


SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
MODEL	SCC0024-V01
CUSTOMER APPROVED	

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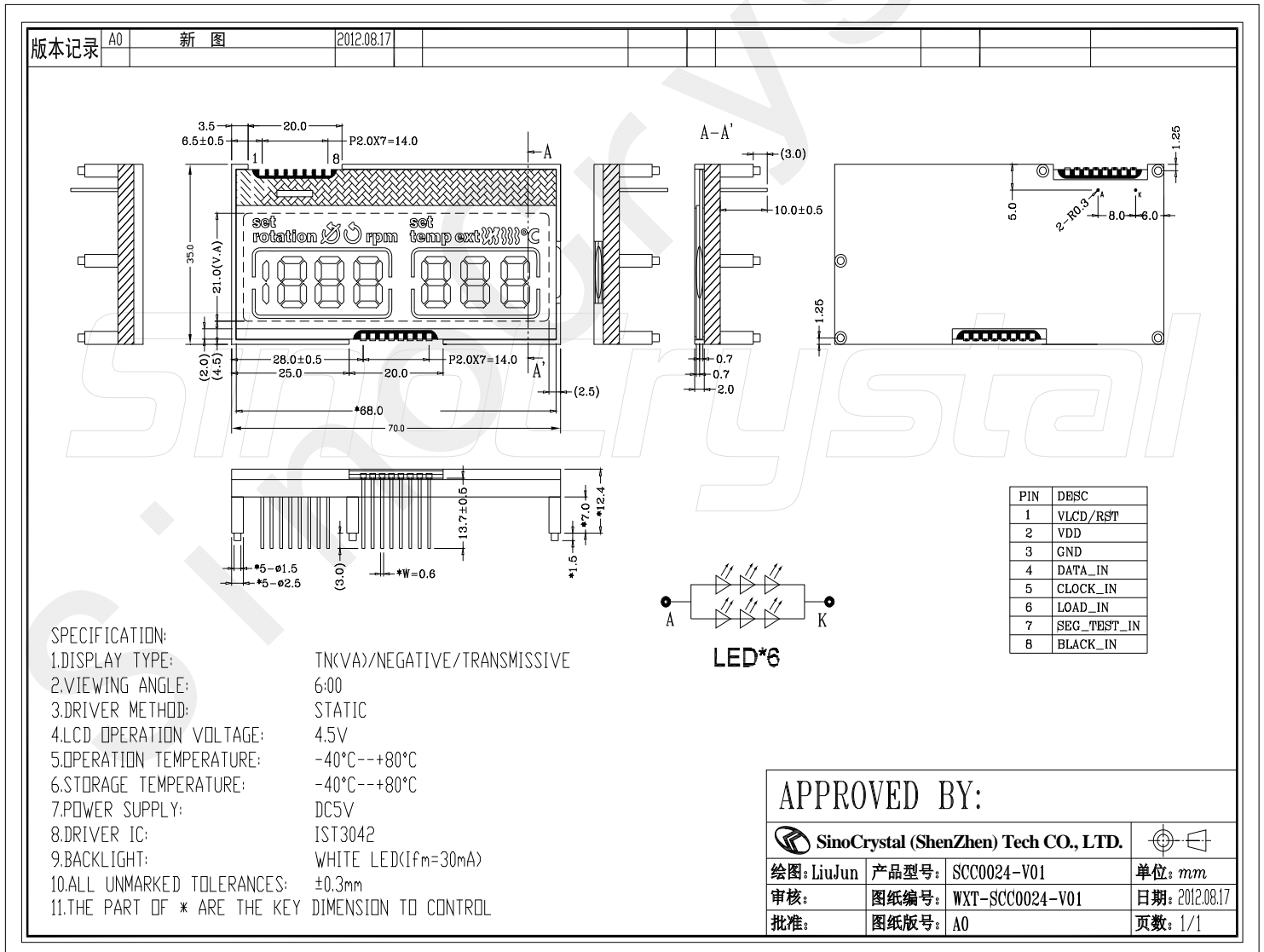
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MODULE CLASSIFICATION INFORMATION

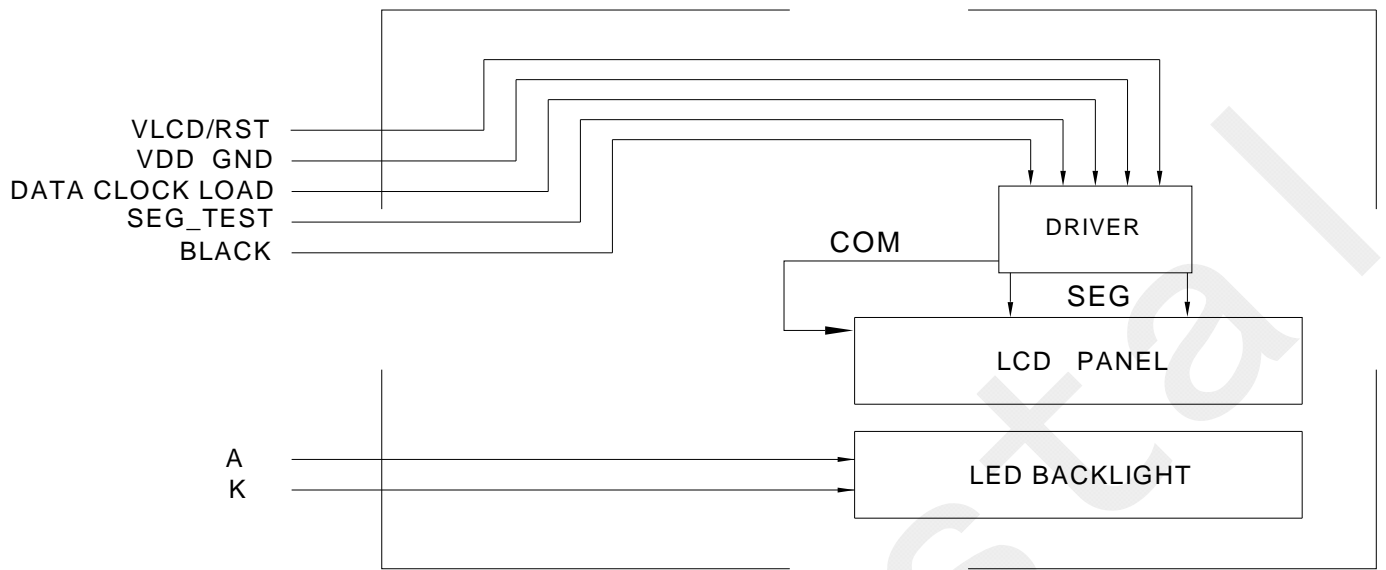
PHYSICAL DATA

ITEM	STANDARD VALUE	UNIT
NUMBER OF GRAPHIC	SEGMENT	Mm
MODULE DIMENSION	70.0×35.0×13.9	Mm
EFFECTIVE DISPLAY AREA	65.0×21.0	Mm
DOT SIZE	-	Mm
DOT PITCH	-	Mm
LCD TYPE	TN(VA)/NEGATIVE/TRANSMISSIVE	
DUTY	STATIC	
VIEWING DIRECTION	6	o'clock
BACK LIGHT TYPE	SIDE LIT LED	
BACK LIGHT COLOR	WHITE	
APPROX. WEIGHT	TBD	G

MECHANICAL DIMENSIONS



■DIAGRAM



■ INTERFACE PIN CONNECTIONS

NO	SYMBOL	LEVEL	FUNCTION
1	VLCD/RST	--	Power for LCD and Reset signal
2	VDD	--	Power supply
3	GND	--	Ground
4	DATA IN	H/L	Data signal
5	CLOCK IN	H/L	Shift clock signal
6	LOAD IN	H/L	Load signal
7	SEG TEST IN	H/L	Segment test signal
8	BLACK IN	H/L	Black signal

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply voltage for logic	VDD	2.7	5.2	V
Supply voltage for LCD	VLCD	-0.3	5.5	V
Input voltage	VI	-0.3	VDD+0.3	V
Operating temperature	TOP	-20	+70	°C
Storage temperature	TST	-30	+80	°C

■ ELECTRICAL CHARACTERISTICS

▼ DC Characteristics

Condition: VDD=+5.0V±5%, VSS=0V, VLCD=4 to 5V, Ta=-30 to +85°C

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply voltage for logic	VDD	----	4.0	5.0	5.2	V
Supply current for logic	IDD	----	-	-	-	Ma
Operating voltage for LCD	VLCD	----	4.0	4.5	5.2	V
Input voltage 'H' level	VIH	----	0.7VDD	-	VDD	V
Input voltage 'L' level	VIL	----	GND	-	0.3VDD	V
output voltage 'H' level	VOH	IOH=-150μA	0.9VDD	-	-	V
output voltage 'L' level	VOL	IOL=150μA	-	-	0.1VDD	V

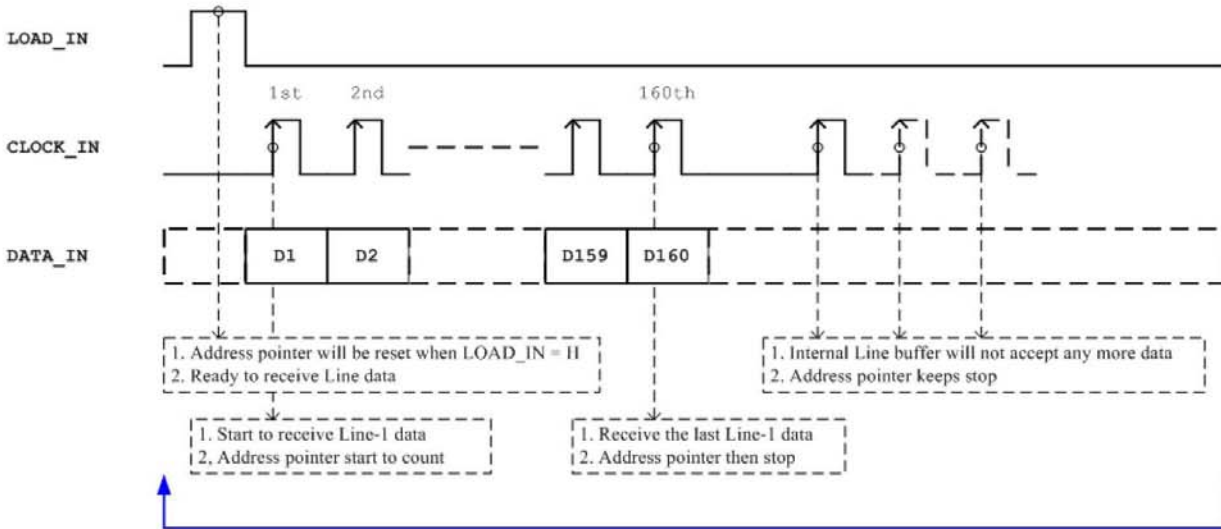
▼ AC Characteristics

DIRECT SERIAL INTERFACE SWITCHING CHARACTERISTICS

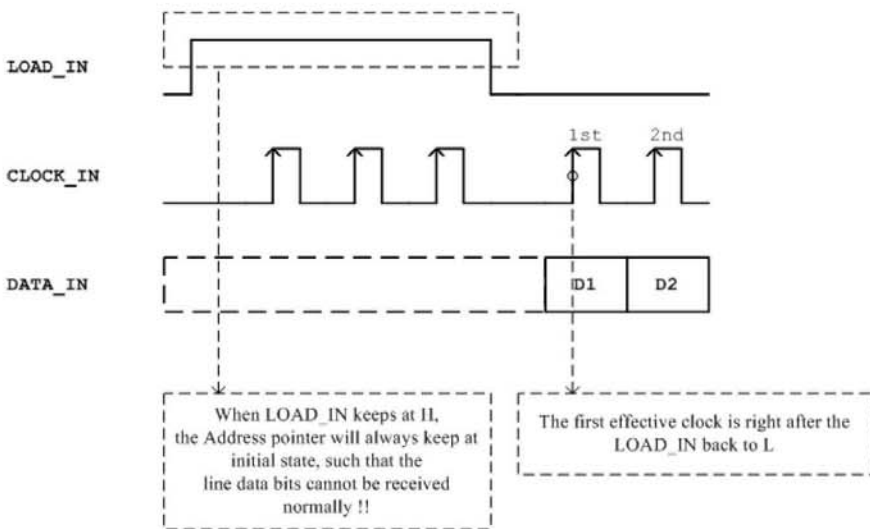
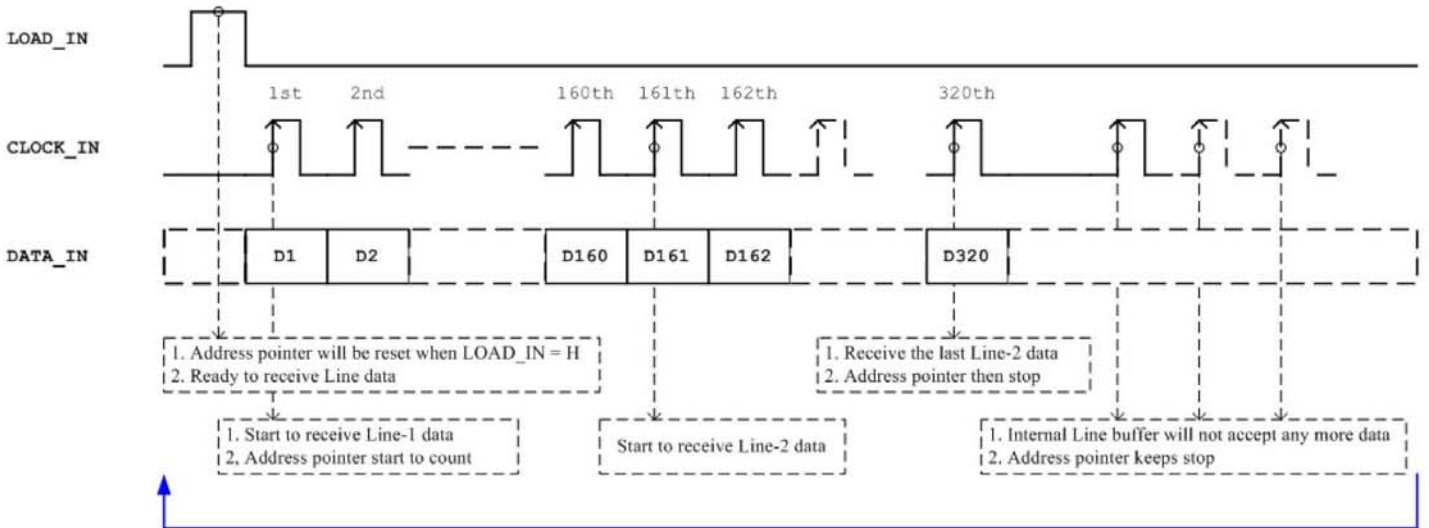
(VDD = 2.7 TO 5.5V, VLCD = 3.0 to 5.5V, Ta = -40 to +85 °C)

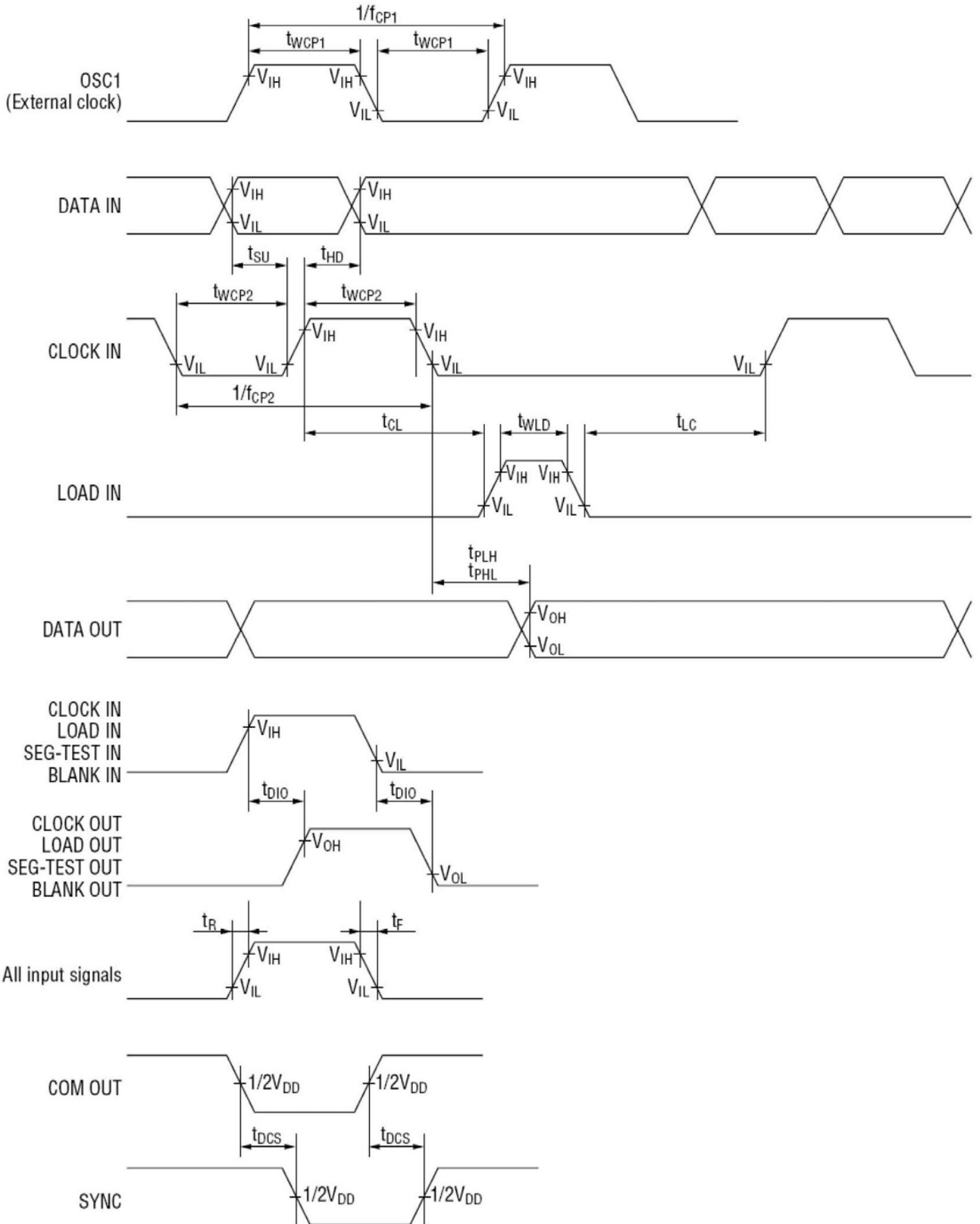
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Applicable pin
Internal RF clock frequency	f _{osc}		TBD	20	TBD	kHz	-
External clock frequency	f _{CP1}			20		kHz	OSC1
External clock pulse width	t _{wCP1}			50		us	OSC1
Data clock frequency	f _{CP2}		-	-	1	MHz	CLOCK IN
Data clock pulse width	t _{wCP2}		100	-	-	ns	CLOCK IN
Data setup time	t _{SU}		50	-	-	ns	DATA IN
Data hold time	t _{HD}		50	-	-	ns	CLOCK IN
CLOCK to LOAD Period	t _{CL}		100	-	-	ns	CLOCK IN
LOAD to CLOCK Period	t _{LC}		100	-	-	ns	LOAD IN
LOAD Pulse width	t _{wLD}		100	-	-	ns	LOAD IN
CLOCK IN to DATA OUT delay time	t _{PLH} t _{PHL}	C _L = 15 pF	-	-	50	ns	CLOCK IN DATA OUT
IN to OUT delay time	t _{DIO}	No load	-	-	20	ns	CLOCK IN/OUT LOAD IN/OUT SEG-TEST N/OUT BLANK IN/OUT
COM OUT to SYNC Delay time	t _{DCS}	C _L = 15pF	-	-	40	ns	COM OUT SYNC
Input signal rise time	t _R		-	-	50	ns	All inputs
Input signal fall time	t _F		-	-	50	ns	All inputs

(D/S=0)



(D/S=1)



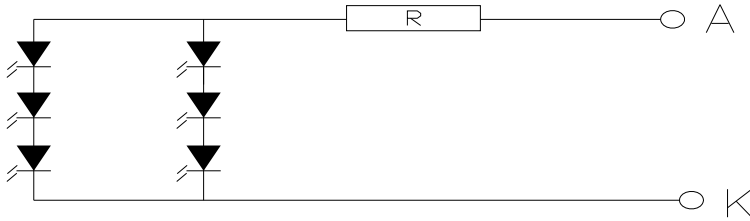


■ BACKLIGHT

▼ Backlight Type

Backlight Type: LED

▼ Power Supply For Backlight



▼ Absolute Maximum Rating

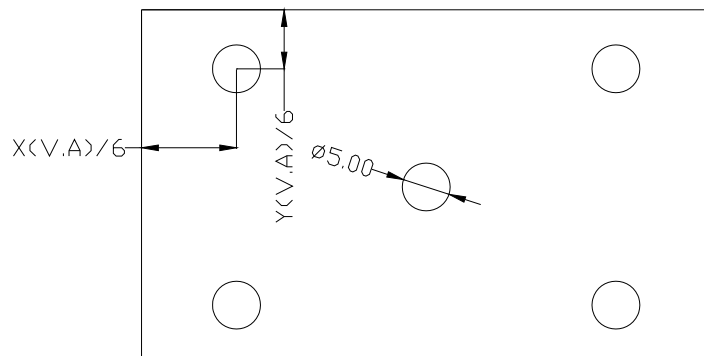
PARAMETER	SYMBOL	CONDITION	MAX	UNIT
Absolute maximum forward current	Ifm		40	Ma
Peak forward current	Ifp	1 MSEC plus 10% Duty Cycle	40	mA
Reverse voltage	VR		12	V
Life	Hour	If(forward current) = 160mA	80000	H

Note: For operation above 25°C, Then Ifm Ifp must be decreased, the Current decreased is -1.08mA/°C for DC drive and -2.58mA/°C Pulse drive, the power dissipation is -4.5mW/°C. The product working current must not more than the 70% of the Ifm or Ifp according to the working temperature.

▼ Electrical-Optical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Forward voltage	Vf (LED(+)-LED(-))		8.7	9.3	9.9	V
Forward current	If		----	30	----	mA
Reverse current	Ir	VR=5.0V	----	----	40	μA
Wavelength (Chromaticity)	λp	If(forward current) = 15mA	x=0.275 y=0.285	x=0.295 y=0.300	x=0.305 y=0.315	
Luminance	Lv	If(forward current) = 15mA	200	260		cd/m ²

Note: The Master Screen's luminance is the average value of 5 points, and The Lvmin./Lvmax. is not less than 70%. The measurement instrument is BM-7 luminance Colorimeter. The aperture is Φ5 mm.



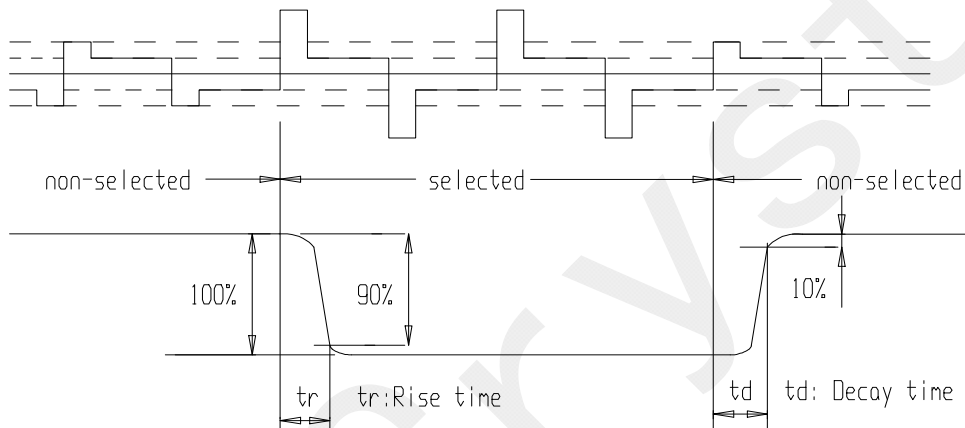
■ OPTICAL CHARACTERISTICS

Test instrument is LCD-5000, made in Japan

Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Operating voltage	Vop	25°C	9.6	9.8	10.0	V	---	---
Response time	Tr	----	----	128	400	Ms	---	1
	Td	----	----	143	400	Ms	---	1
Contrast ratio	Cr	----	----	24	----	---	---	2
Viewing angle range	θ	$Cr \geq 6$	----	60	----	Deg	$\theta = 0^\circ$	3
			----	28	----	Deg	$\theta = 180^\circ$	3

▼ Definition Of Viewing Angle

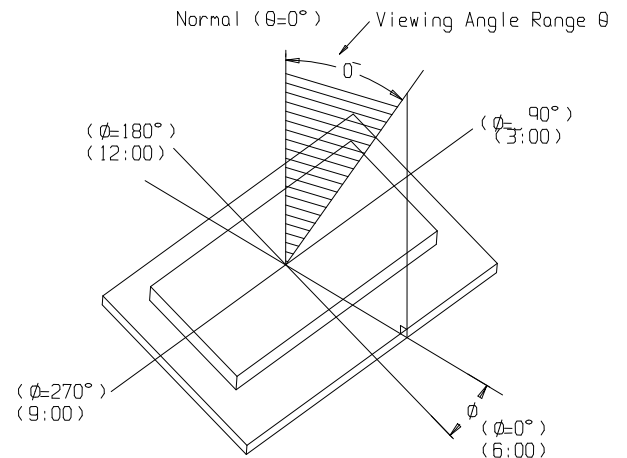
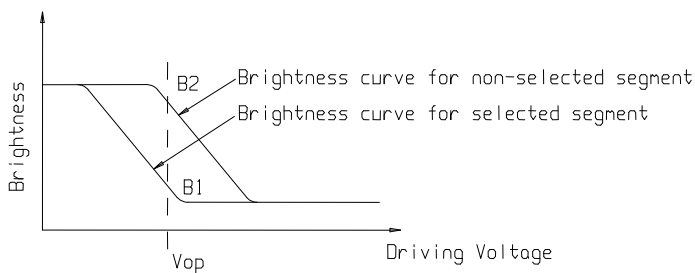
Note1: Definition of response time



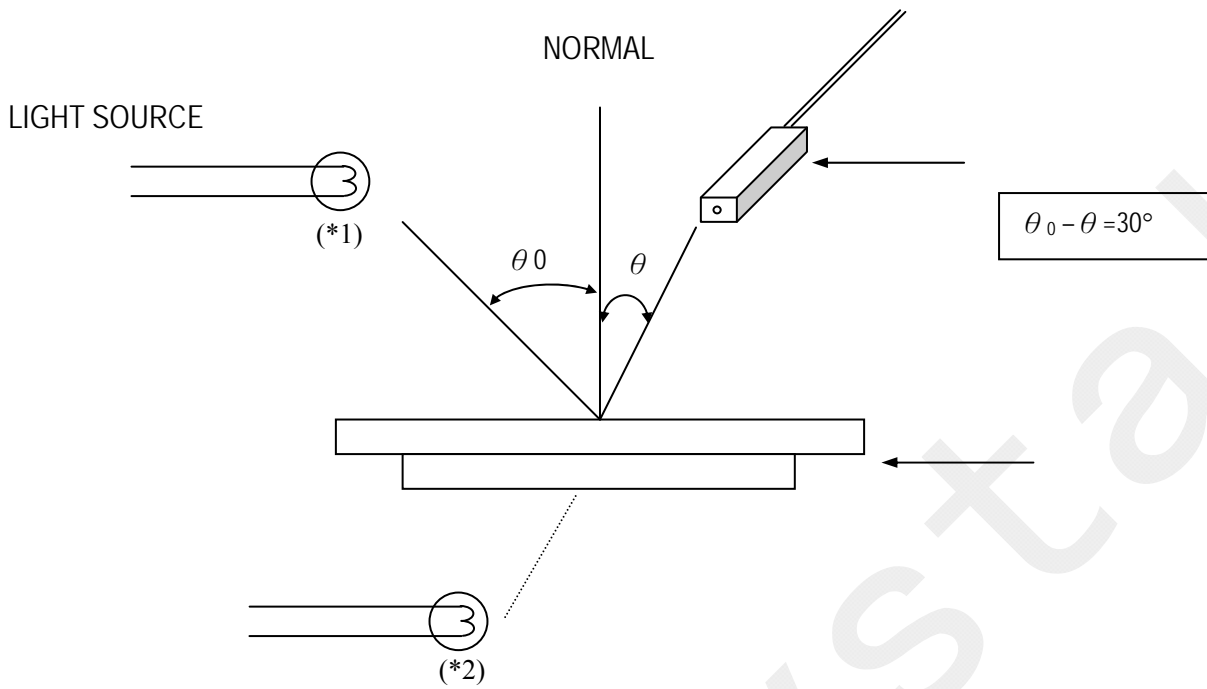
Note2: Definition of contrast ratio 'Cr'

Note3: Definition of viewing angle range ' θ '

$$Cr = \frac{\text{Brightness of non-selected segment}(B2)}{\text{Brightness of selected segment}(B1)}$$



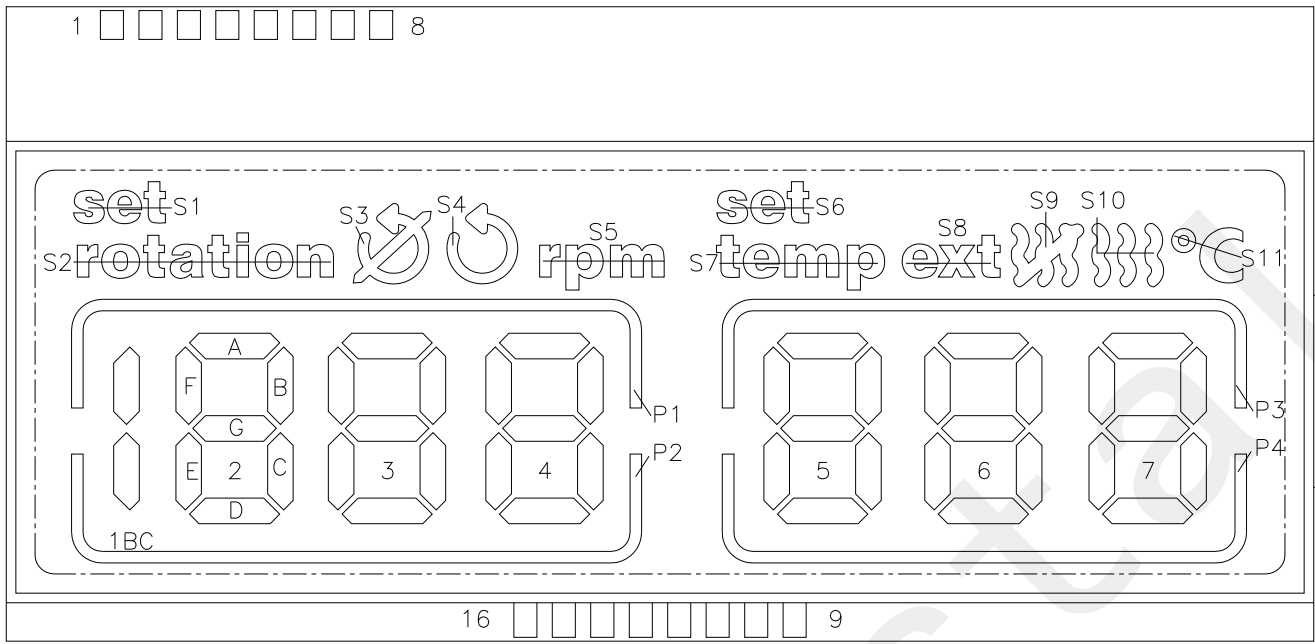
Note4: Measuring Instruments For Electro-optical Characteristics



*1. Light source position for measuring the reflective type of LCD panel

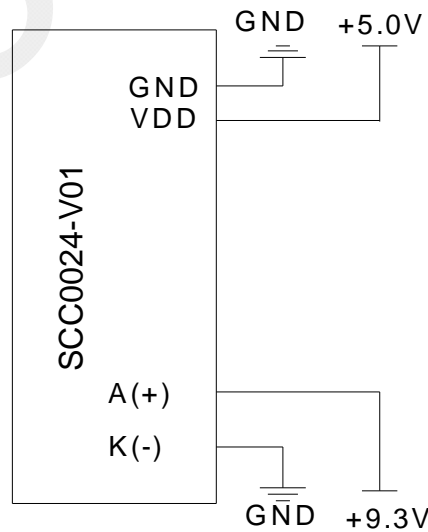
*2. Light source position for measuring the transmissive / transmissive types of LCD panel

■ DISPLAY DATA RAM ADDRESS MAP



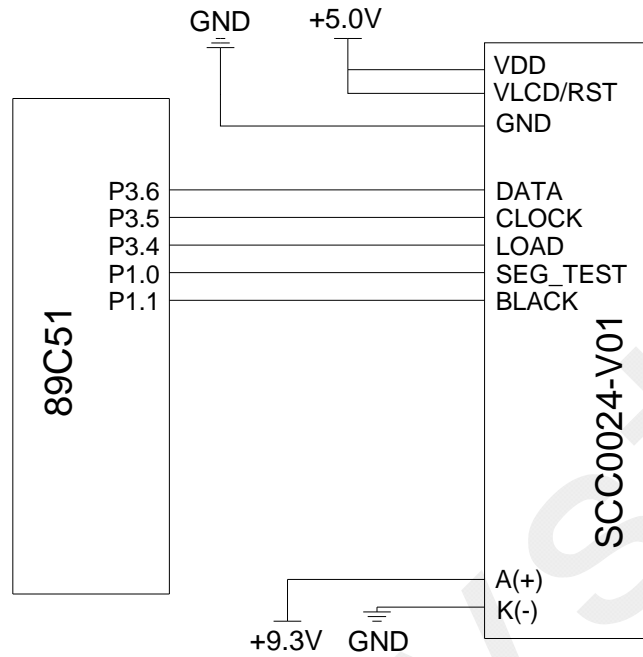
PIN	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	SEG11	SEG12	SEG13	SEG14	SEG15	SEG16	SEG17	SEG18	SEG19	SEG20
COMA	P4	6E	6D	6C	7D	7C	7B	7A	7F	7E	6G	6B	6A	6F	P3	S11	S10	S9	S8	
PIN	SEG21	SEG22	SEG23	SEG24	SEG25	SEG26	SEG27	SEG28	SEG29	SEG30	SEG31	SEG32	SEG33	SEG34	SEG35	SEG36	SEG37	SEG38	SEG39	SEG40
COMA	S7	S6	5C	5B	5A	5F	5G	5E	5D	3E	3D	3C	4D	4C	4G	4B	4A	4F	4E	3G
PIN	SEG41	SEG42	SEG43	SEG44	SEG45	SEG46	SEG47	SEG48	SEG49	SEG50	SEG51	SEG52	SEG53	SEG54	SEG55	SEG56	SEG57	SEG58		
COMA	3B	3A	3F	S5	S4	S3	S2	S1	P1	2C	2B	2A	2F	2G	2E	2D	1BC	P2		

■ POWER SUPPLY FOR LCM MODULE



■ **EXAMPLE**

▼ **Application Circuit (Serial interface)**



■ RELIABILITY

▼ Content of Reliability Test

Environmental Test				
No.	Test Item	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80 °C 200 hrs	----
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30 °C 200 hrs	----
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70 °C 200 hrs	----
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20 °C 200 hrs	----
5	High temperature / Humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	50 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
6	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40 °C 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. $\begin{array}{ccccc} -20^{\circ}\text{C} & \rightleftharpoons & 25^{\circ}\text{C} & \rightleftharpoons & 70^{\circ}\text{C} \\ 30\text{min.} & \leftarrow & 5\text{min.} & \rightarrow & 30\text{min.} \\ & & \text{1 cycle} & & \end{array}$	-20°C / 70°C 10 cycles	----
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz → 1.5mmp-p 22~500Hz → 1.5G Total 0.5hrs	MIL-202E-201A JIS-C5025 JIS-C7022-A-10
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G half sign wave 11 msdc 3 times of each direction	MIL-202E-213B
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115 mbar 40 hrs	MIL-202E-105C
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V , RS=1.5 kΩ CS=100 pF 1 time	MIL-883B-3015.1

*** Supply voltage for logic system = 5V. Supply voltage for LCD system = Operating voltage at 25°C.

▼ Failure Judgement Criterion

Criterion Item	Test Item No.											Failure Judgment Criterion	
	1	2	3	4	5	6	7	8	9	10	11		
Basic specification													Out of the Basic Specification
Electrical characteristic													Out of the DC and AC Characteristic
Mechanical characteristic													Out of the Mechanical Specification Color change : Out of Limit Apperance Specification
Optical characteristic													Out of the Apperance Standard

■ INSPECTION CRITERIA

■ PRECAUTIONS FOR USING LCD MODULES

▼ Handing Precautions

- (1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- (2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- (5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents :
 - Isopropyl alcohol
 - Ethyl alcohol
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solvents
- (7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

■ USING LCD MODULES

▼ Liquid Crystal Display Modules

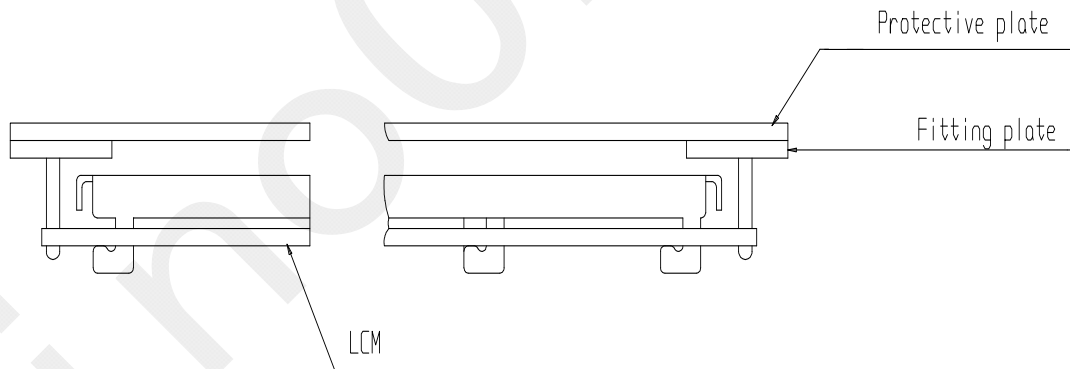
LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (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 polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).
- (3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.
- (4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. 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 with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- (8) Do not put or attach anything on the display area to avoid leaving marks on.
- (9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).
- (10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

▼ 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.



- (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.

▼ 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 writing on the printed circuit board.
- (4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(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.

▼ **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 remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.

(3) When soldering the terminal of LCM, make certain 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 commutator 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 work is not too dried. A relative humidity of 50%-60% is recommended.

▼ **Precaution for soldering to the LCM**

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

- Soldering iron temperature : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$.

- 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 remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

▼ **Precautions for Operation**

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

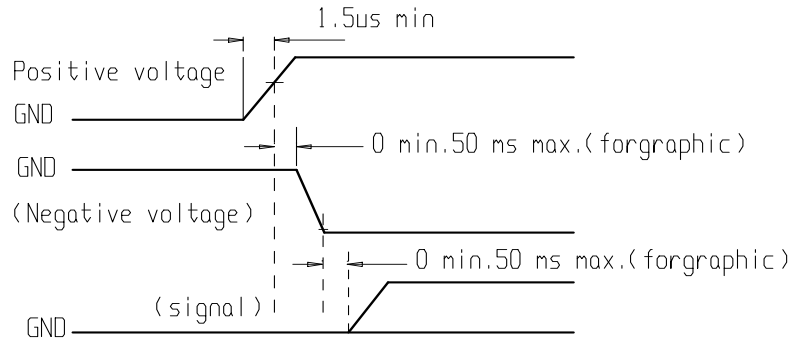
(2) Driving the LCD in the voltage above the limit shortens its life.

(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the 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 under the relative condition of 40°C , 50% RH.

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



▼ Storage

When storing LCD's as spares for some years, the following precaution are necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.
- (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 objects. (We advise you to store them in the container in which they were shipped.)
- (4) Environmental conditions :
 - Do not leave them for more than 168hrs. at 80°C.
 - Should not be left for more than 48hrs. at -30°C.

▼ Safety

- (1) It is recommended to crush damaged or unnecessary LCD's into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

▼ Limited Warranty

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

▼ Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The 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 with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.