	0	0	1	ADD						Set DD RAM address. DD RAM data is sent and received after this setting.	40μS		
Read BF & Addr	0	1	B	AC						Read BUSY FLAG (BF) and the contents of the address counter. BF=1: internal operation; BF=0: can accept instruction.	0μS		
Write Data to RAM	1	0	WRITE DATA									Write data into DD RAM or CG RAM.	40 μS**

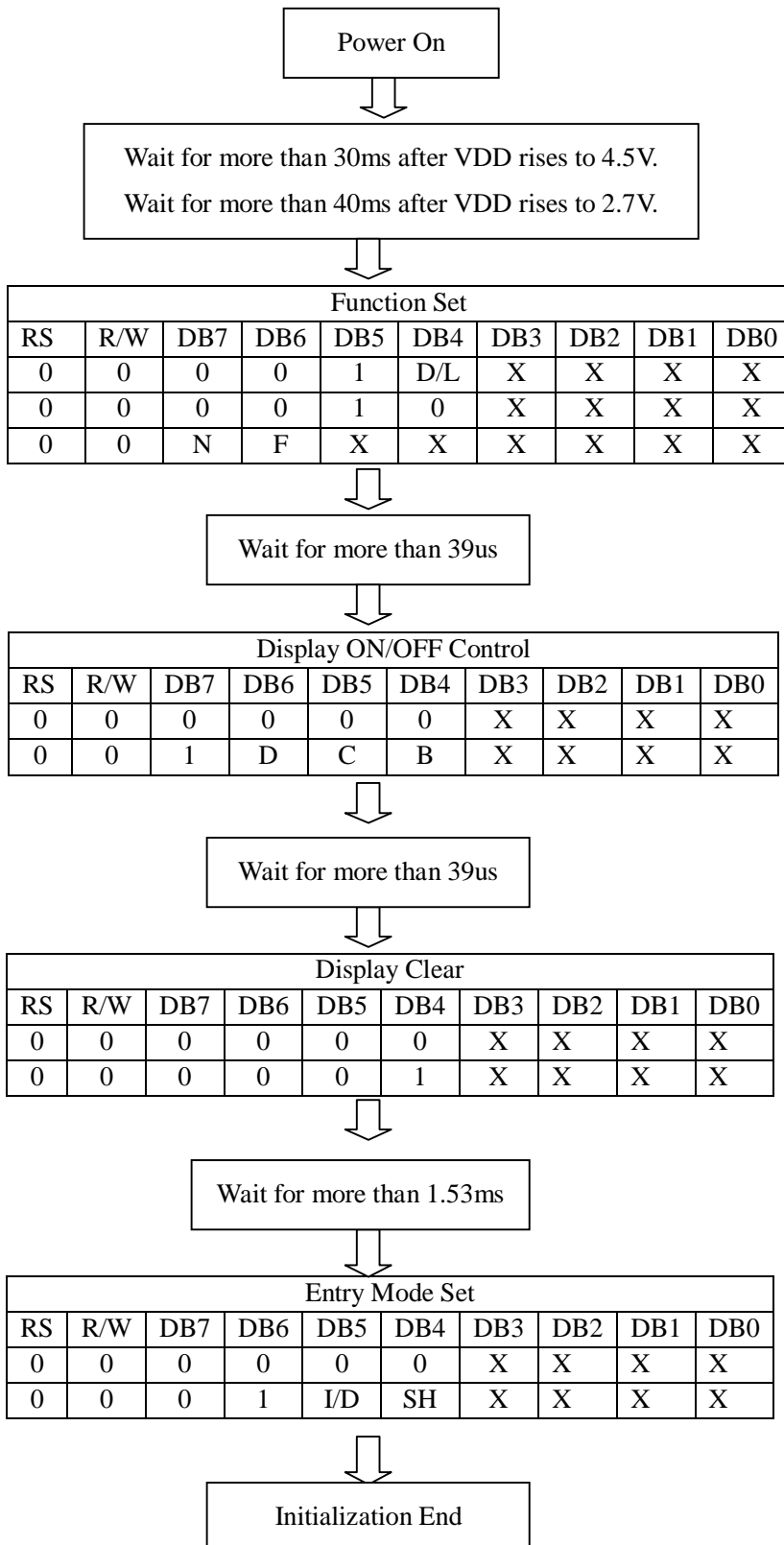
Read Data from RAM	1 0	READ DATA	Read data from DD RAM or CG RAM.	40 μ S**
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INITIALIZING BY INSTRUCTION

◇ 8-bit Interface Mode(Condition: fosc=270kHz)



◇ 4-bit Interface Mode(Condition: $f_{osc}=270kHz$)



D/L	0	4-bit mode
	1	8-bit mode

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

■ INTERNAL CHARACTER GENERATOR FONT

Upper 4 bit Lower 4 bit	LLLL	LLHH	LLHL	LLHH	HLHL	HLHH	HLHL	HLHH	HLLL	HLLH	HLLH	HLLH	HLLH	HLLH	HLLH	HLLH	HLLH	
LLLL				⊗	⊗	⊗	⊗	⊗						一	夕	三	⊗	⊗
LLHH			!	⊗	⊗	⊗	⊗	⊗						。	⊗	⊗	⊗	⊗
LLHL			"	⊗	⊗	⊗	⊗	⊗						「	⊗	⊗	⊗	⊗
LLHH			#	⊗	⊗	⊗	⊗	⊗						レ	⊗	⊗	⊗	⊗
LHLL			⊗	⊗	⊗	⊗	⊗	⊗						ノ	⊗	⊗	⊗	⊗
LHLH			⊗	⊗	⊗	⊗	⊗	⊗						・	⊗	⊗	⊗	⊗
LHHL			⊗	⊗	⊗	⊗	⊗	⊗						ヲ	⊗	⊗	⊗	⊗
LHHH			”	⊗	⊗	⊗	⊗	⊗						ヲ	⊗	⊗	⊗	⊗
HLLL			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HLLH			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HLHL			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HLHH			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HHLL			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HHLH			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HHHL			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗
HHHH			⊗	⊗	⊗	⊗	⊗	⊗						⊗	⊗	⊗	⊗	⊗

■ **EXAMPLE FOR SOFTWARE APPLICATION**

8-BIT OPERATION

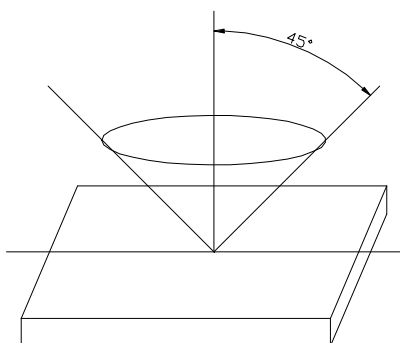
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4-BIT OPERATION

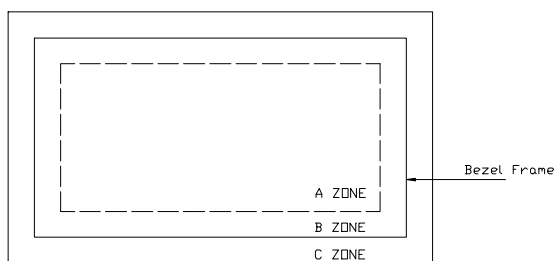
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■ **INSPECTION STANDARDS**

- ◇ The LCD shall be inspected under 40W white fluorescent light.
The distance between the eyes and the samples shall be more than 30cm.
All directions for inspecting the sample should be within 45 degree against perpendicular line.

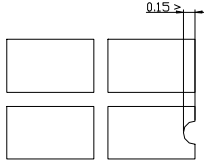


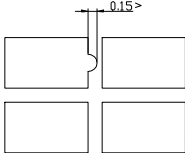
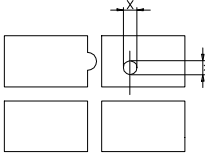
◇ **Definition of Applicable Zone**



- A Zone: Active Display Area
- B Zone: Area from Bezel Frame to A Zone
- C Zone: Rest Area of Bezel
- A Zone + B Zone=Effective Viewing Area

◇ **Standards**

NO	PARAMETER	CRITERIA																																																														
1	Black and White Spots, Foreign Substances	<p align="center">Round Shape</p> <table border="1"> <thead> <tr> <th rowspan="2">Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>DIMENSION(MM)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>D≤0.1</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.1<D≤0.2</td> <td>5</td> <td>5</td> <td>*</td> </tr> <tr> <td>0.2<D≤0.3</td> <td>0</td> <td>1</td> <td>*</td> </tr> <tr> <td>0.3<D</td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>D=(long+short)/2 * Disregard</p> <p align="center">Line Shape</p> <table border="1"> <thead> <tr> <th colspan="2">Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>X(mm)</th> <th>Y(mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>0.02≥W</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>2.0≥L</td> <td>0.03≥W</td> <td>3</td> <td>3</td> <td>*</td> </tr> <tr> <td>1.0≥L</td> <td>0.04≥W</td> <td>1</td> <td>2</td> <td>*</td> </tr> <tr> <td>1.0≥L</td> <td>0.05≥W</td> <td>0</td> <td>2</td> <td>*</td> </tr> <tr> <td>-</td> <td>0.05<W</td> <td colspan="3">Not acceptable</td> </tr> </tbody> </table> <p>X: Length Y: Width * Disregard Total defects shall not exceed 5.</p>	Zone	Acceptable Number			A	B	C	DIMENSION(MM)				D≤0.1	*	*	*	0.1<D≤0.2	5	5	*	0.2<D≤0.3	0	1	*	0.3<D	0	0	*	Zone		Acceptable Number			X(mm)	Y(mm)	A	B	C	-	0.02≥W	*	*	*	2.0≥L	0.03≥W	3	3	*	1.0≥L	0.04≥W	1	2	*	1.0≥L	0.05≥W	0	2	*	-	0.05<W	Not acceptable		
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2	Air Bubbles (Between glass and polarizer)	<table border="1"> <thead> <tr> <th rowspan="2">Dimension(mm)</th> <th>Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <td></td> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>D≤0.1</td> <td></td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.1<D≤0.2</td> <td></td> <td>5</td> <td>5</td> <td>*</td> </tr> <tr> <td>0.2<D≤0.3</td> <td></td> <td>0</td> <td>1</td> <td>*</td> </tr> <tr> <td>0.3<D</td> <td></td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>*: Disregard Total defects shall not exceed 3.</p>	Dimension(mm)	Zone	Acceptable Number				A	B	C	D≤0.1		*	*	*	0.1<D≤0.2		5	5	*	0.2<D≤0.3		0	1	*	0.3<D		0	0	*																																	
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0.2<D≤0.3		0	1	*																																																												
0.3<D		0	0	*																																																												
3	The Shape of Dot	(1) Dot Shape(with dent)  As per the sketch of left hand.																																																														
		(2) Dot Shape(with Projection)																																																														

		 <p>Should not connect to next dot.</p> <p>(3) Pin Hole</p>  <p>$(X+Y)/2 < 0.2\text{mm}$ (less than 0.1mm is not counted)</p> <p>Total defects shall not exceed 5.</p>
4	Polarizer Scratches	Not to be conspicuous defects.
5	Polarizer Dirts	If the stains are removed easily from LCD surface, the module is not defective.
6	Color Variation	Not to be conspicuous defects.

■ PRECAUTIONS IN USING LCM

◇ LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzine.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handling. especially at corners and edges.
- (5). Do not drive LCD with DC voltage.

◇ Liquid Crystal Display Modules

◆ Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
- (4). When mounting a LCM make sure that the PCB is not under any tress such as bending or

twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

- (5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

◆ Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
- (6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

◆ Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature: $280\text{ }^{\circ}\text{C}\pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

◆ Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage V_0 .
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

◆ Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.