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The LCD(M) Specialist

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PART NO. :   PRG2412A- SERIES

FOR MESSRS. :

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ACCEPTED BY :   PROPOSED BY :

RECORD OF REVISION

DATE	PAGE	SUMMARY

1.General Specifications

PRG2412A is a graphic LCM ,it includes row driver/line driver,240×128 pixels LCD. It can display graphic picture and English text ,also can show 16×16(5×8,6×8,7×8,or 8×8 pixels) characters. The following table will show it's main features:

ITEM	Standard value	Unit	Remark
Module size	144.0×104.0×11.0(MAX)	mm	
Display type	STN(Y/G)		
Dot Pixels	240×128	dot	
Dot size	0.40×0.40	mm	
Dot pith	0.45×0.45	mm	
Approx. weight	--	g	
Drive method	1/128duty		
Viewing direction	6	o'clock	
Negative display	Display dots: black Background: blue		
Back Light	LED		Yellow-green

2. Maximum absolute limit

Item	Symbol	MIN.	MAX.	Unit
Power supply for logic	$V_{DD}-V_{SS}$	0	7.0	V
Power supply for LCD driver	$V_{DD}-V_{EE}$	0	27.0	V
	$V_{DD}-V_0$	0	20.0	V
Input Voltage	V_I	V_{SS}	V_{DD}	V
Operating temperature	T_{OP}	-20	70	°C
Storage temperature	TSTG	-30	80	°C
Static electricity	Be sure that you are grounded when handing LCM			

Note: Stresses beyond those given in the Absolute Maximum Rating table may cause operational errors or damage to the device.

3. External dimensions

4. Electrical characteristics

a) **DC CHARACTERISTICS** (TA =25 °C, VDD = 5.0± 10% V, V$_{DD}$-V$_O$=16.0± 5%V, V$_{SS}$=0V)

Item	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Input High level	V$_{IH}$	0.8V$_{DD}$	-	V$_{DD}$	V	
Input Low level	V$_{IL}$	V$_{SS}$		0.2V$_{DD}$	V	
Operating current for LCD driving	I$_0$	-	0.6	-	mA	
Current consumption	I$_{DD}$	-	70	-	mA	

b) **AC CHARACTERISTICS** (TA =-20 to 70°C, VDD = 5.0±10% V, V$_{SS}$=0V)

CON1:

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
C/D setup time	t$_{CDS}$	100	-	-	ns	-
C/D hold time	t$_{CDH}$	10	-	-	ns	-
/CE,/RD,/WR, pulse,	T$_{CE}$, t$_{RD}$,	80	-	-		-
Data setup Time	t$_{DS}$	80	-	-	ns	-
Data hold Time	t$_{DH}$	40		-	ns	-
Access Time	t$_{ACC}$	-		150	ns	-
Output hold Time	t$_{OH}$	10	-	50	ns	-

Bus timing
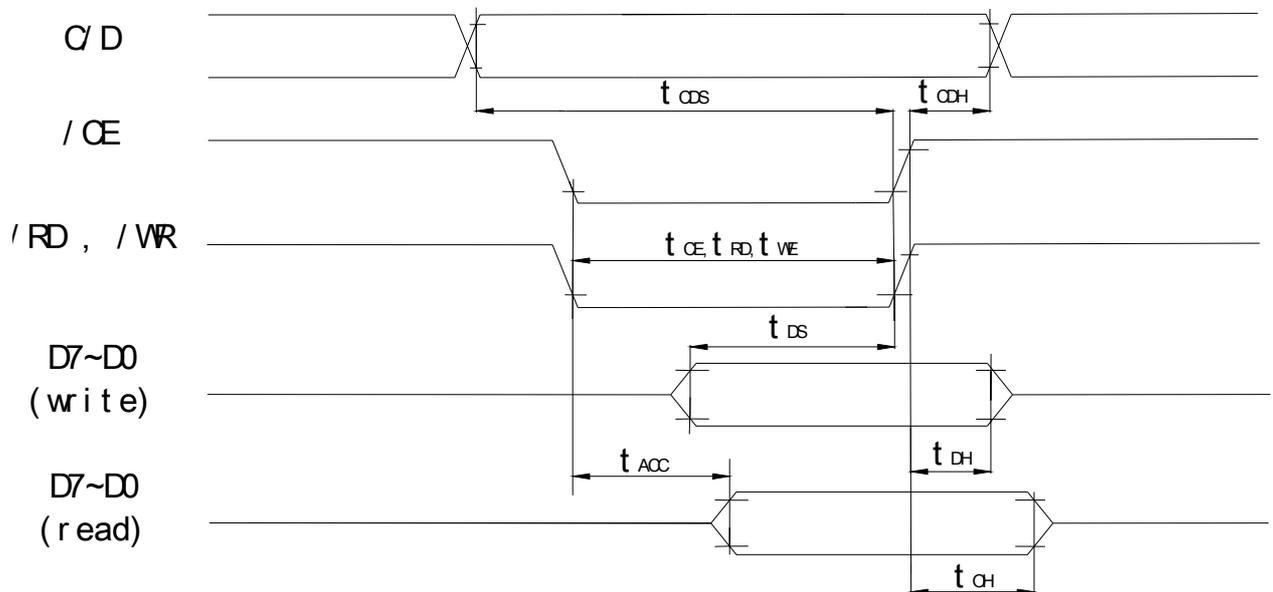
			CON2:			

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Clock cycle time for	t_{CYS}	125	-	-	ns	Duty=50%
Clock cycle time for	t_{CYC}	250	-	-	ns	Duty=50%
Clock pulse width	t_{WCK}	45	-	-	ns	-
Clock rise/fall time	t_R/t_F	-	-	50	ns	-
Data setup time	t_{DS}	30	-	-	ns	-
Data hold time	t_{DH}	30	-	-	ns	-
Clock setup time	t_{CS}	80		150	ns	-
Clock hold Time	t_{CH}	80	-	50	ns	-
FR-OUT propagation delay	t_{PD1}	-	-	1.0	μ S	CL=15pF
LP-OUT propagation delay	t_{PD2}	-	-	1.0	μ S	CL=15pF

Bus timing
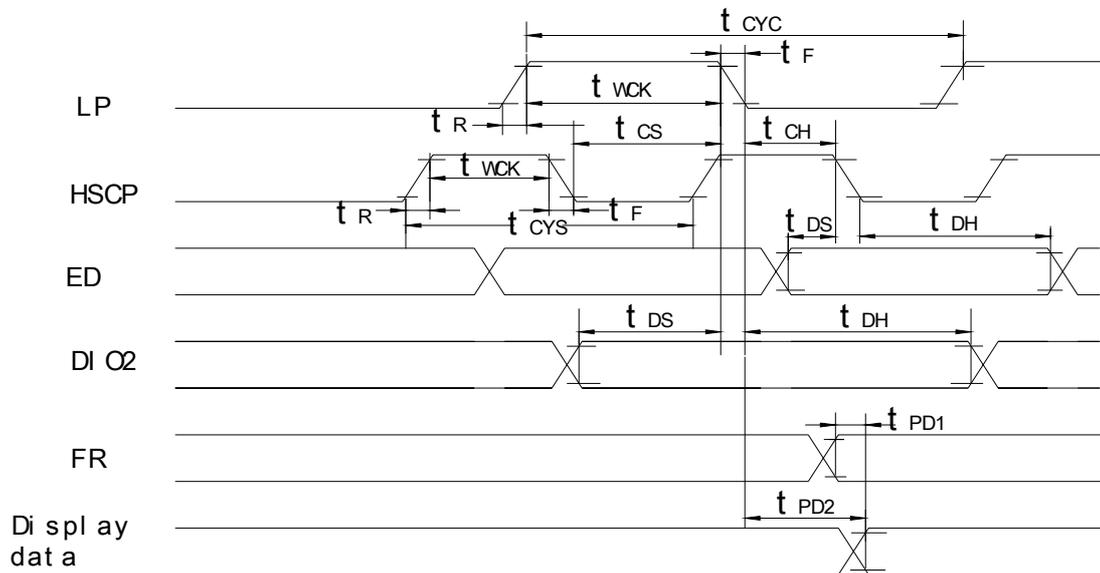
this module contian these capacitors.Please be careful about timing characteristics.
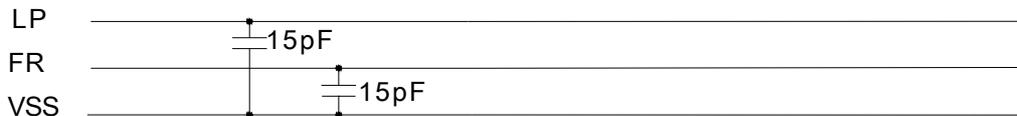
c) BACKLIGHT CHARACTERISTICS

LED BL	Symbol	Condition	Min	Typ	Max	Unit
Forward	V_f		-	4.1	-	V
Operating Current	I_r		-	300	400	mA
Luminous	L_v		-	150	-	cd/m^2
Peak Wave Lengh			-	568	-	nm

5. Operating Principles

a) PIN DESCRIPTION

CON1:

NO.	Symbol	Function	NO.	Symbol	Function
1	FG	Frame ground	8	C/D	Select Data or Instruction
2	VSS	Ground			
3	VDD	Power Supply	9	RET	Reset signal
4	V0	Power Supply for LCD	10~17	D0~D7	DATA BUS
5	/WR	Write signal	18	FS	Font Select Note 1
6	/RD	Read signal	19	BLA	Power Supply for LED
7	/CE	Chip enable Signal	20	BLK	Power Supply for LED

Note 1: FS=1,font: 5*8 or 7*8

FS=0,font: 6*8 or 8*8

CON2:

NO.	Sym.	Function	NO.	Symbol	Function
21	ED	Data	27	VDD	
22	DIO2	First line masker	28	GND	Ground
23	FR	Ac signal for LCD	29	V0	Power Supply for LCD
24	LP	Data latch signal	30	VEE	Power Supply for LCD
25	HSCP	Clock signal for shift	31	BLA	Power Supply for LED
26	NC	Non-connection	32	BLK	Power Supply for LED

b) OPERATING VOLTAGE FOR LCD DRIVING

Item	Symbol	Condition	MIN.	Typ.	MAX.	Unit
Operating voltage (1/128 duty)	VDD-V0	Ta=-20°C	-	17.4	19.0	V
		Ta=0°C	-	16.8	-	V
		Ta=25°C	-	16.2	-	V
		Ta=50°C	-	15.7	-	V
		Ta=70°C	-	15.3	-	V

c)BLOCK DIAGRAM
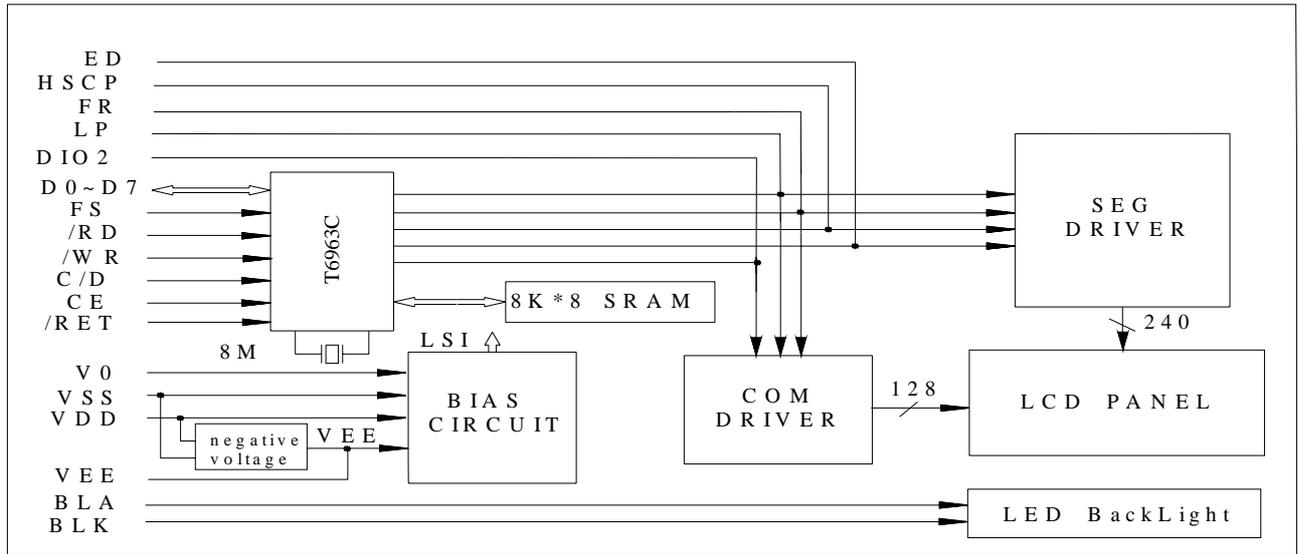
d)IC Instruction description

Please refer to T6963C and S6B0086.

6. Operating Methods
a) Interface with MPU

b) Power supply

VDD-V0: LCD driving voltage
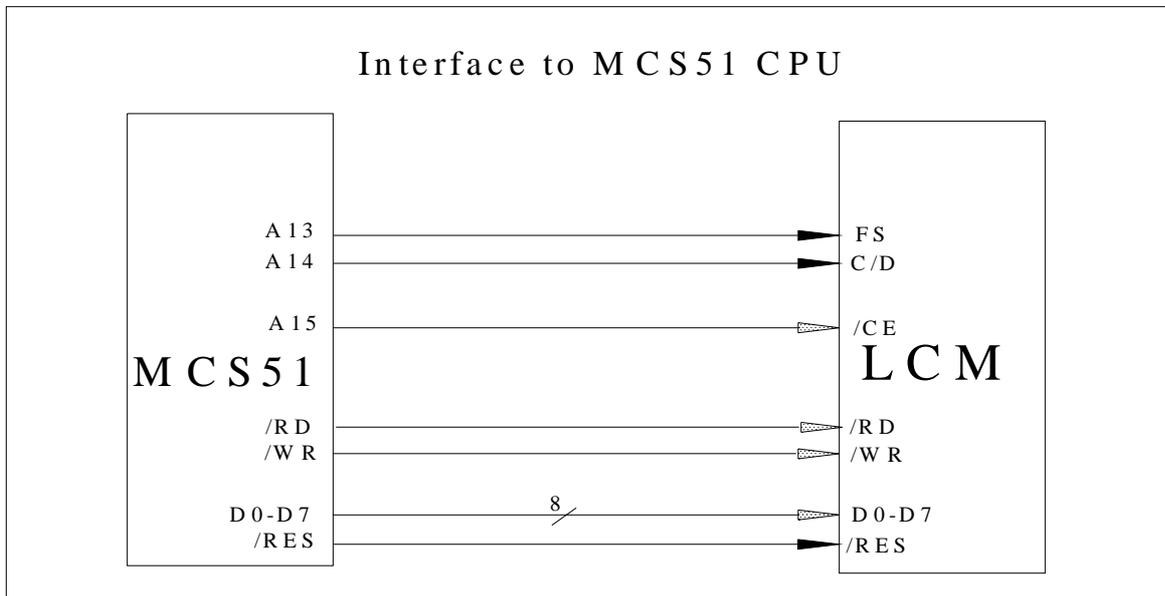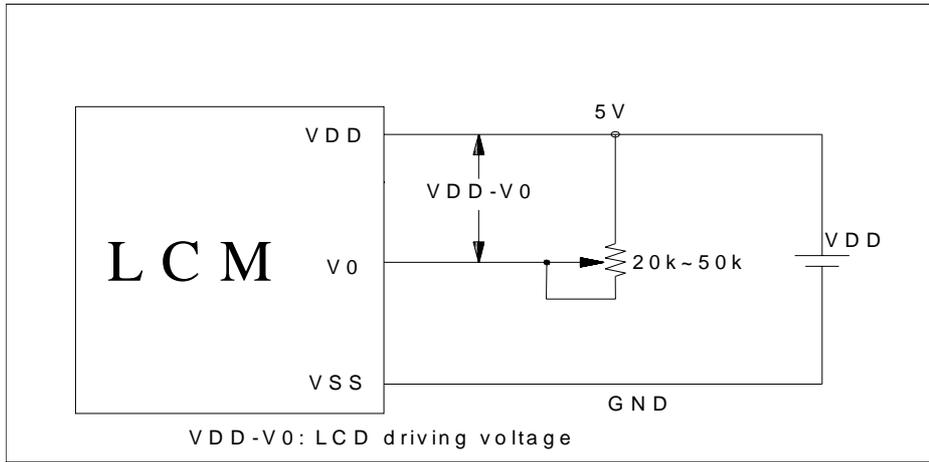
c) Operating example
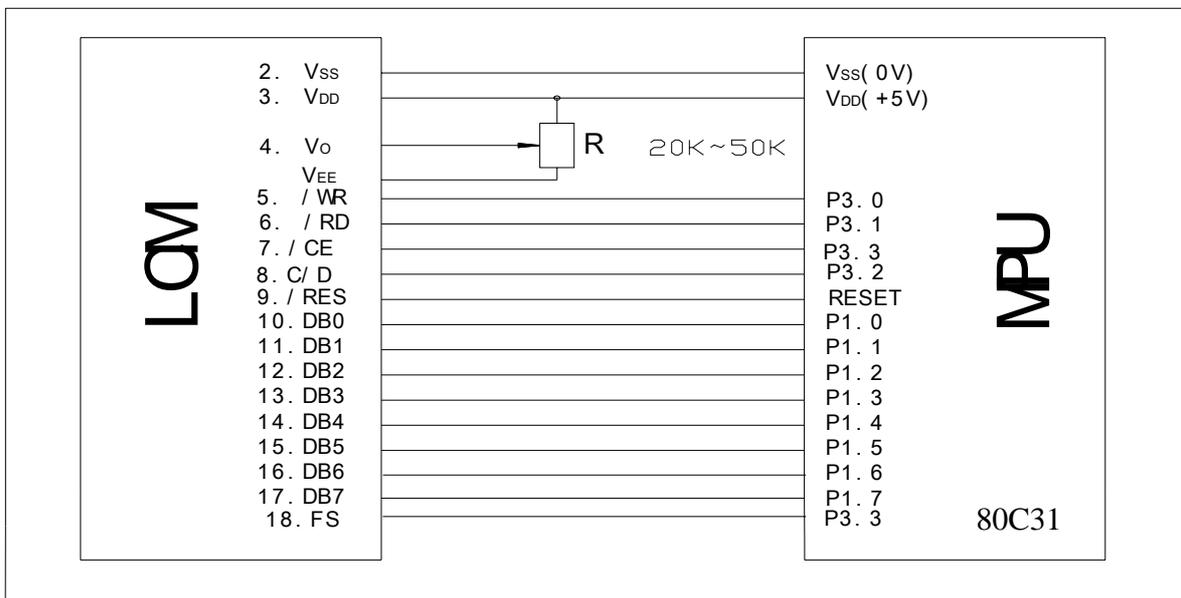
7. Precautions relation product handing

1) Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizer with anything harder than an MB pencil lead (glass, tweezers, etc.).

(3) N - hexane is recommended for cleaning the adhesives used to attach front/rear polarizer and reflectors made of organic substances which will be damaged by such chemicals as acetone, toluene, ethanol and isopropyl alcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzene. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperatures they must be warmed up in a container before coming to contact with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on it.

(9) Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals. (Some cosmetics are detrimental to the polarizer).

(10) As glass is fragile, it tends to become chipped during handling especially on the edges. Please avoid dropping or jarring.

2) Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.

Protective plate
Fitting plate
LCM
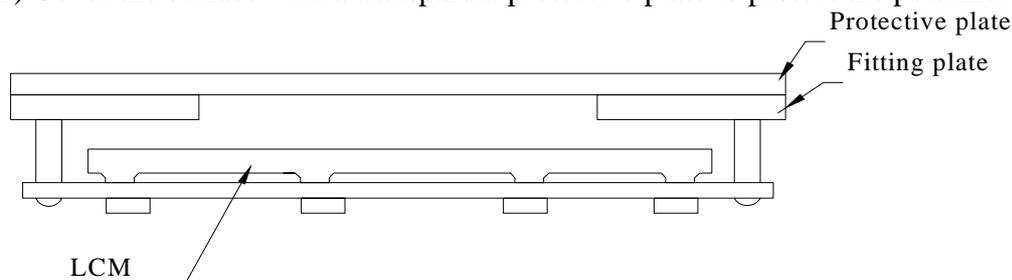
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface. Refer to the individual specifications for measurements. The measurement tolerance should be ±0.1 mm

3) Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern wiring on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or touch it with another object.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

4) Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handling LCM.

(2) Before removing LCM from its packing case or incorporating it into a set, be sure that the module and your body have the same electric potential.

(3) When soldering the terminal of LCM, make certain that the AC power source for the soldering iron does not leak.

(4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutate of the motor.

(5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

(6) To reduce the generation of static electricity be careful that the air in the working environment is not too dry. (A relative humidify of 50%-60% is recommended.)

5) Precaution for Soldering to the LCM

(1) Observe the following when soldering lead wire, connector cable, etc., to the LCM.

• Soldering iron temperature: 280°C±10°C

• Soldering time: 3-4 sec.

• Solder; eutectic solder

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When removing the electroluminescent panel from the PC board, be sure that the solder has completely melted, the soldered pad on the PC board could be damaged.

6) Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo)
   Adjust Vo to show the best contrast.

(2)Driving an LCD in the voltage above the limit shortens its life.

(3)Response time is greatly delayed at temperatures below the operating temperature range. The display area becomes dark color at temperatures above this range. However, this does not mean the LCD will be out of order; it will recover when it returns to the specified temperature range.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used in the relative condition of 40°C, 50% RH.

(6) When turning on power, input each signal after the positive/negative voltage becomes stable.

```
                              1.5us min
                    |--| |----|
    Positive voltage      _____
GND _____/
                        | 0 min. 50ms max.( for graphic)
GND _____
    Negative voltage  _____
                                | 0 min. 50ms max.( for graphic)
    Signal                    |--| |----|
GND _____
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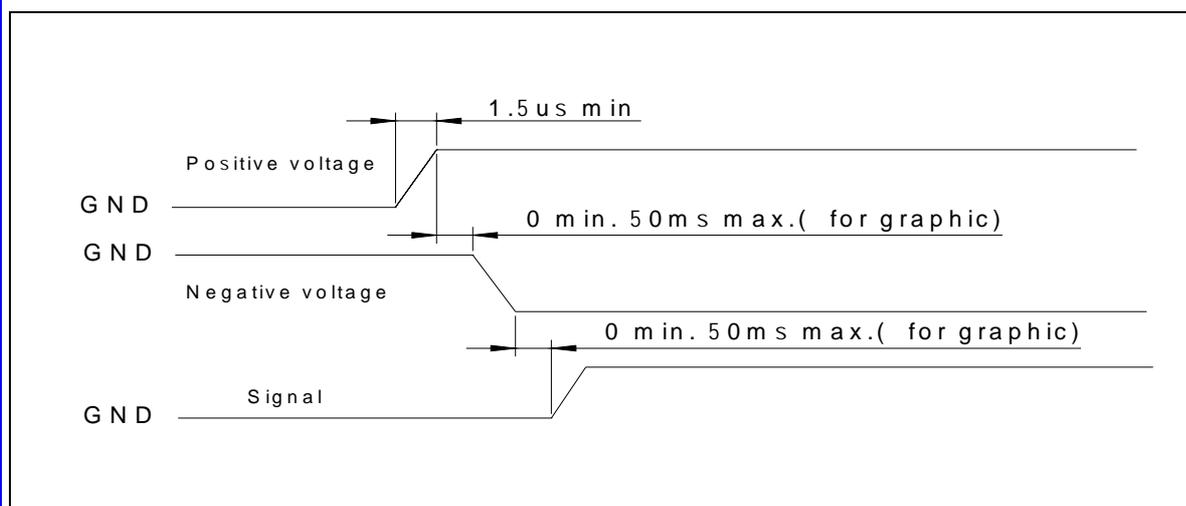
7) Storage

When storing LCD as spares for some years, the following precautions are necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there's no need for desiccant.

(2) Store them in a dark place, do not expose to sunlight or fluorescent light. Keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other object. (We advise you to store them in the container in which they were shipped).

(4) Environmental conditions:
   - Do not leave them for more than: 168 hrs. at 60°C.
   - Should not be left for more than 48 hrs. at -20°C.

8) Safety

(1) It is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

9) Limited Warranty

   Unless otherwise agreed between DigiTron and customer, DigiTron will replace or repair any of its LCD and modules which are found to be functionally defective when inspected in accordance with DigiTron LCD acceptance standards (copies available upon request), for a period of one year from date of shipments. Cosmetic/visual defects must be returned to DigiTron within 90 days of shipment. Confirmation of such date be based on freight documents. The warranty liability of TRULY is limited to repair and/or replacement on the terms set forth above. DigiTron will not be responsible for any subsequent or consequential events.

10) Return LCM under Warranty

No warranty can be granted if the precautions stated above have been disregarded. A typical examples of violations are:

- Broken LCD glass;
- PCB eyelet's damaged or modified;
- PCB conductors damaged;
- Circuit modified in any way, including addition of components;
- PCB tampered with by grinding, engraving or painting varnish;
- Soldering to or modifying the bezel in any manner. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned in antistatic packaging together with sufficient description of the failures or defects. Any connectors or cables installed by the customer must be removed completely without damaging the PCB eyelets, conductors and terminals.