ZX12864P-12DYSWSN

MAR 20 ,2006

Version 1.0

RECORDS OF REVISION

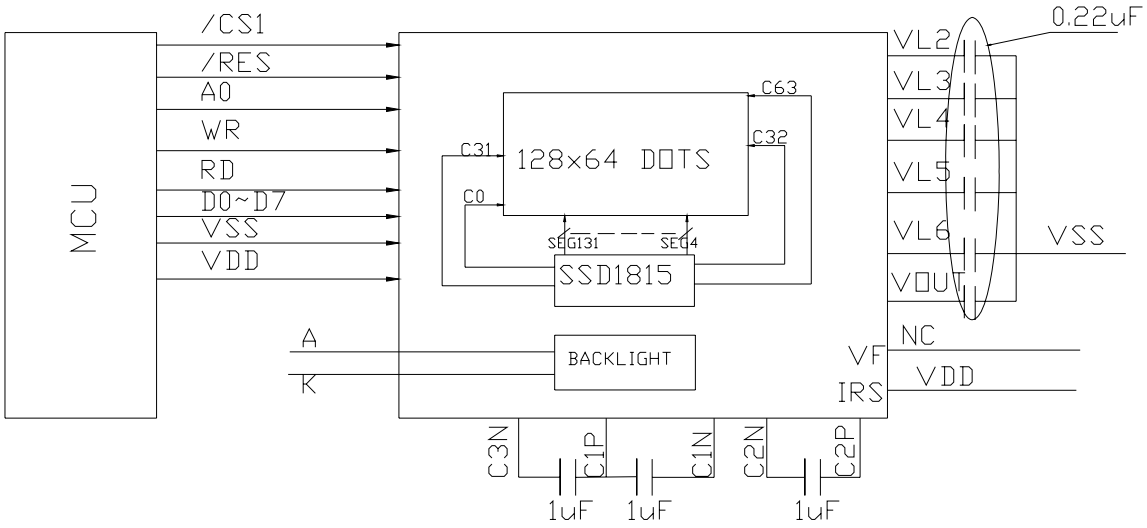
DATE	REVISED NO.	REVISED DESCRIPTIONS	PREPARED	CHECKED	APPROVED
Mar 20，2006	1.00	FIRST ISSUE	HCC		

CONTENTS

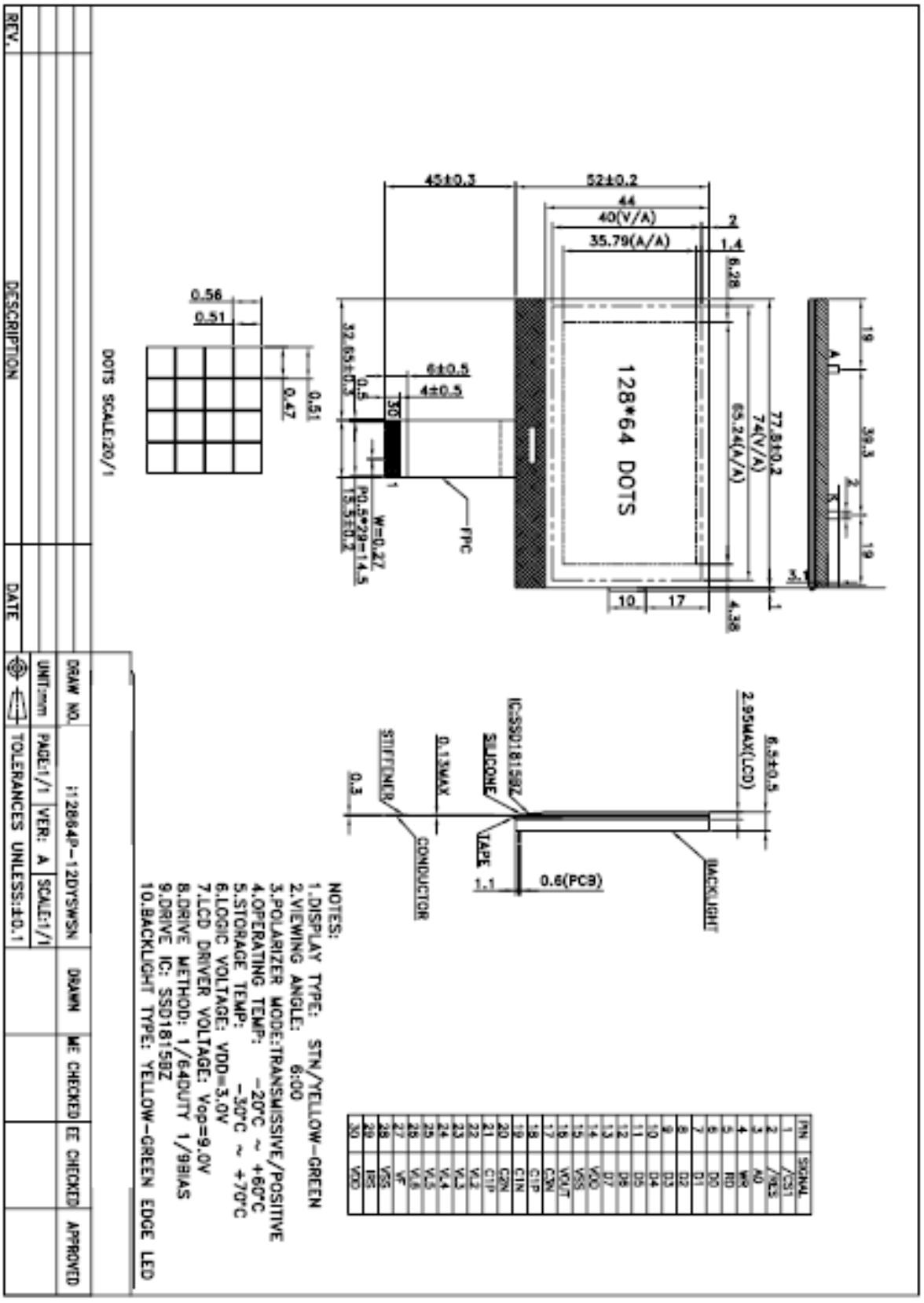
1. FEATURES：

ITEM	STANDARD VALUE	UNIT
Display Type	128 *64 dots	-
LCD Type	STNYELLOW-GREEN,Transmissive,Positive	-
LCD Duty	1/64	-
Viewing Direction	6:00	
Backlight Type	YELLOW-GREEN EDGE LED	-
Interface	8-bit 8080 MPU	-
Driver IC	SSD1815BZ	-
LCD Bias	1/9	-
Module Dimension	77.8(W) X 97.0(H) X2.95(T)	mm
Effective Display Area	65.24(W) X35.79(H)	mm
Dot Size	0.47(W) X 0.51(H)	mm
Dot Pitch	0.51W) X 0.56 (H)	mm

2. BLOCK DIAGRAM &APPLICATION CIRCUIT：



3. OUTLINE DIMENSIONS



4. ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
POWER SUPPLY FOR LOGIC	VDD	Ta=25℃	-0.3	—	4.0	V
POWER SUPPLY FOR LCD	VEE		0		12	
INPUT VOLTAGE	VIN	Ta=25℃	VSS-0.3	—	VDD+0.3	V
Module OPERATION TEMPERATURE	TOPR	---	-20	—	+60	℃
Module STORAGE TEMPERATURE	TSTG	---	- 30	—	+70	℃
Storage Humidity	H_D	Ta < 40 °C	-		90	%RH

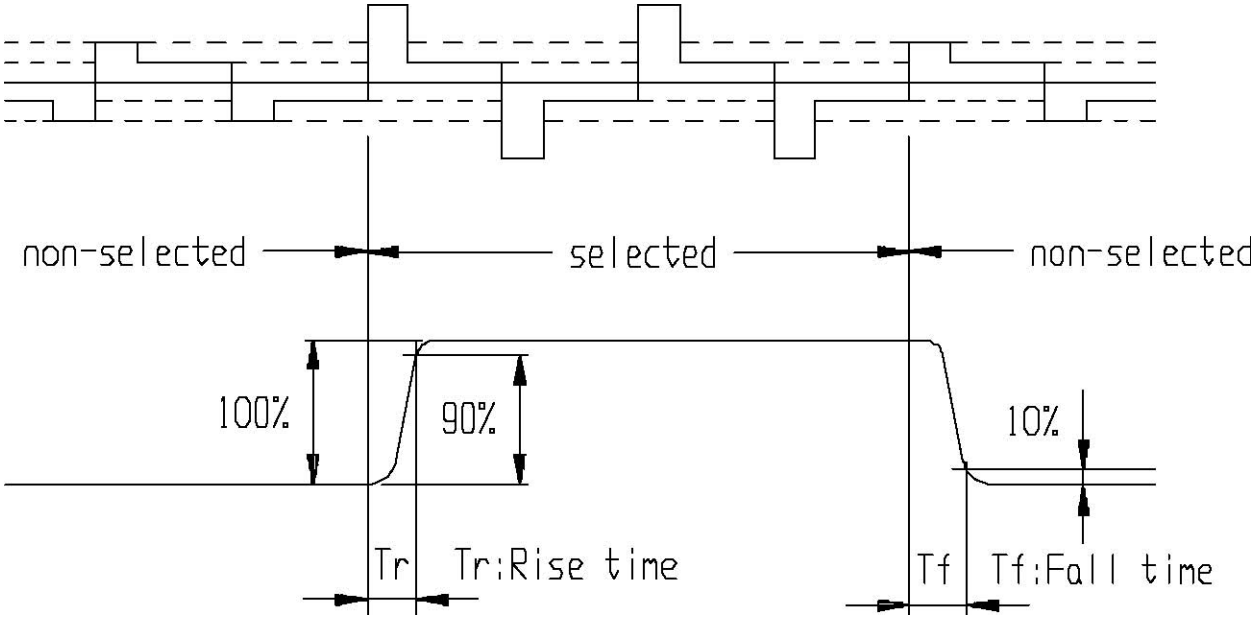
5. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage (logic)	VDD-VSS	-	2.9	3.0	3.1	V
Supply Voltage (LCD)	VDD-V0	Ta= +25℃	8.8	9.0	9.2	V
Input signal voltage	V-IH	“H” level	0.8VDD	-	VDD	V
	V-IL	“L” level	0	-	0.2 VDD	V
Output signal voltage	V-OH	“H” level	0.9VDD	-	VDD	V
	VOL	“L” level	0	-	0.1VDD	V
Supply Current (logic)	IDD	VDD=3.V	-	0.1	0.15	mA
Backlight Voltage	V-BL	-	2.9	3.0	3.1	V
Backlight Current	I-BL	-	-	80		mA

6. OPTICAL CHARACTERISTICS

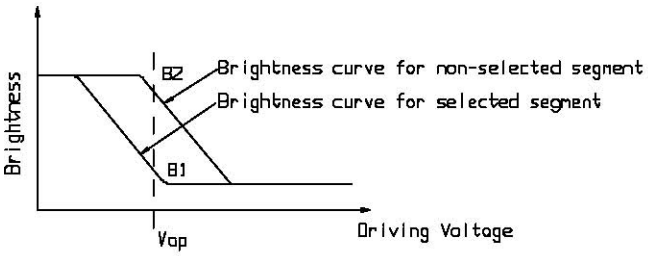
Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Response Time	Tr	-	-	110	220	ms	-	1
	Tf	-	-	260	520	ms	-	1
Contrast Ratio	Cr	-	-	3	-	-	-	2
Viewing Angle Range	θ	Cr≥ 2	-	-	30	deg	Ø= 90	3
			-	-	30	deg	Ø = 270	3
			15	-	105	deg	Ø = 0	3
			-	-	-	deg	Ø = 180	3

Note 1. Definition of response time

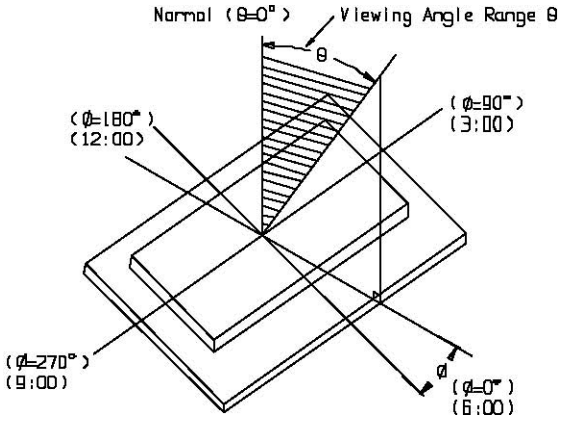


Note 2. Definition of Contrast Ratio 'Cr'

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



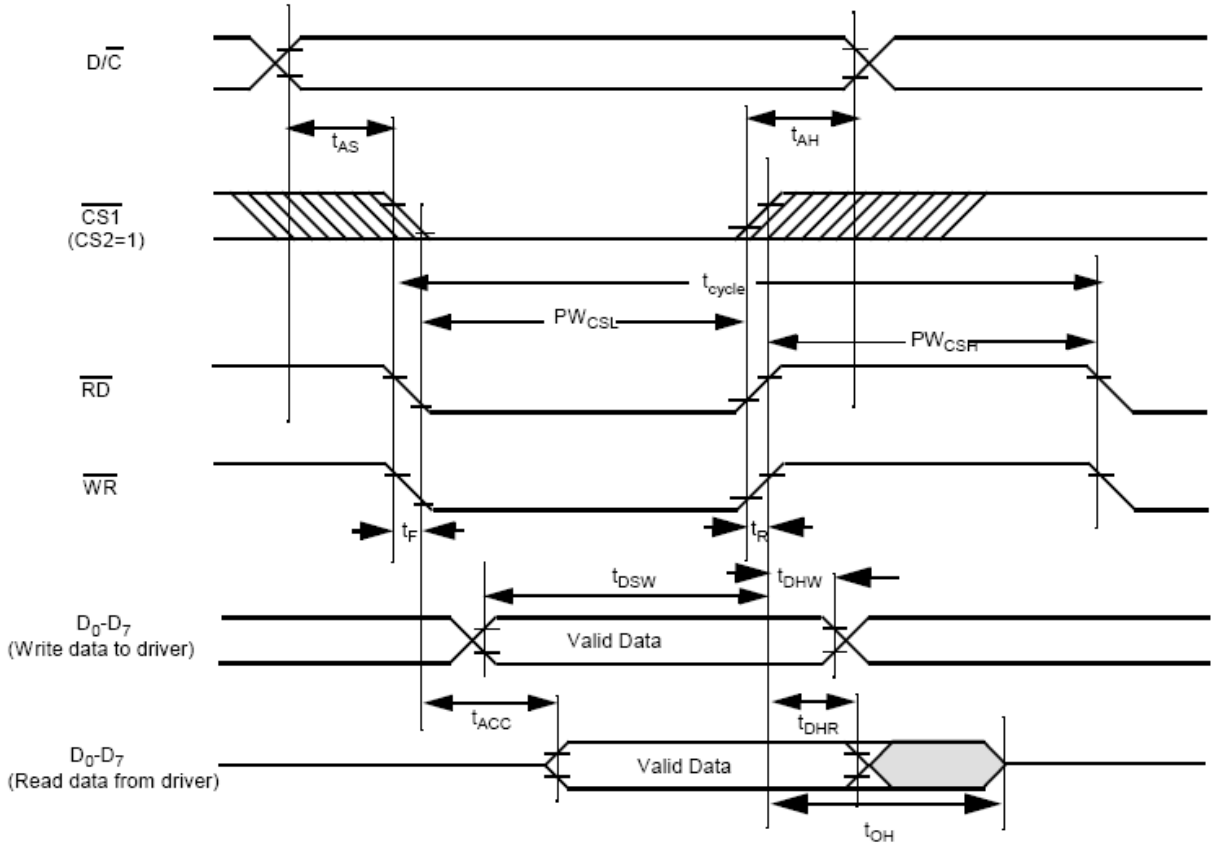
Note 3. Definition of Viewing Angle Range 'q'



7.TIMING CHARACTERISTICS

8080-Series MPU Parallel Interface Timing Characteristics (V_{DD} - V_{SS} = 2.4 to 3.5V, T_A = -30 to 85°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	- -	- -	ns ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	- -	- -	ns ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns



8.Display Control Instruction

COMMAND TABLE

Bit Pattern	Write Command (D/C=0, R/W(WR)=0, E(RD)=1)	Comment
0000$X_3X_2X_1X_0$	Set Lower Column Address	Set the lower nibble of the colume address register using $X_3X_2X_1X_0$ as data bits. The initial display line register is reset to 0000b during POR.
0001$X_3X_2X_1X_0$	Set Higher Column Address	Set the higher nibble of the colume address register using $X_3X_2X_1X_0$ as data bits. The initial display line register is reset to 0000b during POR.
00100$X_2X_1X_0$	Set Internal Regulator Resistor Ratio	Internal regulator gain increases as $X_2X_1X_0$ increased from 000b to 111b. At POR, $X_2X_1X_0$ = 100b.
00101$X_2X_1X_0$	Set Power Control Register	X_0=0: turns off the output op-amp buffer (POR) X_0=1: turns on the output op-amp buffer X_1=0: turns off the internal regulator (POR) X_1=1: turns on the internal regulator X_2=0: turns off the internal voltage booster (POR) X_2=1: turns on the internal voltage booster
01$X_5X_4X_3X_2X_1X_0$	Set Display Start Line	Set display RAM display start line register from 0-63 using $X_5X_4X_3X_2X_1X_0$. Display start line register is reset to 000000 during POR.
10000001 * * $X_5X_4X_3X_2X_1X_0$	Set Contrast Control Register	Set Contrast level from 64 contrast steps. Contrast increases (V_{LC} decreases) as $X_5X_4X_3X_2X_1X_0$ is increased. $X_5X_4X_3X_2X_1X_0$ = 100000b (POR)
1010000X_0	Set Segment Re-map	X_0=0: column address 00h is mapped to SEG0 (POR) X_0=1: column address 83h is mapped to SEG0 Refer to Figure 5 for example.
1010001X_0	Set LCD Bias	X_0=0: 1/9 bias (POR) X_0=1: 1/7 bias For setting bias ratio to 1/4, 1/5, 1/6 or 1/8, see Extended Command Table.
1010010X_0	Set Entire Display On/Off	X_0=0: normal display (POR) X_0=1: entire display on
1010011X_0	Set Normal/Reverse Display	X_0=0: normal display (POR) X_0=1: reverse display
1010111X_0	Set Display On/Off	X_0=0: turns off LCD panel (POR) X_0=1: turns on LCD panel
1011$X_3X_2X_1X_0$	Set Page Address	Set GDDRAM Page Address (0-8) using $X_3X_2X_1X_0$
1100X_3 * * *	Set COM Output Scan Direction	X_3=0: normal mode (POR) X_3=1: remapped mode, COM0 to COM[N-1] becomes COM[N-1] to COM0 when Multiplex ratio is equal to N. See Figure 5 as an example for N equal to 64.
11100000	Set Read-Modify-Write Mode	Read-modify-write mode will be entered in which the column address will not be incremented during display data read. At POR, Read-modify-write mode is turned OFF.
11100010	Software Reset	Initialize the internal status register.
11101110	Set End of Read-Modify-Write Mode	Exit Read-modify-write mode. Column address before entering the mode will be restored. At POR, Read-modify-write mode is OFF.
1010110X_0 * * * * * * X_1X_0	Set Indicator On/Off Indicator Display Mode, This second byte command is required ONLY when "Set Indicator On" command is sent.	X_0 = 0: Indicator off (POR, no need of second command byte) X_0 = 1: Indicator on (second command byte required) X_1X_0 = 00: Indicator off X_1X_0 = 01: Indicator on and blinking at ~1 second interval X_1X_0 = 10: Indicator on and blinking at ~1/2 second interval X_1X_0 = 11: Indicator on constantly
11100011	NOP	Command for No Operation
11110000	Test Mode Reset	Reserved for IC testing. Do NOT use.
1111 * * * *	Set Test Mode	Reserved for IC testing. Do NOT use.
* * * * * * * *	Set Power Save Mode	Standby or sleep mode will be entered with compound commands

Bit Pattern	Read Command (D/C=0, R/W(WR)=1, E(RD)=0)	Comment
$D_7D_6D_5D_4D_3D_2D_1D_0$ (Data Read Back from the driver)	Status Register Read	D_7=0: Indicates an internal operation is completed. D_7=1: Indicates an internal operation is in progress. D_6=0: Indicates reverse segment mapping with column address D_6=1: Indicates normal segment mapping with column address D_5=0: Indicates the display is ON D_5=1: Indicates the display is OFF D_4=0: Initialization is not in progress D_4=1: Initialization is in progress after RES or software reset $D_3D_2D_1D_0$ = 1010, these 4-bit is fixed to 1010 which could be used to identify as Solomon Systech Device.

EXTENDED COMMAND TABLE

Bit Pattern	Command	Comment
10101000 $00X_5X_4X_3X_2X_1X_0$	$X_5X_4X_3X_2X_1X_0$: Set Multiplex Ratio	To select multiplex ratio N from 2 to 65 [Included Icon Line]. N = $X_5X_4X_3X_2X_1X_0$ + 2, eg. N = 111111b + 2 = 65 (POR)
10101001 $X_7X_6X_5X_4X_3X_2X_1X_0$	X_1X_0: Set Bias Ratio	X_1X_0 = 00: 1/8, 1/6 X_1X_0 = 01: 1/6, 1/5 X_1X_0 = 10: 1/9, 1/7 (POR) X_1X_0 = 11: Prohibited
	$X_4X_3X_2$: Set TC Value	$X_4X_3X_2$ = 000: -0.01%/C (TC0, POR) $X_4X_3X_2$ = 010: -0.10%/C (TC2) $X_4X_3X_2$ = 100: -0.18%/C (TC4) $X_4X_3X_2$ = 111: -0.25%/C (TC7) $X_4X_3X_2$ = 001, 011, 101, 110: Reserved
	$X_7X_6X_5$: Modify Osc. Freq.	Increase the value of $X_7X_6X_5$ will increase the oscillator frequency and vice versa. This command is not recommended to be used. $X_7X_6X_5$ = 011(POR)
$1010101X_0$	X_0: Set 1/4 Bias Ratio	X_0 = 0: use Normal Setting (POR) X_0 = 1: fixed at 1/4 Bias
11010010 $0X_6X_500010$	X_6X_5: Set Total Frame Phases	The On/Off of the Static Icon is given by 3 phases/1 phase overlapping of the M and MSTAT signals. This command set how many phases of dividing the M/MSTAT signals for each frame. The more the phases, the less the overlapping and thus the lower the effective driving voltage. X_6X_5 = 00: 3 phases X_6X_5 = 01: 5 phases X_6X_5 = 10: 7 phases (POR) X_6X_5 = 11: 16 phases
11010011 $00X_5X_4X_3X_2X_1X_0$	$X_5X_4X_3X_2X_1X_0$: Set Display Offset (for mux ratio has been set less than 64 only)	After POR, $X_5X_4X_3X_2X_1X_0$ = 0 After setting mux ratio less than 64, data will be displayed at Center of matrix. See Table 1. To move display towards Row 0 by L, $X_5X_4X_3X_2X_1X_0$ = L To move display away from Row 0 by L, $X_5X_4X_3X_2X_1X_0$ = 64-L Note: max. value of L = (64 - display mux)/2

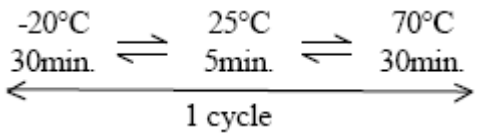
Note: Patterns other than that given in Command Table and Extended Command Table are prohibited to enter to the chip as a command. Otherwise, unexpected result will occurs.

9.INTERFACE PIN CONNECTIONS

PIN	SYMBOL	I/O	FUNCTION
1	/CS1	-	This pin is the chip select input. The chip is enabled for mcp communication only when /CS1 is pulled low.
2	/RES	-	This pin is reset signal input.Initialization of the chip is started once this pin is pulled low.
3	A0	I	When the pin is pulled high,the data at D7~D0 is treated as display data.When the pin is pulled Low, the data at D7~D0 will be tranferred to the command register.
4	WR	I	Data write operation is initiate when this pin is pulled low when the chip is selected.
5	RD	I/O	Data read operation is initiate when this pin is pulled low when the chip is selected.
6~13	D0~D7	I/O	8-bit bi-directional data bus
14	VDD	I	Power supply pin.
15	VSS	I	Ground.
16	VOUT	I	This is the most negative voltage supply pin of the chip.
17	C3N	I	When internal DC-DC voltage converter is used, external capacitor(s) is/are connected between These pins.Details please refer to BLOCK DIAGRAM &APPLICATION CIRCUIT
18	C1P	I	
19	C1N	I	
20	C2N	I	
21	C2P	I	
22	VL2	I	LCD driving voltates.They can be supplied externally or generated by the internal bias divider. Details please refer to BLOCK DIAGRAM &APPLICATION CIRCUIT
23	VL3	I	
24	VL4	I	
25	VL5	I	
26	VL6		This pin is the most negative LCD driving voltage. It can be supplied externally or generated by the internal regulator.
27	VF		This pin is the input of the built-in voltage regulator.When external resester network is selected to generate the LCD driving level, VL6,two external resistors,R1and R2,are connected between VDD and VF ,and VF and VL6,respectively.
28	VSS		Ground.
29	IRS		When this pin is pulled high the internal resistors will be enalbed,and when it is low,the external resistors,R1 and R2, should be connected to VDD and VF,and VF and VL6,respectively
30	VDD		Power supply pin.

10.RELIABILITY

Content of Reliability Test

No.	Test Item	Content of Test	Test Condition	Applicable Standard
		Environmental Test		
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80 ℃ 200 hrs	
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30 ℃ 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 ℃ 200 hrs	
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20 ℃ 200 hrs	
5	High temperature Humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	50 ℃ , 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.	50 ℃ , 90 RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. 	-20℃ – 70℃ 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 1l msedc 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 k CS=100 pF 1 time	MIL-883B-3015.1

*** Supply voltage for logic system = 3V. Supply voltage for LCD system = Operating voltage at 25℃.

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 Characterstic
Mechanical characterstic												Out of the Mechanical Specification Color change : Out of Limit Apperance Specification
Optical characterstic												Out of the Apperance Standard

11. QUALITY GUARANTEE

Acceptable Quality Level

Each lot should satisfy the quality level defined as follows.

- Inspection method : MIL-STD-105E LEVEL II Normal one time sampling
- AQL

Partition	AQL	Definition
A: Major	0.4%	Functional defective as product
B: Minor	1.5%	Satisfy all functions as product but not satisfy cosmetic standard

Definition of 'LOT'

One lot means the delivery quantity to customer at one time.

Conditions of Cosmetic Inspection

Environmental condition

The inspection should be performed at the 1cm of height from the LCD module under 2 pieces of 40W white fluorescent lamps (Normal temperature 20~25℃and normal humidity 60±15%RH).

Inspection method

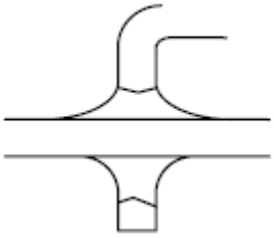
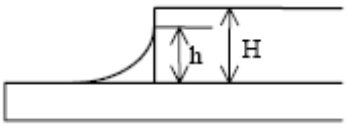
The visual check should be performed vertically at more than 30cm distance from the LCD panel.

Driving voltage

The VO value which the most optimal contrast can be obtained near the specified VO in the specification. (Within ±0.5V of typical value at 25℃.).

12. INSPECTION CRITERIA

12.1 Module Cosmetic Criteria

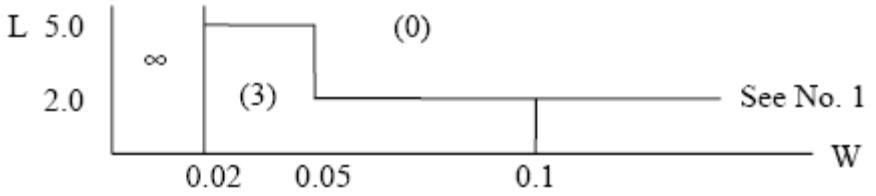
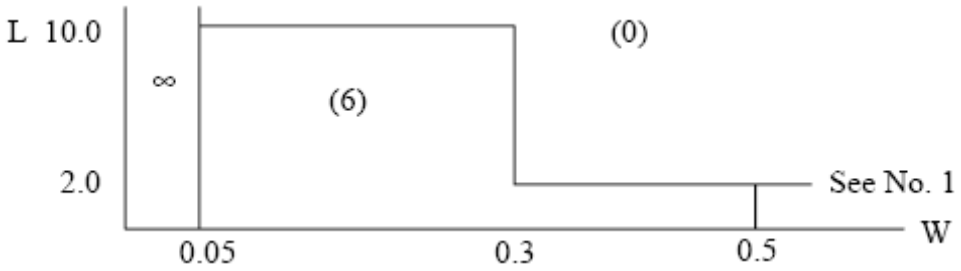
No.	Item	Judgement Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Major
4	Resist flaw on substrate	Invisible copper foil (′0.5mm or more) on substrate pattern	Minor
5	Accretion of metallic Foreign matter	No soldering dust No accretion of metallic foreign matters (Not exceed ′0.2mm)	Minor Minor
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate discoloring	No plate fading, rusting and discoloring	Minor
8	Solder amount 1. Lead parts	a. Soldering side of PCB Solder to form a ‘Filet’ all around the lead. Solder should not hide the lead form perfectly. (too much) b. Components side (In case of ‘Through Hole PCB’) Solder to reach the Components side of PCB. 	Minor
	2. Flat packages	Either ‘Toe’ (A) or ‘Seal’ (B) of the lead to be covered by ‘Filet’. Lead form to be assume over solder. A B 	Minor
	3. Chips	(3/2) H ≥h ≥(1/2) H 	Minor

12.2 Screen Cosmetic Criteria (Non-Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgement Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>In accordance with Screen Cosmetic Criteria (Operating) No.1.</td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>In accordance with Screen Cosmetic Criteria (Operating) No.2.</td><td>Minor</td></tr>
<tr><td>3</td><td>Bubbles in polarizer</td><td><table><tr><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>$d \le 0.3$</td><td>Disregard</td></tr><tr><td>$0.3 < d \le 1.0$</td><td>3</td></tr><tr><td>$1.0 < d \le 1.5$</td><td>1</td></tr><tr><td>$1.5 < d$</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>4</td><td>Scratch</td><td>In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.</td><td>Minor</td></tr>
<tr><td>5</td><td>Allowable density</td><td>Above defects should be separated more than 30mm each other.</td><td>Minor</td></tr>
<tr><td>6</td><td>Coloration</td><td>Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.</td><td>Minor</td></tr>
<tr><td>7</td><td>Contamination</td><td>Not to be noticeable.</td><td>Minor</td></tr>
</table>

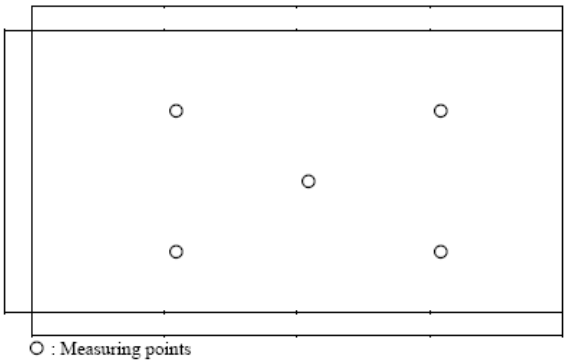
12.3. Screen Cosmetic Criteria (Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgement Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>A) Clear Note :
<table><tr><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>$d \le 0.1$</td><td>Disregard</td></tr><tr><td>$0.1 < d \le 0.2$</td><td>3</td></tr><tr><td>$0.2 < d \le 0.3$</td><td>2</td></tr><tr><td>$0.3 < d$</td><td>0</td></tr></table>Including pin holes and defective dots which must be within one pixel size.
B) Unclear Size :
<table><tr><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>$d \le 0.2$</td><td>Disregard</td></tr><tr><td>$0.2 < d \le 0.5$</td><td>6</td></tr><tr><td>$0.5 < d \le 0.7$</td><td>2</td></tr><tr><td>$0.7 < d$</td><td>0</td></tr></table></td><td>Minor</td></tr>
</table>

2	Lines	A)Clear  Note : ( ) - Acceptable Qty in active area L -Length (mm) W - Width (mm) ∞ - Disregard B) Unclear  	Minor

'Clear' = The shade and size are not changed by VO.
'Unclear' = The shade and size are changed by VO.

12.4. Screen Cosmetic Criteria (Operating) (Continued)

No.	Defect	Judgement Criterion	Partition
3	Rubbing line	Not to be noticeable.	
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'Spot'. (see *Screen Cosmetic Criteria (Operating) No.1*)	Minor
7	Uneven brightness (only back-lit type module)	Uneven brightness must be BMAX / BMIN ≤ 2 - BMAX : Max. value by measure in 5 points - BMIN : Min. value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure.  	Minor

Note :

(1) Size : d = (long length + short length) / 2

(2) The limit samples for each item have priority.

(3) Complexed defects are defined item by item, but if the number of defects are defined in above table, the total number should not exceed 10.

(4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.

- 7 or over defects in circle of ′5mm.
- 10 or over defects in circle of ′10mm.
- 20 or over defects in circle of ′20mm.

13. 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.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) 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 modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling 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 (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.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction 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.

14. 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 temp erature air.

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

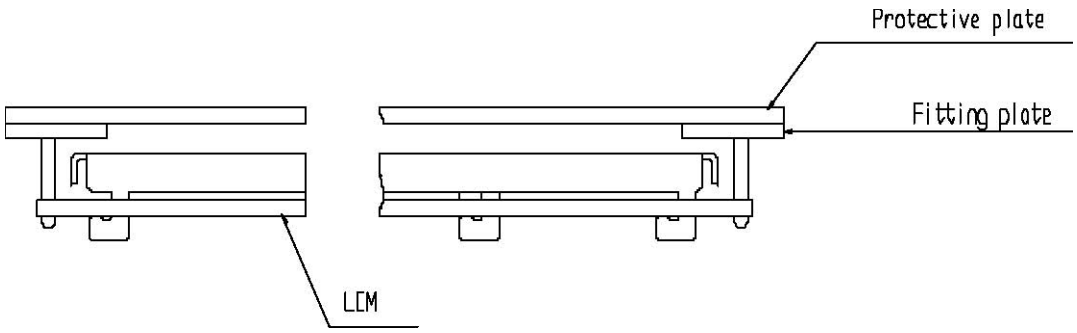
(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

(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 0.1mm.

Precaution for Handing 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 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 handing 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□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 dur 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 electoluminescent 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.

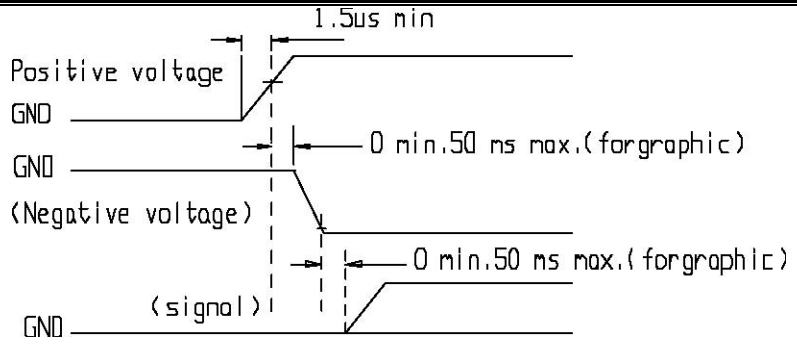
(2) Driving the LCD in the voltage above the limit shortens its life.

(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 LCDs 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.)

Safety

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

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

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.