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Spec. No. TD-0029

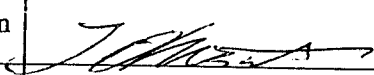
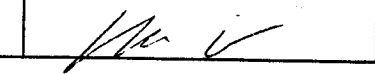
LIQUID CRYSTAL DISPLAY MODULE

G242CX5R1AC

Graphic type : 240 dots (H) by 128 dots (V)

With Built in controller (SED1330)

PRODUCT SPECIFICATION

Design	
QA	

Seiko Instruments Inc.

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[REVISION RECORD]

DATE	ITEM	CONTENT	REASON
15-Apr-92	REV.1	Issued	

1. SCOPE

This specification meets the engineering requirements for 240 dots x 128 dots liquid crystal module

2. PRODUCT SPECIFICATIONS**2.1 General**

- 240 (H) x 128 (V) dots matrix LCD
- 1/200 duty (single screen)
- Built in Controller (EPSON SED 1330FBA)
- Interface to 8 bit MPU
 - Internal characters generator ROM
160 types 5x7 dots character font based on JIS Standard
 - Internal character generator RAM
256 characters maximum
- 8 Kbytes RAM
- Super new TN LCD panel
 - Black/White with R.C.F. with antiglare
 - Transmissive type
 - 12 o' clock viewing angle
- +5 V single power supply
 - Built in DC/DC converter
 - or External VLC
- Built-in FL backlight (side edge type)
- Inverter Input Voltage 5 V +/-1 (Max power 3.5 W)

2.2 Mechanical Characteristics

ITEM	CHARACTERISTICS
Dot configuration	240 x 128 dots (full dots matrix)
Dot dimensions (mm)	0,47 x 0,47
Dot spacing (mm)	0,04 x 0,04
Module dimension (incl. backlight) (Horizontal x Vertical x Thickness,mm)	180 x 110 x 15,1
Viewing area (Horizontal x Vertical, mm)	134 x 76
Weight (g)	280 typ

2.3 Absolute Maximum Ratings

Item	Symbol	Item	Min	Max	Unit
Power supply voltage	$V_{DD} - V_{SS}$		-0.3	6	V
	VLC		$V_{DD} - 30$	VDD	V
	V0	(V0 => VLC)	$V_{DD} - 30$	VDD	
Input voltage	Vin		-0.3	$V_{DD} + 0.3$	V
Operating temperature	Topr		0	+50	°C
Storage temperature	Tstg		-20	+60	°C
Storage humidity		<=48 hrs	20	85	%RH
		<=1000 hrs	20	65	%RH

2.4 DC Electrical Characteristics

$V_{DD} = 5V \pm 5\%$, $V_{SS} = 0$, Temp = 0~50 °C

Conditions		Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage		VDD		4.75	5.00	5.25	V
		VLC*		-	-13	-	V
Input voltage	High	V _{IH}		2.2		VDD	V
	Low	V _{IL}		-0.3		0.8	V
Output voltage	High	V _{OH}		2.4			V
	Low	V _{OL}				0.4	V
Current consumption		I _{DD} **	TA=25°C		40	50	mA

* VLC and V0 are used when the internal DC/DC converter is not used

** Current consumption is the addition of logic circuit consumption + ILC + DC/DC converter

2.5 MPU Timing Interface

Signal		Symbol	Item	Min.	Max.	Unit
80 series timing	$\overline{WR}, \overline{RD}$	t_{CYC}	System cycle time	(1)	-	ns
		t_{CC}	Control pulse width	220	-	ns
68 series timing	$A0, \overline{CS}, R/W, E$	t_{CYC}	System cycle time	(2)	-	ns
		t_{EW}	Enable pulse width	220	-	ns
80 and 68 series timing	$A0, \overline{CS}$	t_{AH}	Address hold time	10	-	ns
		t_{AW}	Address setup time	30	-	ns
	D0-D7	t_{DS}	Data setup time	120	-	ns
		t_{DH}	Data hold time	10	-	ns
		t_{ACC}	\overline{RD} access time	-	120	ns
		t_{OH}	Output disable time	10	50	ns

(1) For memory control and cursor movement control:

$$t_{CYC} = 2t_c + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

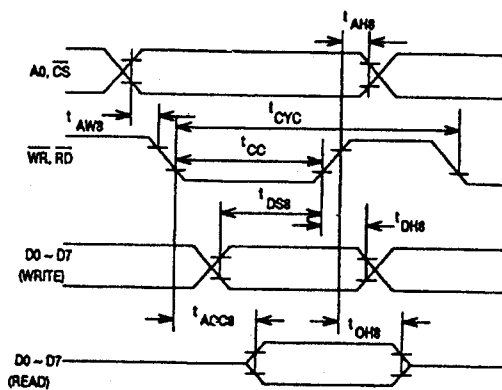
$$t_{CYC} = 4t_c + t_{CC} + 30$$

(2) For memory control and cursor movement control:

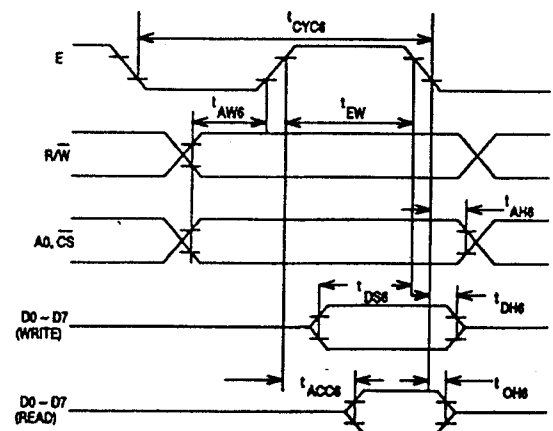
$$t_{CYC} = 2t_c + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC} = 4t_c + t_{EW} + 30$$



80 series timing diagram



68 series timing diagram

2.6 Optical Characteristics

2.6.1 Optical Characteristics

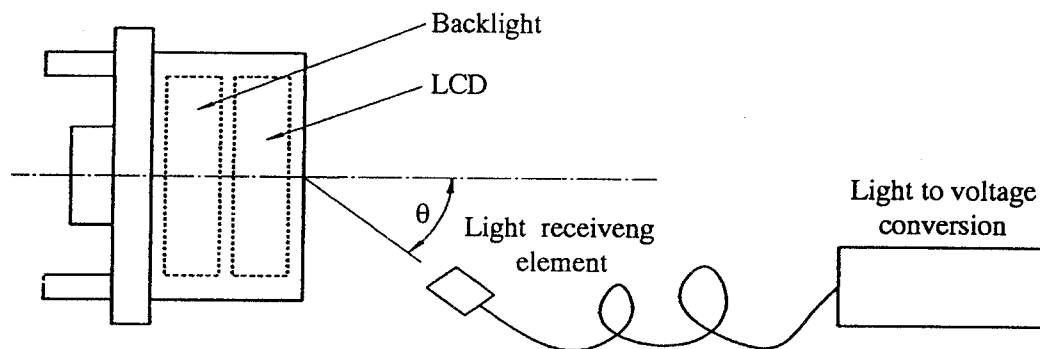
1/128 duty, 1/12.3bias, $V_{opr} = V_{DD} - V_{LC}$

Item	Symbol	Conditions	Temp.	Min.	Typ.	Max.	Unit
Contrast*	C	$\theta = -5^\circ$ $\Phi = 180^\circ$ $V_{opr} = 17V$	21°C	5	6	-	
Viewing angle	θ_1	$C \geq 2.0$ $\Phi = 180^\circ$ $V_{opr} = 17V$	21°C	-	-	-15	deg.
	θ_2			40	-	-	
	$\theta_2 - \theta_1$			55	-	-	
Response time**	ton	$\theta = 0^\circ$ $\Phi = 180^\circ$ $V_{opr} = 18V$	0°C	-	-	1600	ms
	toff			-	-	1100	
	ton	$\theta = 0^\circ$ $\Phi = 180^\circ$ $V_{opr} = 17V$	21°C	-	-	490	
	toff			-	-	410	

Measuring equipment : Canon illuminometer LC-4SR

* Optical characteristics measurement

Set the FL backlight behind the requid crystal display panel, recive the transmitted light with a light receiving element, covert the quantity of transmitted light to voltage, and measure the optical characteristics.



** Response time measurement

Use a transmissive standard panel with a display area of 1 cm² to measure the response time.

2.6.2 Recommended operating voltage ($V_{opr}=V_{DD}-V_0$)

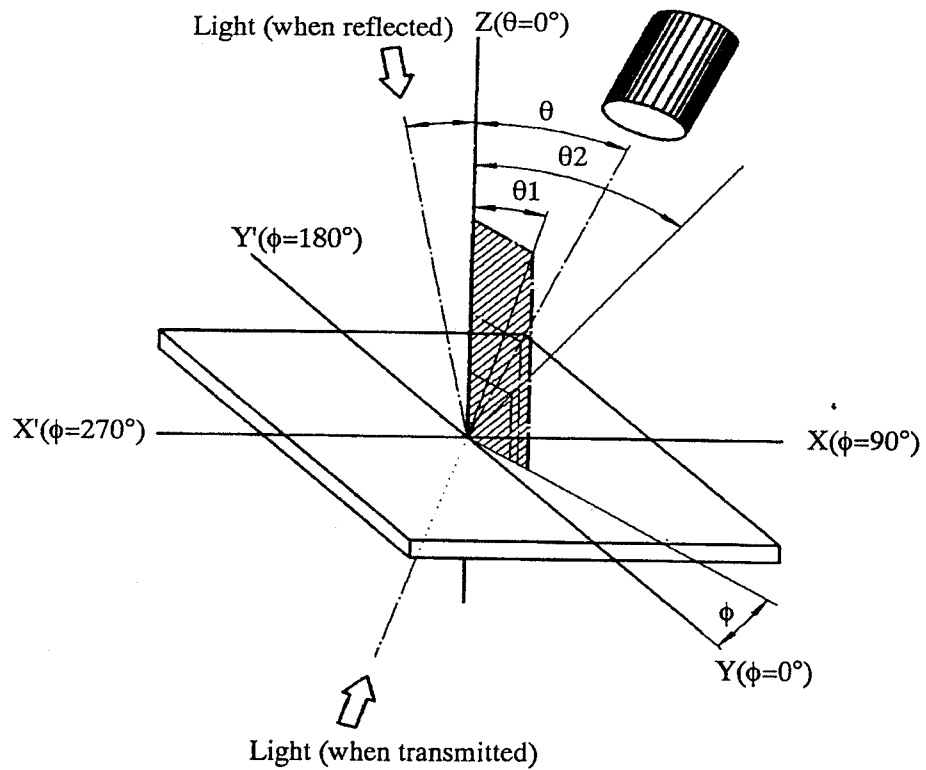
Temperature (°C)	0	25	50
V_{op} (V)	18.0	17.0	16.2

2.6.3 Recommended frame frequency

Set the frame frequency to the following value to prevent screen flicker.
Frame frequency (FLM frequency): 70Hz \pm 5%

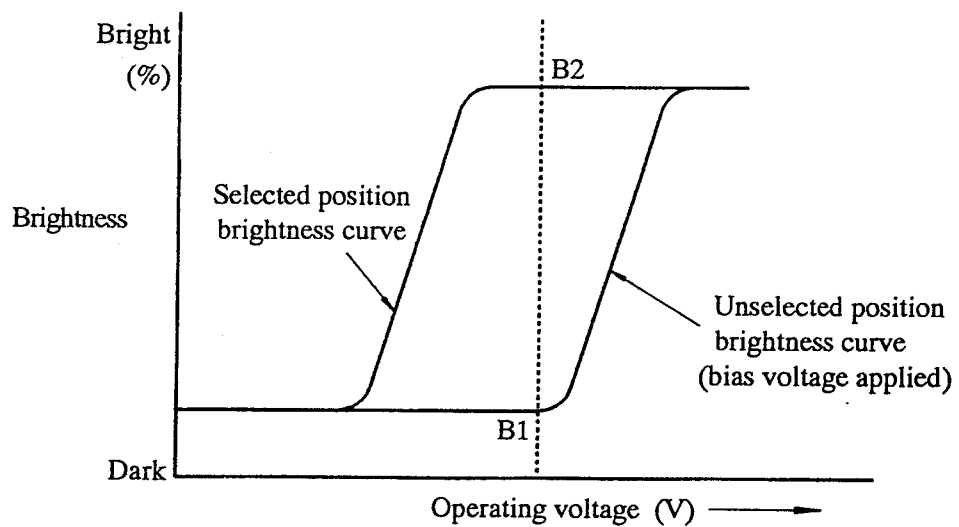
2.6.4 Definition of optical characteristics

*Definition of angles ϕ and θ



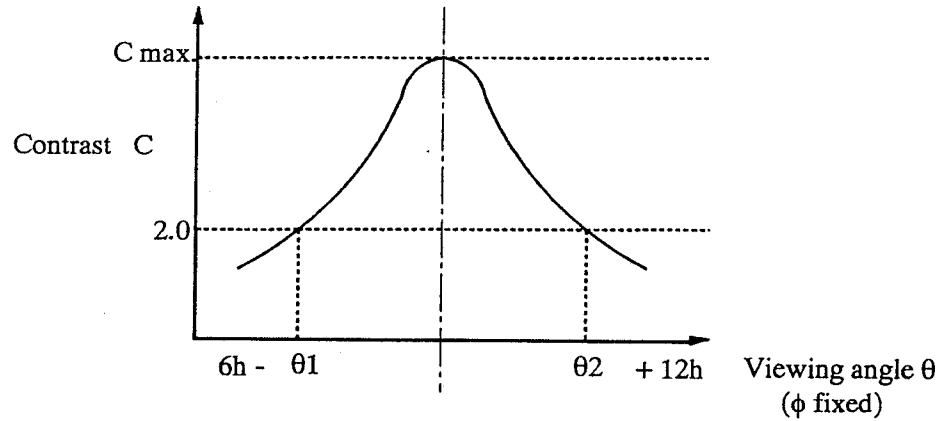
*Definition of contrast C

$$C = \frac{B1}{B2} = \frac{\text{Brightness of unselected portion}}{\text{Brightness of selected portion}}$$



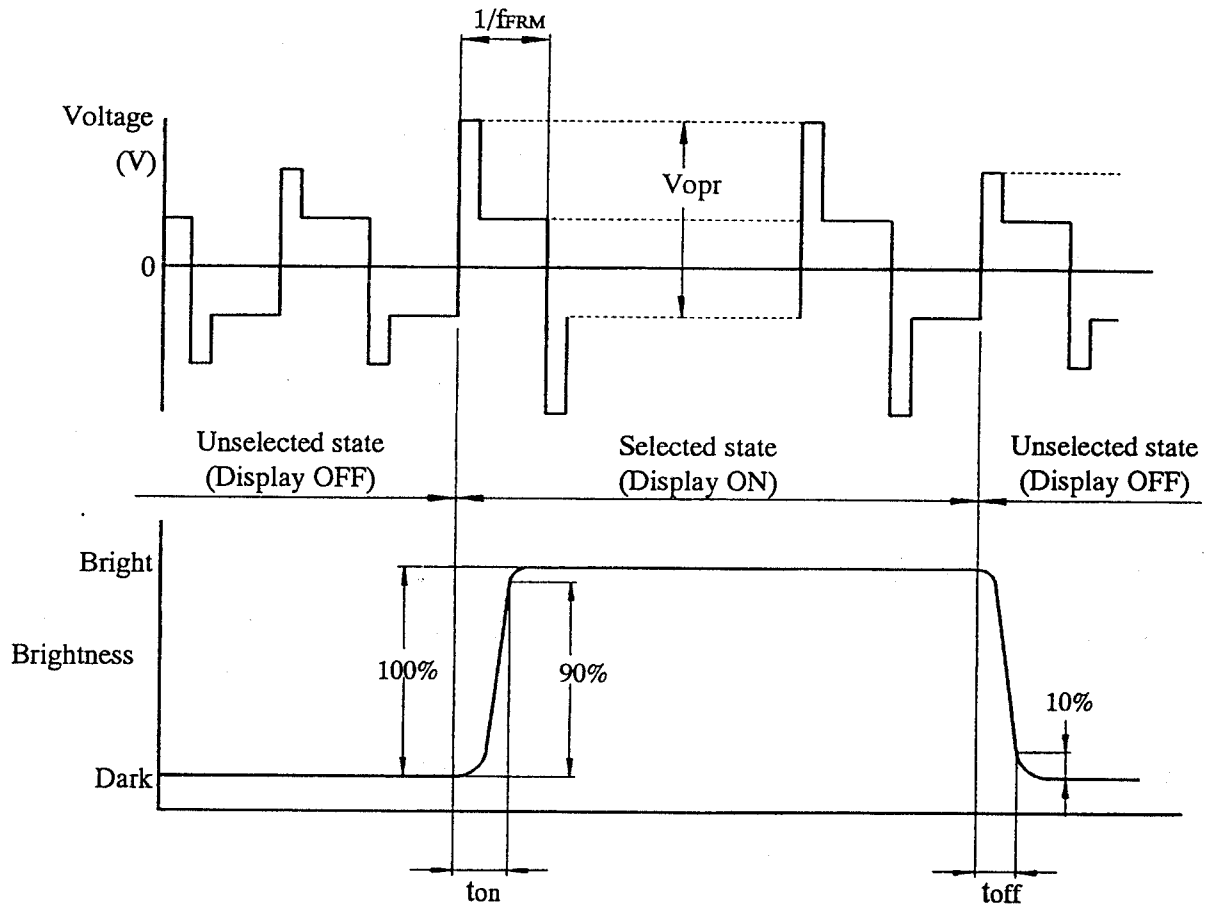
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* Definition of viewing angle θ_1 and θ_2

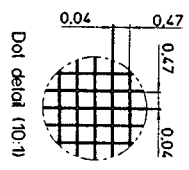
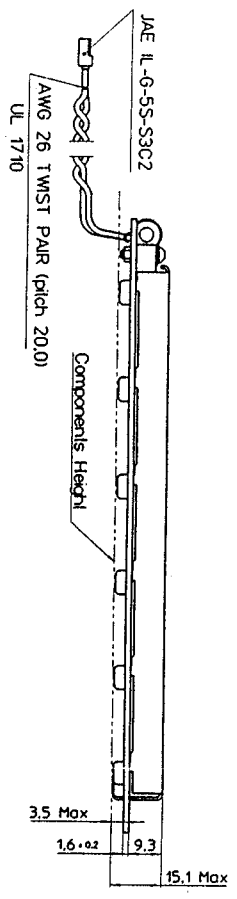
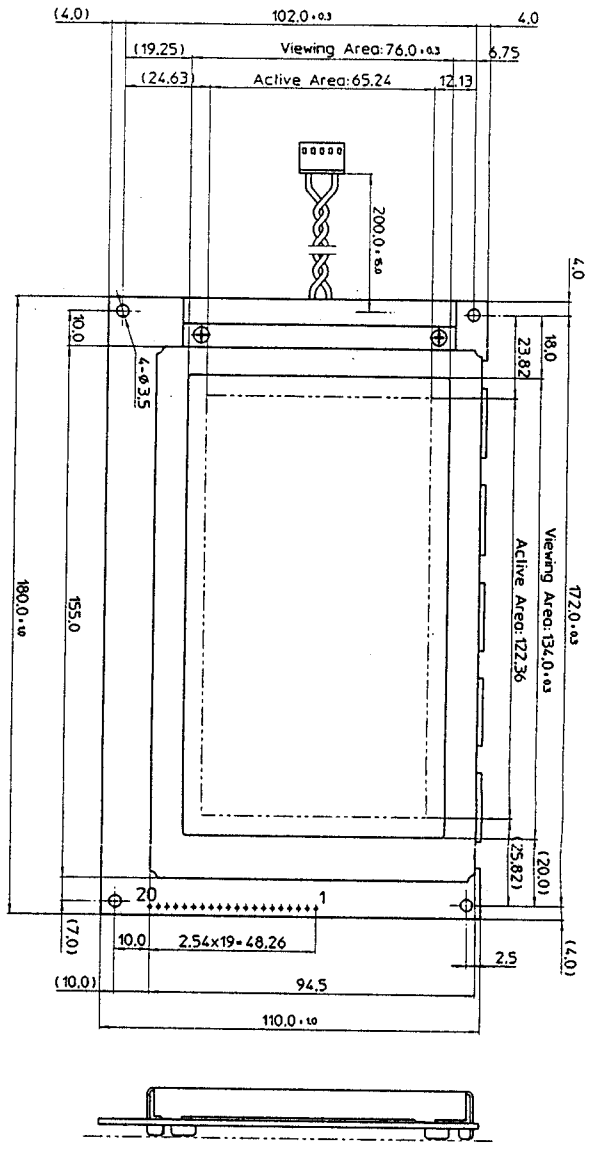


Note: optimum vision with the naked eye and viewing angle θ at C_{max} above are not always the same.

* Definition of response time



- | | | | | | |
|-----------|---|-----------------------|-----------|---|--------------------|
| V_{opr} | : | Operating voltage (V) | t_{on} | : | Response time (ms) |
| f_{FRM} | : | Frame frequency (Hz) | t_{off} | : | Response time (ms) |



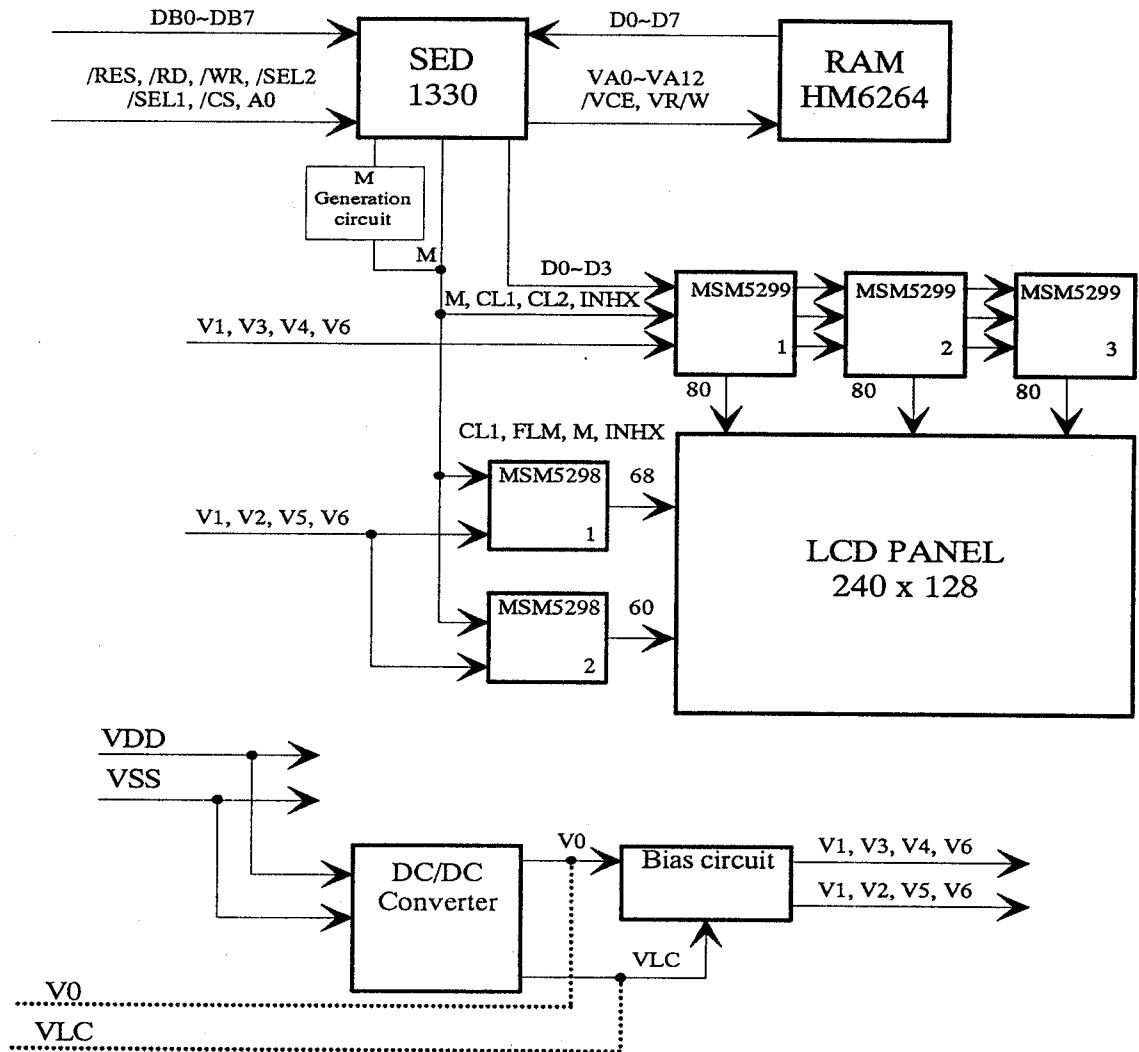
6242CX	6242CX
No Symbol	No Symbol
1 RES	1 NC
2 RD	2 NC
3 WR	3 NC
4 SEL2	4 NC
5 SEL1	5 NC
6 CS	6 NC
7 A0	7 INHX
8 DB0	8 DO
9 DB1	9 D1
10 DB2	10 D2
11 DB3	11 D3
12 DB4	12 FLM
13 DB5	13 M
14 DB6	14 CL2
15 DB7	15 CL1
16 VDD	16 VDD
17 VSS	17 VSS
18 NC*	18 NC*
19 NC*	19 NC*
20 FOND	20 FOND

* When the DC-DC converter is not used
 Pn 18: V0
 Pn 19: V1C

DRAWING NUMBER		G242CX*****		DATE		M01-28-91	
PART NUMBER		G242C-001		SHEET No.		10	
SCALE		1:1		DRAWN BY			
CHECKED BY				DATE			
MATERIAL				QTY		1	
MODEL ORIGNAL NUMBER				CHECKED BY			
CUSTOMER				ITEM			
NUMBER				DATE			

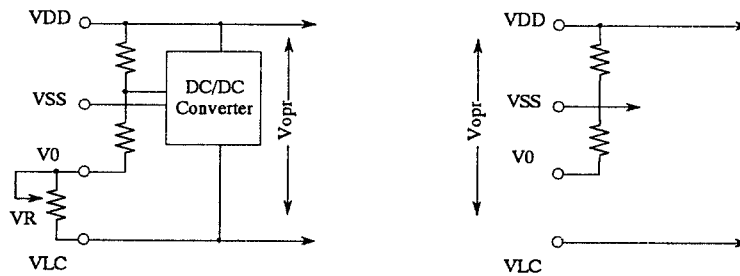
TITLE ASSEMBLY DRAWING REV. A PAGE 10

2.8 Circuit Block Diagram



V0 is used as a terminal when the DC/DC converter is used and the contrast is adjusted by external variable resistor (6.8 kΩ).

VLC is used as a terminal when the DC/DC converter is not used.



2.9 Pin Connection (Signal Function)

2.9.1 LCM

No.	Name	Function
1	$\overline{\text{RES}}$	Reset
2	$\overline{\text{RD}}$	Read
3	$\overline{\text{WR}}$	Write
4	SEL1	select MPU interface
5	SEL2	select MPU interface
6	$\overline{\text{CS}}$	SED1330 chip select
7	A0	Command mode set
8	DB0	Data bus
9	DB1	Data bus
10	DB2	Data bus
11	DB3	Data bus
12	DB4	Data bus
13	DB5	Data bus
14	DB6	Data bus
15	DB7	Data bus
16	VDD	Logic power supply +5V
17	VSS	GND 0V
18	V0	Liquid Crystal contrast adjustment
19	VLC	Liquid Crystal drive voltage
20	FGND	Frame ground

* V0 is used as a terminal when the DC/DC converter is used ,and the contrast is adjusted by external variable resistor.

** VLC is used as a terminal when the DC/DC converter is not used.

2.9.2 FL

No.	Name	Function
1	AC out	Output voltage
2	NC	Not Connected
3	NC	Not Connected
4	NC	Not Connected
5	AC out	Output voltage

3.BACKLIGHT

3.1 Brightness

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Surface brightness *1*2	B_p	$T_a=25^{\circ}\text{C}$ 30~85%RH	60	-	-	nit
Distribution of brightness *1*3	ΔB_p		-	-	30	%

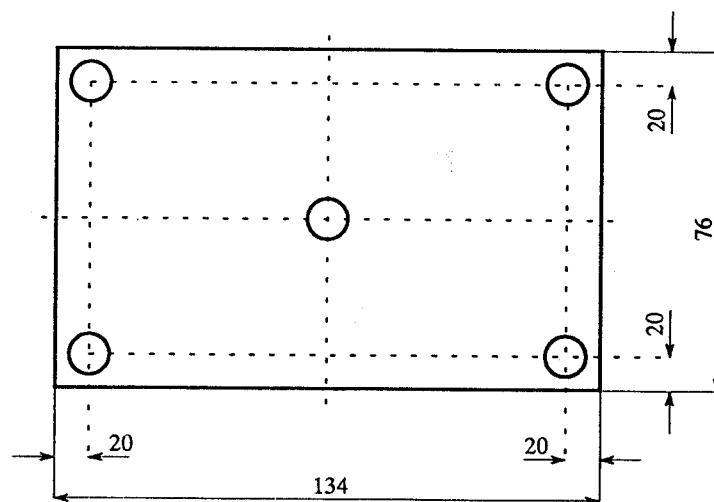
Measuring equipment: Minolta LS100

- *1 Lamp current 4.5mA
LCD driving conditions: Optimum: V_{opr} , $F_{frm} = 70 \text{ Hz}$
LCD display pattern: All ON display (all data = "H")
- *2 Center of LCD panel
- *3 Definition of ΔB_p (Distribution of brightness)

$$\Delta B_p = (B_p(\text{max.}) - B_p(\text{min.})) / B_p(\text{max.}) \times 100 (\%)$$

$$B_p(\text{max.}) = \text{Maximum brightness of 5 measuring points}$$

$$B_p(\text{min.}) = \text{Minimum brightness of 5 measuring point}$$



5 Measuring points referred to viewing area

Unit: mm

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3.2 FL Absolute Maximum Ratings

Item	Symbol	Conditions	Ratings	Unit
Circuit voltage	Vs	TA=25 °C	1300 max	V rms
Lamp current	I _{FL}		10 max	mA rms
Frequency	f _{FL}		50 max	kHz

3.3 FL Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Lamp voltage	V _{FL}	Ta=25°C	190	220	250	V rms
Discharge start voltage	Vs	Ta=0°C	850	-	-	V rms
Lamp current*	I _{FL}	Ta=25°C	4.5	5.0	5.5	mA rms

*FL inverter

V_{FL}= 260 Vrms, f_{FL}=30 k Hz

3.4 FL Life

Item	Conditions	Ratings	Unit
Life	TA = 25°C ±3°C	10.000	hrs

*Time until the intensity decrease to half of the initial brightness, or time until "no lit" because of increase in FL discharge start voltage.

FL driving condition: I_{FL}=4.5 mA rms

3.5 Recommended FL inverter

(1) Model name
ILP-324-INV

(2) Absolute maximum ratings

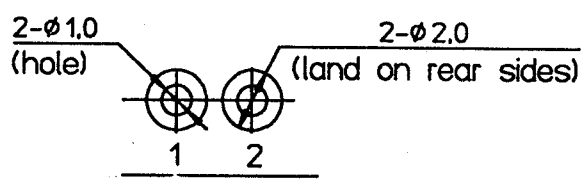
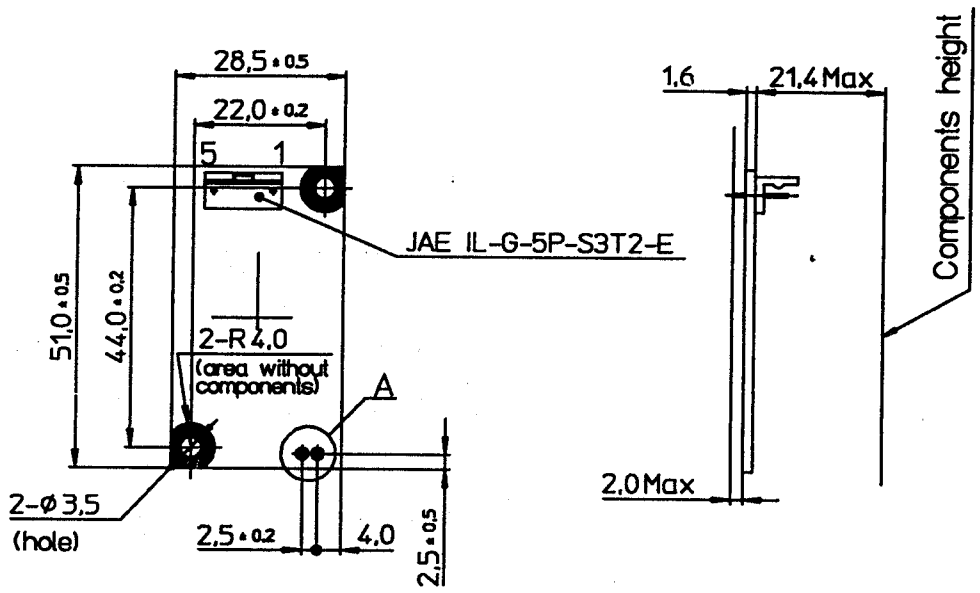
Item	Symbol	Ratings	Unit
Input current	I_{IN}	700 Max	mA
Input voltage	V_{IN}	6 V Max	Vdc
Operating temp.	T_a	0~+50	C°
Storage temp.	T_s	-30~+70	C°

(3) Electrical characteristics.

Item	Symbol	Min	Typ	Max	Unit
Input voltage	V_{in}	4.5	5	5.5	Vdc
Circuit voltage	V_0	-	650	1300	Vrms
Output current*	I_o	4.0	4.5	5.0	mArms
Oscillation frequency*	FL	25	35	45	KHz

* $V_{IN}=5$ V, $T_a=25^\circ\text{C}$

3.6 Inverter Dimension



A detail (5:1)

CN1

PIN No	SIGNAL
1	Vcc
2	GND

CN2

PIN No	SIGNAL
1	AC out
2	NC
3	NC
4	NC
5	AC out

Material: UL approved 94V-0

4. RELIABILITY

4.1 Reliability

Test item	Test conditions	Evaluation and assessment
Operation at high temperature and humidity	40°C +/- 2°C 90% RH for 500 hours	No abnormalities in functions* and appearance**
Operation at high temperature	55°C +/- 2°C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20°C +60°C, Left for 1 hour at each temperature, transition time 5 min, repeated 10 times	No abnormalities in functions* and appearance**
Low temperature	-20 +/- 2°C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55 Hz, 10 Hz, amplitude 1.5 mm 2 hrs each in the X, Y, and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10 cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration other appearance defects

4.2 Liquid crystal panel service life

100,000 hours minimum at 25° C ± 10°C, 65% RH maximum.

4.3 Definition of panel service life

- Contrast become 30% of initial value
- Current consumption become three times higher than initial value
- Remarkable allignement deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

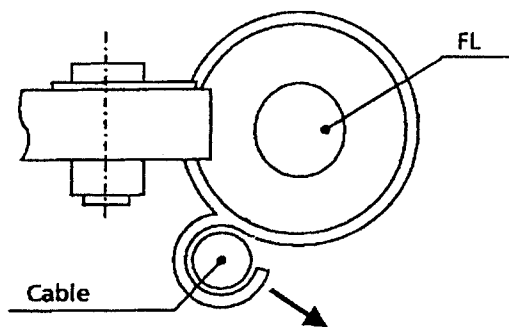
5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth.
- If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

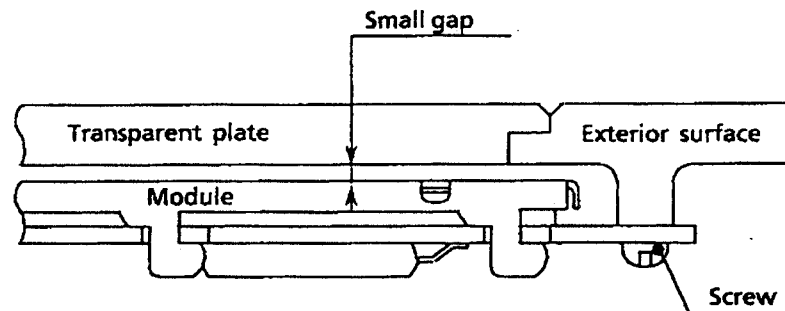
Handling

- Avoid static electricity as this can damage the CMOS LSI .
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully.
- Do not pull the cable in the direction of the arrow, as it may go off the unit.



Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, recommend to leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate.



- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crash, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with a soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.