中显液晶
技术资料

型号:ZX320240A

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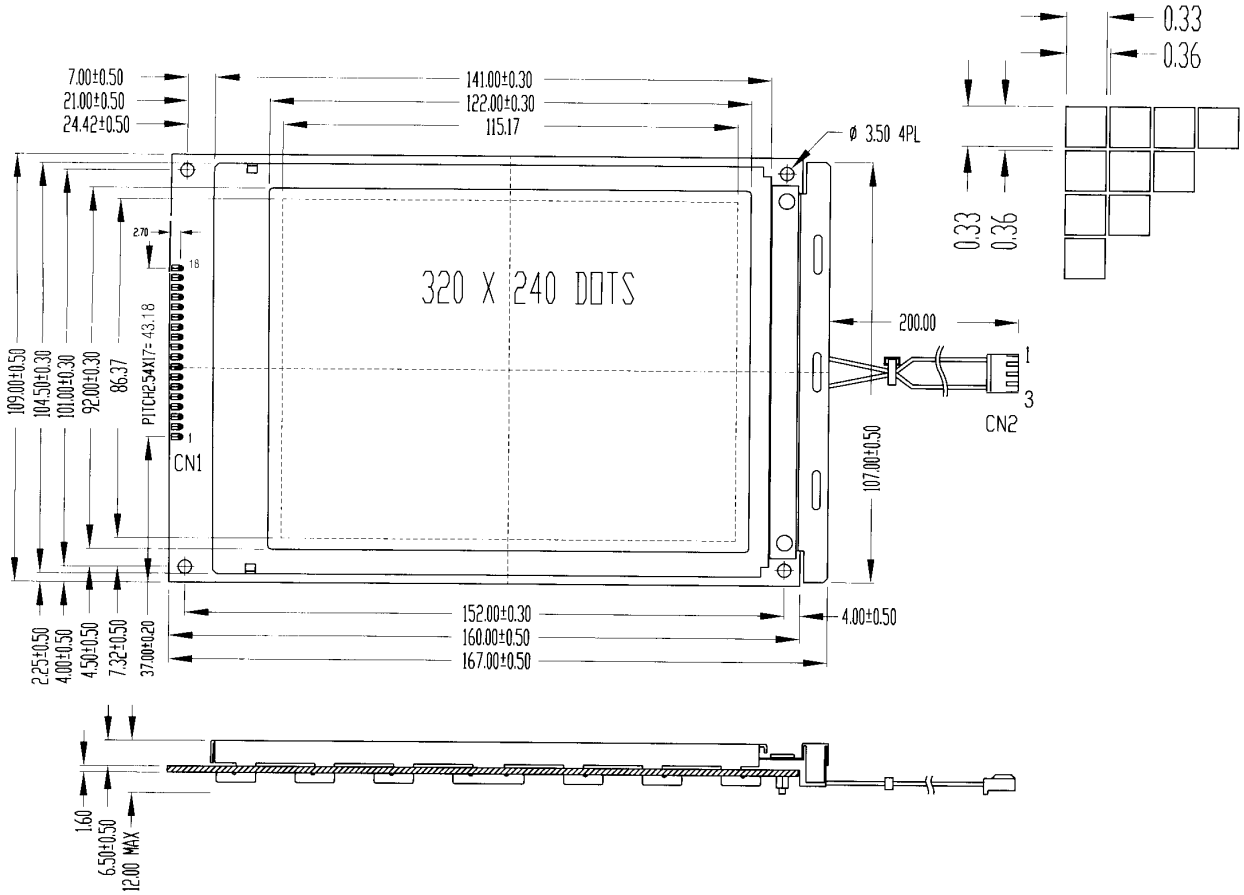
PRODUCT SPECIFICATIONS

- PHYSICAL DATA
- EXTERNAL DIMENSIONS
- BLOCK DIAGRAM
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- TIMING DIAGRAMS
- OPERATING PRINCIPLES & METHODS
- DISPLAY DATA PATTERN
- FL BACKLIGHT CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE PIN CONNECTIONS
- PART LIST
- RELIABILITY
- QUALITY GUARANTEE
- INSPECTION CRITERIA
- PRECAUTIONS FOR USING LCD MODULES
- USING LCD MODULES

■ PHYSICAL DATA

Item	Contents	Unit
LCD type	FSTN	---
LCD duty	1/240	---
LCD bias	1/17	---
Viewing direction	6	O'clock
Module size (W×H×T)	167 × 109 × 12MAX (6.57″ × 4.29″ × 0.47″MAX)	mm
Viewing area (W×H)	122 × 92 (4.80″ × 3.62″)	mm
Number of dots	320 × 240	dots
Dot size (W×H)	0.33 × 0.33 (0.013″ × 0.013″)	mm
Dot pitch (W×H)	0.36 × 0.36 (0.014″ × 0.014″)	mm

■ EXTERNAL DIMENSIONS



■ BLOCK DIAGRAM

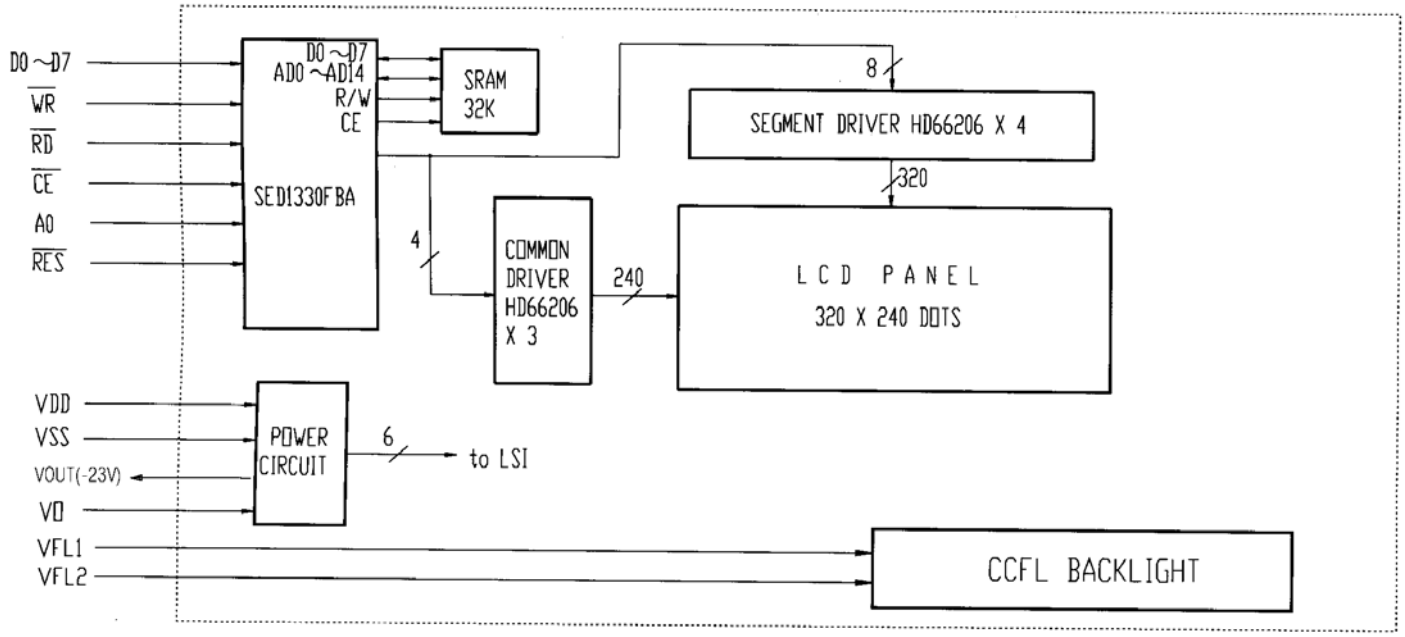
该模块现今大部使用LED背光，原有CCFL背光接口就不用了，
在18脚后面增加两个管脚，19脚加+5V，20脚加GND即可点亮背光。

CON 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
VSS	VDD	VO	$\overline{WR}$	$\overline{RD}$	$\overline{CS}$	A0	$\overline{RES}$	D0	D1	D2	D3	D4	D5	D6	D7	NC	VOUT

CON 2

1	2	3
VFL1	NC	VFL2



■ ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	VDD	-0.3	7.0	V
Supply voltage for LCD	VDD - VO	-0.3	30.0	V
Input voltage	VI	-0.3	VDD+0.3	V
Operating temperature	TOP	0	50	°C
Storage temperature	TST	-10	60	°C

■ ELECTRICAL CHARACTERISTICS (VDD = 5V , VSS = 0V, Ta = 25°C)

△ DC Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for logic	VDD	---	4.5	5.0	5.5	V
Supply current for logic	IDD	---	---	19	23	mA
Operating voltage for LCD	VDD - VO	0°C	22.1	23.3	24.5	V
		25°C	21.2	22.4	23.6	V
		50°C	20.2	21.4	22.6	V
Input voltage ' H ' level	VIH	---	0.7VDD	---	VDD	V
Input voltage ' L ' level	VIL	---	0	---	0.3VDD	V

△ AC Characteristics

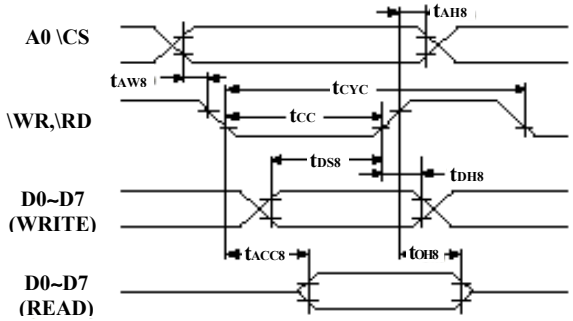
Item	Symbol	Min	Typ	Max	Unit
Clock frequency	f_{CP}	---	---	8	MHz
Clock pulse width	t_W	40	---	---	ns
Clock rise/fall time	t_r , t_f	---	---	1	ns
Data set up time	t_{DSU}	20	---	---	ns
Data hold time	t_{DHD}	20	---	---	ns
Load set up time	t_{LSU}	100	---	---	ns
Load → Clock time	t_{LC}	80	---	---	ns
' FRAME ' set up time	t_{SETUP}	100	---	---	ns
' FRAME ' hold time	t_{HOLD}	100	---	---	ns
' LOAD ' pulse width	t_{WC}	80	---	---	ns

■ TIMING DIAGRAMS

现今模块使用的1335已经停产，换用RA8835I，与原1335时序完全相同，一般可直接替换，如果有问题请及时联络北京中显公司技术支持，给予配合解决。

◆ SED1330 Timing Diagrams

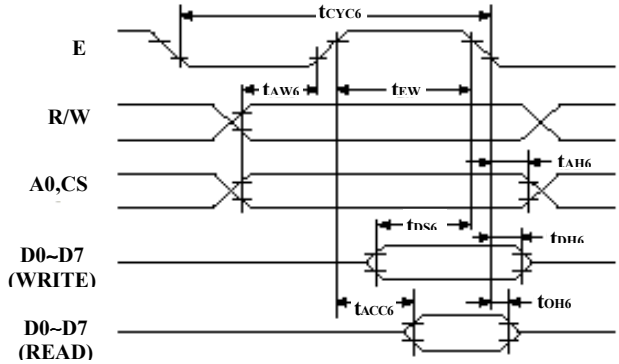
● System bus READ/WRITE timing I (8080)



Signal	Symbol	Parameter	Rating		Unit	Condition
			min	max		
A0,CS	tAH8	Address hold time	10	---	ns	CL = 100 pF
	tAW8	Address setup time	30	---	ns	
WR,RD	tCYC	System cycle time	(1)	---	ns	
	tCC	Strobe pulsewidth	220	---	ns	
D0 to D7	tDS8	Data setup time	120	---	ns	
	tDH8	Data hold time	10	---	ns	
	tACC8	RD access time	---	120	ns	
	tOH8	Output disable time	10	50	ns	

Note: t CYC =2t C + t CC + t CEA + 75 > t ACV + 245:
memory control/movement control commands:
= 4t C + t CC + 30:
all other commands:

● System bus READ/WRITE timing II (6800)

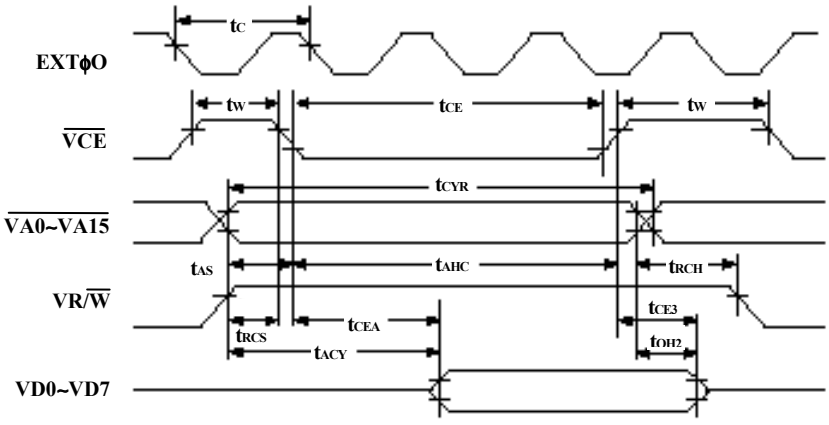


Signal	Symbol	Parameter	Rating		Unit	Condition
			min	max		
A0, CS R/W	tAH6	Address hold time	10	---	ns	CL = 100+1TTL pF
	tAW6	Address setup time	30	---	ns	
	tCYC6	System cycle time	(1)	---	ns	
	tCC	Strobe pulsewidth	220	---	ns	
D0 to D7	tDS6	Data setup time	120	---	ns	
	tDH6	Data hold time	10	---	ns	
	tACC6	RD access time	---	120	ns	
	tOH6	Output disable time	10	50	ns	
E	tEW	Enable pulse width	220	---	ns	

Note: (1) t CYC6 = 2t C + t EW + t CEA + 75 > t ACV + 245:
memory control/movement control commands:
= 4tC + tEW + 30:
all other commands:

1. tCYC6 means a cycle of (CS.E) not E alone.

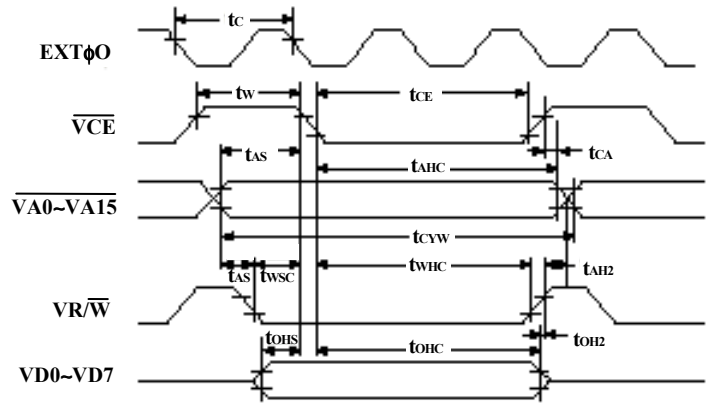
● Display memory READ timing



Signal	Symbol	Parameter	Rating		Unit	Condition
			min	max		
EXT ∅0	tC	Clock cycle	100	---	ns	CL = 100pF +1TTL
VCE	tW	VCE high level pulse width	tc-40	---	ns	
	tCE	VCE low level pulse width	2tc-40	---	ns	
VA0 to VA15	tCYR	Read cycle time	(1)	---	ns	
	tASC	VCE address setup time (fall)	tc-45	---	ns	
	tAHC	VCE address hold time (fall)	2tc-40	---	ns	
VR/W	tRCS	VCE read cycle setup time (fall)	tc-45	---	ns	
	tRCH	VCE read cycle hold time (fall)	tc/2-35			
VD0 to VD7	tACV	Address access time	---	(2)	ns	
	tCEA	VCE access time	---	(3)	ns	
	tOH2	Output data hold time	0	---	ns	
	tCE2	VCE data off time	0			

Note: 1. tCYR = 3tC
2. t ACV = 3t C –120
3. t CEA = 2t C –120

● Display memory WRITE timing



Signal	Symbol	Parameter	Rating		Unit	Condition
			min	max		
EXT ∅0	tC	Clock cycle	100	---	ns	CL = 100pF +1TTL
VCE	tW	VCE high level pulse width	tc-40	---	ns	
	tCE	VCE low level pulse width	2tc-40	---	ns	
VA0 to VA15	tCYR	Read cycle time	3tc	---	ns	
	tAHC	VCE address hold time (fall)	2tc-40	---	ns	
	tASC	VCE address setup time (fall)	tc-55	---	ns	
	tCA	VCE address hold time (rise)	5	---	ns	
	tAS	VR/W address setup time (fall)	0	---	ns	
	tAH2	VR/W address hold time (rise)	15	---	ns	
VR/W	tWSC	VCE write setup time (fall)	tc-55	---	ns	
	tWHC	VCE write hold time (fall)	tc/2-40	---	ns	
VD0 to VD7	tDSC	VCE data input setup time (fall)	twsc-10	---	ns	
	tDHC	VCE data input hold time (fall)	2tc-30	---	ns	
	tDH2	VR/W data hold time (rise)	10*	50	ns	

* Lines VD0 to VD7 are latched.

■ OPERATING PRINCIPLES & METHODS

◆ Command Description

● The Command Set

Table 1. The Command Set

Class	Command	Code											Hex	Command Description	Command Read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			No. of Bytes	Section
System	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display	8	3.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby	0	3.2.2
	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enalbe and disable display and display flashing	1	3.3.1
Display control	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	3.3.2
	CSRFORM	1	0	1	0	1	0	0	0	1	0	0	5D	Set cursor type	2	3.3.3
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	3.3.6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4Cof 4F	Set direction of cursor movement	0	3.3.4
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	3.3.7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	3.3.5
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	3.4.1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	3.4.2
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	---	3.5.1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	---	3.5.2

Notes:

1. In general, the internal registers of the SED1330F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged. 2-byte parameters (where two bytes are treated as one data item) are handled as follows:
   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
   b. SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

● System Control Commands

1.SYSTEM SET

Initializes the device, sets the window sizes, and selects the LCD interface format. Since the command sets the basic operating parameters of the SED1330F, an incorrect SYSTEM SET command may cause other commands to operate incorrectly.

	MSB D7	D6	D5	D4	D3	D2	D1	LSB D0	A0	WR	RD
C	0	1	0	0	0	0	0	0	1	0	1
P1	DR	T/L	IV	1	W/S	M2	M1	M0	0	0	1
P2	WF	0	0	0	0	← FX →			0	0	1
P3	0	0	0	0	← FY →				0	0	1
P4	← C/R →								0	0	1
P5	← TC/R →								0	0	1
P6	← L/F →								0	0	1
P7	← APL →								0	0	1
P8	← APH →								0	0	1

■ DISPLAY DATA PATTERN

	S1	S2	S3	S4	S5	• • • • • •	S316	S317	S318	S319	S320	SEG
C1	D3	D2	D1	D0	D3	• • • • • •	D0	D3	D2	D1	D0	
C2	D3	D2	D1	D0	D3	• • • • • •	D0	D3	D2	D1	D0	
• • • • • • •												
C239	D3	D2	D1	D0	D3	• • • • • •	D0	D3	D2	D1	D0	
C240	D3	D2	D1	D0	D3	• • • • • •	D0	D3	D2	D1	D0	
COM												

Input data	Dots on display				
D0	Dot 4	Dot 8	• • •	Dot 316	Dot 320
D1	Dot 3	Dot 7	• • •	Dot 315	Dot 319
D2	Dot 2	Dot 6	• • •	Dot 314	Dot 318
D3	Dot 1	Dot 5	• • •	Dot 313	Dot 317

■ FL BACKLIGHT CHARACTERISTICS

△ Absolute Maximum Ratings

Item	Symbol	Conditions	Standard			Unit
			Min.	Typ.	Max.	
Circuit voltage	V_S		---	---	350	Vrms
Lamp current	I_{FL}	Ta= 25°C	---	---	6	mArms

△ Electrical Characteristics

Item	Symbol	Conditions	Standard			Unit
			Min.	Typ.	Max.	
Lamp voltage*1	V_{FL}	Ta= 25°C	---	290	300	Vrms
Starting voltage*2	V_S	Ta= 0°C	290	---	---	Vrms
Lamp current*1	I_{FL}	Ta= 25°C	4.0	5.0	6.0	mArms
Frequency*1	f_{FL}	Ta= 25°C	---	30	---	kHz

*1 FL inverter: CXA-L10L

*2 The voltage capable of starting discharge and keeping stable discharge.When the voltage gradually increases, glow discharge will increase and FL tube terminals will be connected electrically.

△ Optical Characteristics

Item	Symbol	Conditions	Standard			Unit
			Min.	Typ.	Max.	
Surface brightness*1*2*4	Bp	Ta= 25 ±3°C	109	114	---	cd/m^2
Distribution of brightness*1*3	Bp	30~85%RH	---	---	30	%

*1 Measurement 30 minutes after turning on of FL tube

FL inverter: CXA-L10L

FL inverter output voltage and freguency: 290V, 30kHz

LCD driving conditions: Optimum Vopr

LCD display pattern: ALL on display (all data= “H”)

*2 Initial brightness of LCD panel center

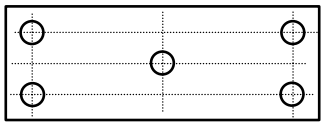
*3 Definition of Bp (Distribution of brightness)

$Bp=(Bp(max.) - Bp(min.))/Bp(max.) \times 100\%$

Bp(max.)=Maximun brightness of 5 measuring points

Bp(min.)=Minimem brightness of 5 measuring points

5 measuring points:



*4 Ambient temperature affects brightness of FL tube. The reason is that radiation efficiency depends on steam pressure of mercury enclosed in the tube. Practically the brightness is low in the cool. As the steam pressure of mercury is also low just after turning on of FL tube, the brightness is low. The heat generated by FL tube will raise temperature on the tube surface, then brightness will increase with a rise in mercury steam pressure.

△ Life

Item	Conditions	Standard		Unit
		Min.	Max.	
Life*1	Ta= 25 ±3°C	15000	---	hrs

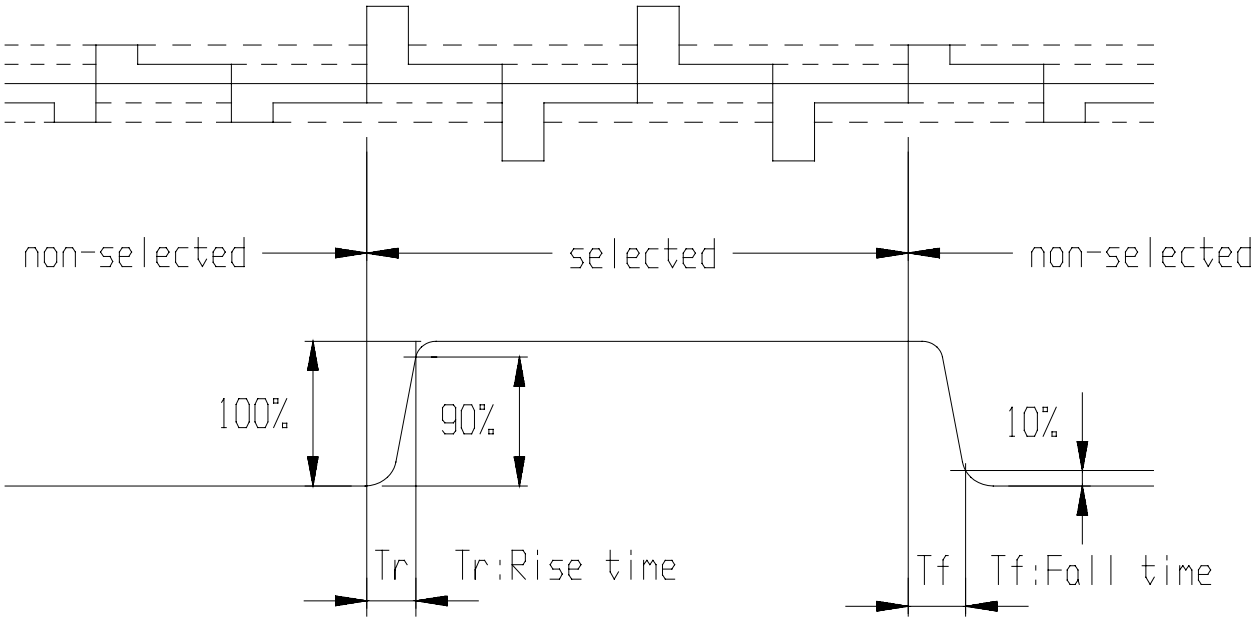
*1 FL driving condition: I_{FL} (Lamp current)=5 mArms

Time until the decreases to half of the initail brightness, or time until “not lit”because of increase in FL discharge start voltage.

■ ELECTRO-OPTICAL CHARACTERISTICS (V_{OP} =22.4V, Ta = 25°C)

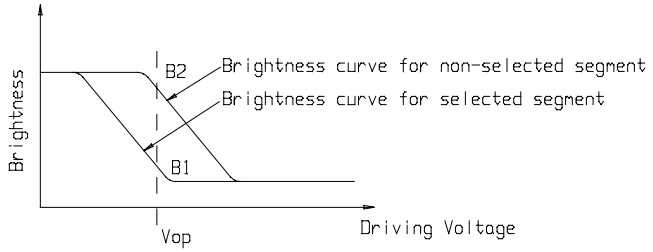
Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Response	Tr	---	---	152	---	ms	---	1
Time	Tf	---	---	329	---	ms	---	1
Contrast Ratio	Cr	---	---	7.6	---	---	---	2
Viewing Angle Range	θ	Cr ≥ 2	47	---	---	deg	∅ = 90°	3
			52	---	---	deg	∅ = 270°	3
			60	---	---	deg	∅ = 0°	3
			36	---	---	deg	∅ = 180°	3

Note 1. Definition of response time

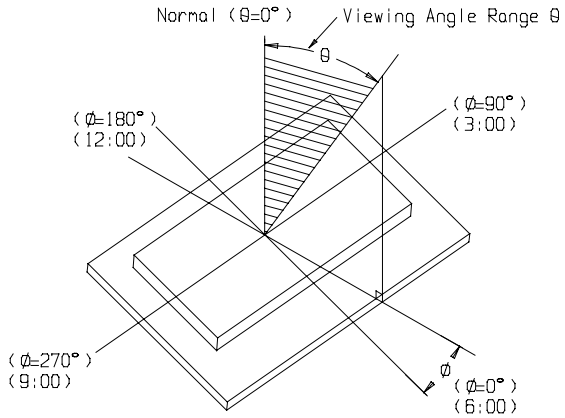


Note 2. Definition of Contrast Ratio 'Cr'

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



Note 3. Definition of Viewing Angle Range 'θ'



■ INTERFACE PIN CONNECTIONS

△ CN1

Pin No.	Symbol	Level	Description
1	VSS	0V	Ground
2	VDD	5.0V	Supply voltage for module
3	VO	-15V	Supply cathode voltage for module
4	/WR	L	Read signal
5	/RD	L	Write signal
6	/CS	L	Chip selected
7	A0	H/L	AO=H /RD=L,/WR=H:display data and cursor address read /RD=H,/WR=LCommand write AO=L /RD=L,/WR=H:Status flag read /RD=H, /WR=L Display data and paremeter write
8	/RES	H/L	Reset signal
9	D0	H/L	Data bit 0
10	D1	H/L	Data bit 1
11	D2	H/L	Data bit 2
12	D3	H/L	Data bit 3
13	D4	H/L	Data bit 4
14	D5	H/L	Data bit 5
15	D6	H/L	Data bit 6
16	D7	H/L	Data bit 7
17	NC		NC
18	VOUT	-23V	VOUT -23V

△ CN2

Pin No.	Symbol	Level	Description
1	VFL1	---	Supply voltage for CCFL
2	NC	---	No connection
3	VFL2	---	Supply voltage for CCFL

■ PART LIST

Part Name	Description	Quantity
IC	KS0086	7
IC	HY62256A	1
IC	SED1330FBA	1
IC	NJM064M	1
LCD	TSF1024-DBTDCN	1
Capacitors	0.1μF	16
Capacitors	4.7μF	4
Resistors	2.2Kohm	4
Resistors	20Kohm	1
CCFL	CA320240B BACKLIGHT	1
PCB	CA320240B	1

■ 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.	60 °C 200 hrs	------
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-10 °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.	50 °C 200 hrs	------
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	0 °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.	50 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. -10°C 30min ⇌ 25°C 5min. ⇌ 60°C 30min ⟷ 1 cycle	-10°C / 60°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 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 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 Characterstic
Mechanical characterstic												Out of the Mechanical Specification Color change : Out of Limit Apperance Specification
Optical characterstic												Out of the Apperance Standard

■ 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°C and normal humidity 60±15%RH).

- Inspection method

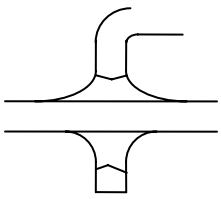
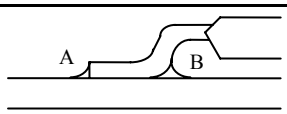
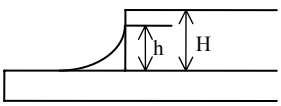
The visual check should be performed vertically at more than 30cm distance from the LCD panel.

- Driving voltage

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

■ INSPECTION CRITERIA

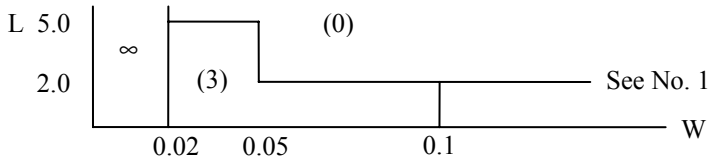
△ Module Cosmetic Criteria

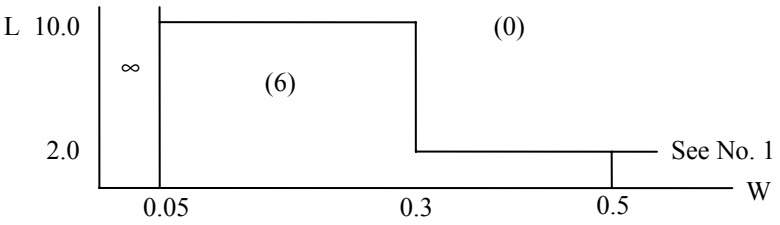
No.	Item	Judgement Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Major
4	Resist flaw on substrate	Invisible copper foil (∅0.5mm or 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. 	Minor
	3. Chips	(3/2) H ≥ h ≥ (1/2) H 	Minor

△ 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 ≤ 0.3</td><td>Disregard</td></tr><tr><td>0.3 < d ≤ 1.0</td><td>3</td></tr><tr><td>1.0 < d ≤ 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>

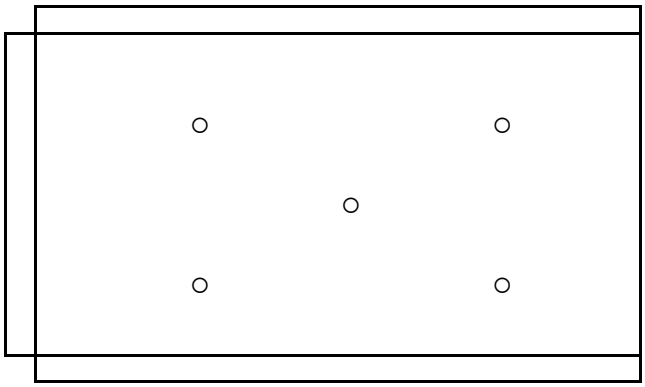
△ Screen Cosmetic Criteria (Operating)

<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<table><tr><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>d ≤ 0.1</td><td>Disregard</td></tr><tr><td>0.1 < d ≤ 0.2</td><td>3</td></tr><tr><td>0.2 < d ≤ 0.3</td><td>2</td></tr><tr><td>0.3 < d</td><td>0</td></tr></table>Note : Including pin holes and defective dots which must be within one pixel size.
B) Unclear<table><tr><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>d ≤ 0.2</td><td>Disregard</td></tr><tr><td>0.2 < d ≤ 0.5</td><td>6</td></tr><tr><td>0.5 < d ≤ 0.7</td><td>2</td></tr><tr><td>0.7 < d</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>A) Clear
 

Note : ( ) - Acceptable Qty in active area
L - Length (mm)
W - Width (mm)
∞ - Disregard
B) Unclear
 
</td><td>Minor</td></tr>
</table>

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

△ 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 慦pot'. (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.  ○ : Measuring points	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.

■ 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.

■ 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.

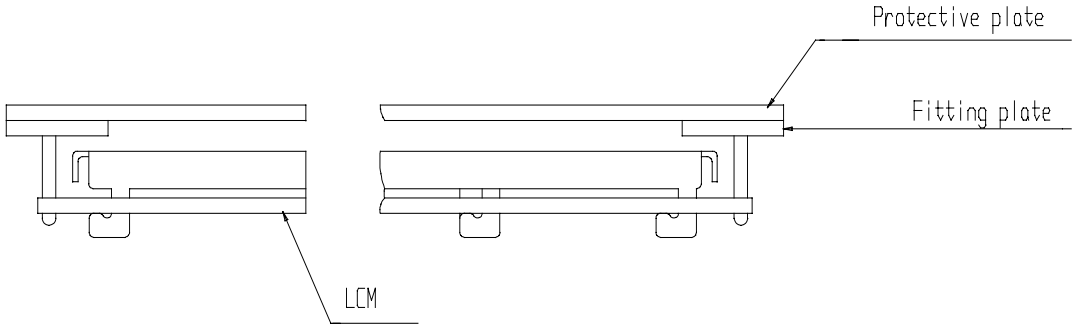
(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

(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 ±0.1mm.

△ 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 (V_O). Adjust V_O to show the best contrast.

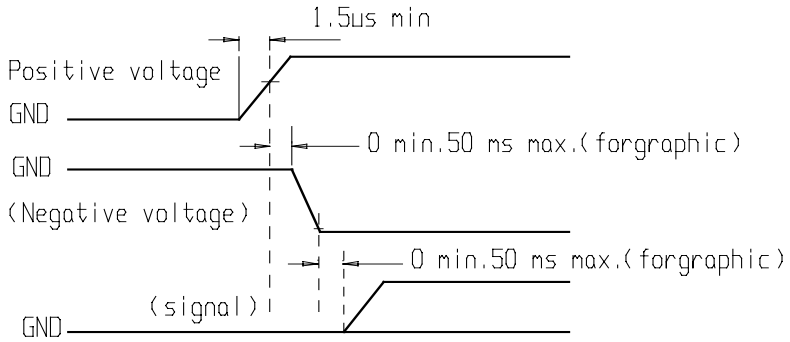
(2) Driving the LCD in the voltage above the limit shortens its life.

(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.

△ Limited Warranty

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

△ Return LCM under warranty

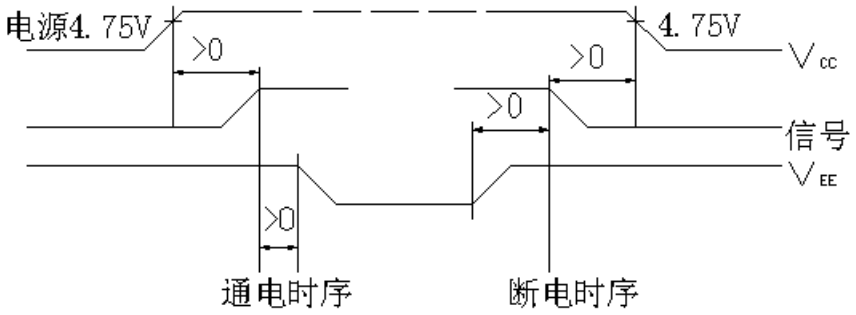
No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- 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.

五.液晶显示模块使用注意事项

1. 请勿随意自行加工、整修、拆卸。
2. 避免对液晶屏表面施加压力。
3. 不要用手随意去摸外引线、电路板上的电路及金属框。
4. 如必须直接接触时，应使人体与模块保持同一电位，或将人体良好接地。
5. 焊接使用的烙铁、操作用的电动改锥等工具必须良好接地，没漏电。
6. 严防各种静电。
7. 模块使用接入电源及断开电源时，必须按图时序进行。即必须在正电源（5 ±0.25V）稳定接入后,才能输入信号电平。如在电源稳定接入前，或断开后就输入信号电平，将会损坏模块中的集成电路，使模块损坏。



8. 点阵模块在调节时，应调整 VEE 至最佳对比度、视角时为止。如果 VEE 调整过高，不仅会影响显示，还会缩短液晶的寿命。
9. 模块表面结雾时，不要通电工作，因为这将引起电极化学反应，产生断线。
10. 模块要存储在暗处（避阳光），温度在-10℃～+35℃，湿度在 RH60%以上的地方。如能装入聚乙烯口袋（最好有防静电涂层）并将口封住最好。

以上使用说明由北京中显电子有限公司编制，有问题请电话联络，我们将竭诚为您服务，同时，提供完善的保修服务！因为每种液晶使用的控制器都不一样，控制器的型号基本就决定了液晶的指令形式和使用方式，所以，在说明书里一般不会详细照搬控制器说明书的每个细节，只会简要介绍常用指令，如果需要了解详细的指令和具体电气参数，请参照 WWW.ZXLCD.COM 网站里的“技术支持”菜单下，均有对应控制器手册免费下载，直接对应现有各类液晶使用的各种控制器，使用手册里一般有具体电气参数说明，指令详细介绍，同时辅以编程实例，以便客户详细参照，同时提高编程及操作技巧。

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