



ENGINEERING SPECIFICATIONS

LIQUID CRYSTAL DOT MATRIX DISPLAY MODULE

9.4 inch VGA, Color STN

LCM-5330-22NSK

(640×R·G·B×480 dots)

(With cold fluorescent backlight)

(Nonglare type)

T E N T A T I V E

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This specifications may be changed without any notice
in order to improve performance or quality.

MECHANICAL CHARACTERISTICS

Item	Specification	Unit
Package dimensions	260 (W) × 183 (H) × 10.5 (D)	mm
Structure	640 R·G·B (W) × 480 (H)	dot
Dot size	0.08 (W) × 0.28 (H)	mm
Dot pitch	0.10 (W) × 0.30 (H)	mm
Effective area	197 (W) × 147 (H)	mm
Weight	560	g

OPERATING TEMPERATURE RANGE

Item	Symbol	MIN.	MAX.	Unit	
Operating temperature	Top	10	40	°C	※

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	MIN.	MAX.	Unit	
Power supply for logic	$V_{DD} - V_{SS}$	0	6.0	V	
Power supply for LC driving	$V_{RE} - V_{SS}$	2.0	4.2	V	
Input voltage	V_I	V_{SS}	V_{DD}	V	
Storage temperature	Tstg	-10	50	°C	※

ELECTRICAL CHARACTERISTICS

$T_a=25^{\circ}\text{C}$, $V_{DD}=5.0\text{V}\pm 5\%$, $V_{RE}-V_{SS}=38\pm 1\text{V}$

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input high voltage	V_{IH}	—	$0.8V_{DD}$	—	V_{DD}	V
Input low voltage	V_{IL}	—	V_{SS}	—	$0.2V_{DD}$	V
Clock frequency	$f_{CL,2}$	—	5.38	5.61	6.14	MHz
Current consumption	I_{DD}	$f_{CL,2}=5.61\text{MHz}$ $UD_0\sim UD_7=\text{LOW}$ $LD_0\sim LD_7=\text{LOW}$	—	1.6	20	mA
	I_{RE}		—	11.4	60	mA

OPERATING VOLTAGE FOR LC DRIVING

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Operating voltage (1/480 duty)	$V_O - V_{SS}$	$T_a=10^{\circ}\text{C}$		34	37	V
		$T_a=25^{\circ}\text{C}$		33		V
		$T_a=40^{\circ}\text{C}$	26	32		V

※

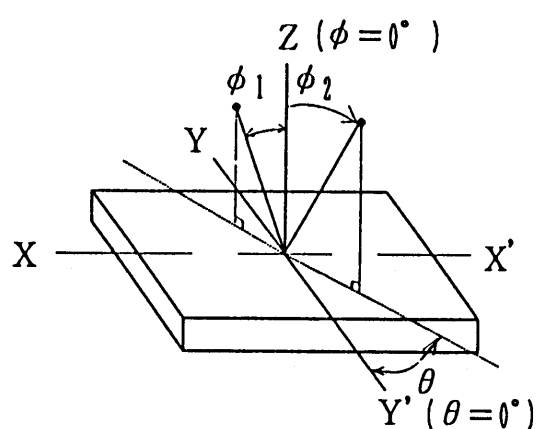
Ambient temperature	$T_a \leq 40^{\circ}\text{C}$	85% RH max. No condensation.
Ambient temperature	$T_a > 40^{\circ}\text{C}$ (Below maximum temperature)	Below maximum absolute humidity of 40°C 85% RH No condensation.

■ OPTICAL CHARACTERISTICS (1)

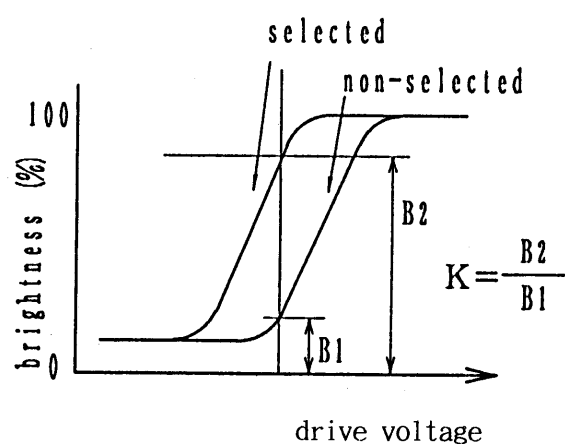
Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	$\phi_1 \sim \phi_2$	$K \geq 2$, $\theta = 0^\circ$ *2	20	—	—	deg.
	θ	$K \geq 2$, $\phi = 20^\circ$ *1	± 10	—	—	deg.
Contrast ratio	K	$\phi = 0^\circ$, $\theta = 0^\circ$ *3	5	15	—	—
Rise time	tr	$\phi = 0^\circ$, $\theta = 0^\circ$ *4	—	200	—	ms.
Fall time	tf	$\phi = 0^\circ$, $\theta = 0^\circ$ *4	—	150	—	ms.

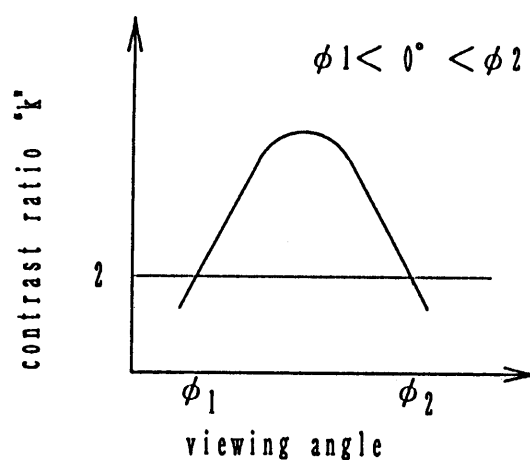
*1. θ and ϕ



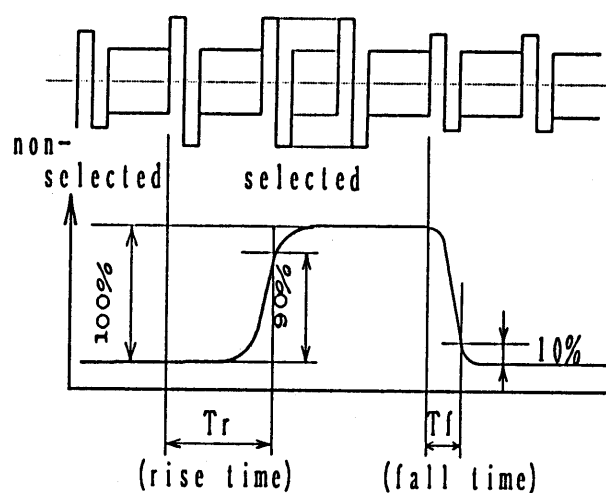
*3. contrast ratio "K"



*2. ϕ_1 and ϕ_2



*4. response time

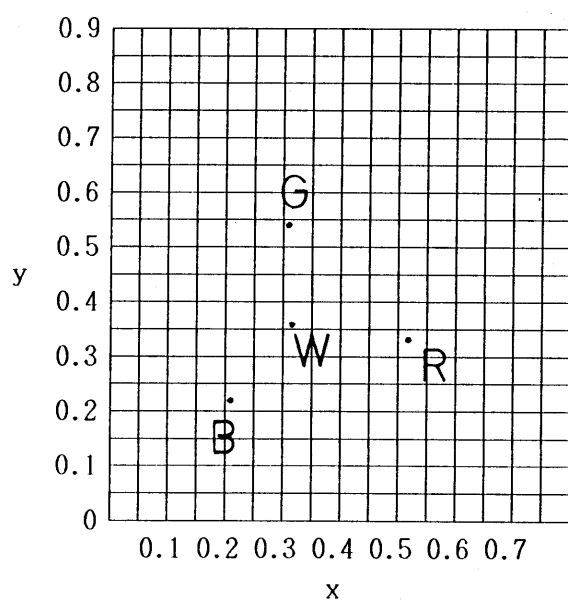


■ OPTICAL CHARACTERISTICS (2)

Ta = 25°C

Item		Symbol	Condition	Typ.	Unit	Note
Color of CIE coordinate	Red	x	$\phi = 0^{\circ} \quad , \quad \theta = 0^{\circ}$	0.52	—	*5
		y		0.33		
	Green	x	$\phi = 0^{\circ} \quad , \quad \theta = 0^{\circ}$	0.31	—	
		y		0.54		
	Blue	x	$\phi = 0^{\circ} \quad , \quad \theta = 0^{\circ}$	0.21	—	
		y		0.22		
	White	x	$\phi = 0^{\circ} \quad , \quad \theta = 0^{\circ}$	0.32	—	
		y		0.36		
	Black	x	$\phi = 0^{\circ} \quad , \quad \theta = 0^{\circ}$	0.30	—	
		y		0.33		

*5. CIE chromaticity diagram



Color of backlight

X = 0.34
Y = 0.36

■ INTERFACE PIN CONNECTION

PIN No.	Symbol	Function
1	N C	
2	V o	Operating voltage for LC driving
3	V E E	Power supply voltage for LCD (+ 3.8 V)
4	V E E	Power supply voltage for LCD (+ 3.8 V)
5	V s s	G N D
6	V s s	G N D
7	V D D	+ 5 V
8	L D ₇	Display data for the even line (Lower Driver)
9	L D ₆	"
10	L D ₅	"
11	L D ₄	"
12	L D ₃	"
13	L D ₂	"
14	L D ₁	"
15	L D ₀	"
16	U D ₇	Display data for the odd line (Upper Driver)
17	U D ₆	"
18	U D ₅	"
19	U D ₄	"
20	U D ₃	"
21	U D ₂	"
22	U D ₁	"
23	U D ₀	"
24	V s s	G N D
25	C L 2	Clock signal for shifting the serial data
26	V s s	G N D
27	C L 1	The CL1 latches the serial data in the shift registers.
28	D I S P	H : display ON, L : display OFF
29	M	Control signal for AC driving
30	F L M	The FLM signal indicates the beginning of each display cycle.

■ CONNECTOR MODEL NO.

IL-402-30SB-S1L-SA (JAE) or equivalent

Suitable FPC: L=31.0±0.1 mm, Pitch P=1 mm

■ CFL INTERFACE

Connector	Pin No.	Symbol	Functional Description
FLCN1	1	HV1	Power supply voltage for CFL
	2	NC	
	3	HV2	Power supply voltage for CFL
FLCN2	1	GND1	CFL GND
	2	GND2	CFL GND

2 CFLs to be used.

■ CFL CONNECTOR

FLCN1 : HXP-3 (J S T)

Suitable connector : B3B-XH-A or S3B-XH-A (J S T)

FLCN2 : HXP-2 (J S T)

Suitable connector : B2B-XH-A or S2B-XH-A (J S T)

■ CFL RATINGS (For one lamp)

Ambient temperature $T_a = 25^{\circ}\text{C}$

Item	Ratings
Non-load output voltage for inverter (VS)	1100 Vrms Min. ~ 1500 Vrms Max.
Lamp current (IL)	4 mArms Min. ~ 8 mArms Max.
Lamp voltage (VL)	460 Vrms Typ.
Operating lifetime (at $IL=8\text{mA}$)	10000 hours Typ.

■ SURFACE BRIGHTNESS OF LCD

MIN.	TYP.	MAX.	UNIT
—	6.5	—	cd/m^2

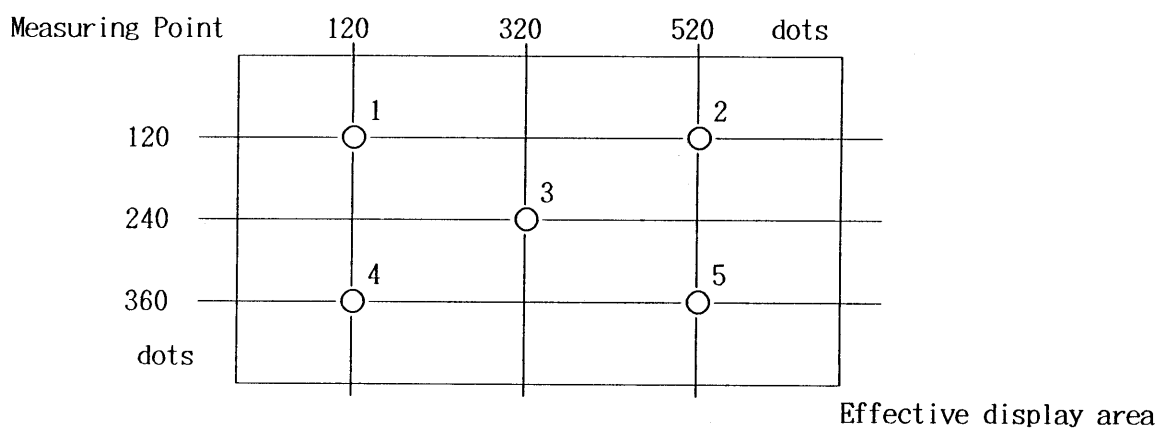
The brightness shall be the average of the following five(5) measuring points.

Ambient temperature $T_a = 25^{\circ}\text{C}$

30 minutes after CFL operation $IL=6.5\text{mA}/\text{lamp} \times 2 \text{ pcs}$

Display pattern : White (all-dot-on)

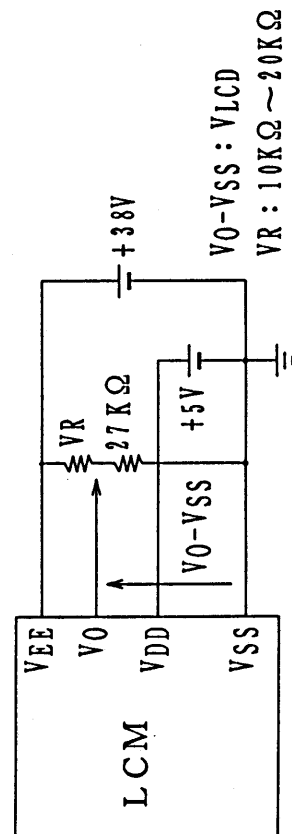
Instrument : BM-7 (TOPCON)



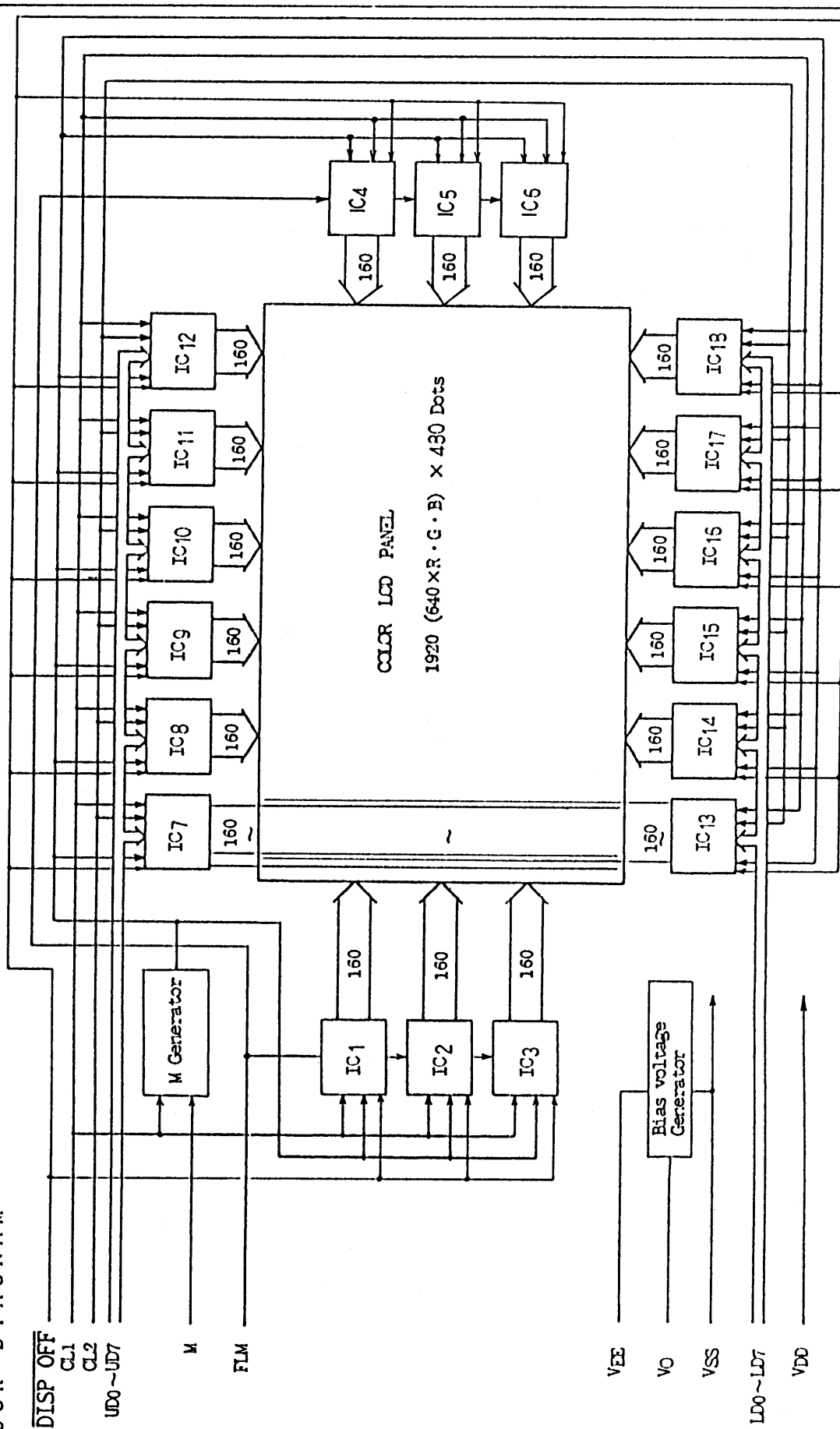
■ DISPLAY VS. DATA CORRESPONDING DIAGRAM

	Y1		Y3		Y5		Y7		Y13		Y15		Y17		Y19	
X1	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X2	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X199	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X200	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X201	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X202	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X479	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0
X480	R0 UD7	G0 LD7	B0 UD6	R1 LD6	G1 UD5	B1 LD5	R2 UD4	G2 LD4	G637 UD3	B637 LD3	R638 UD2	G638 LD2	B638 UD1	R639 LD1	G639 UD0	B639 LD0

■ POWER SUPPLY



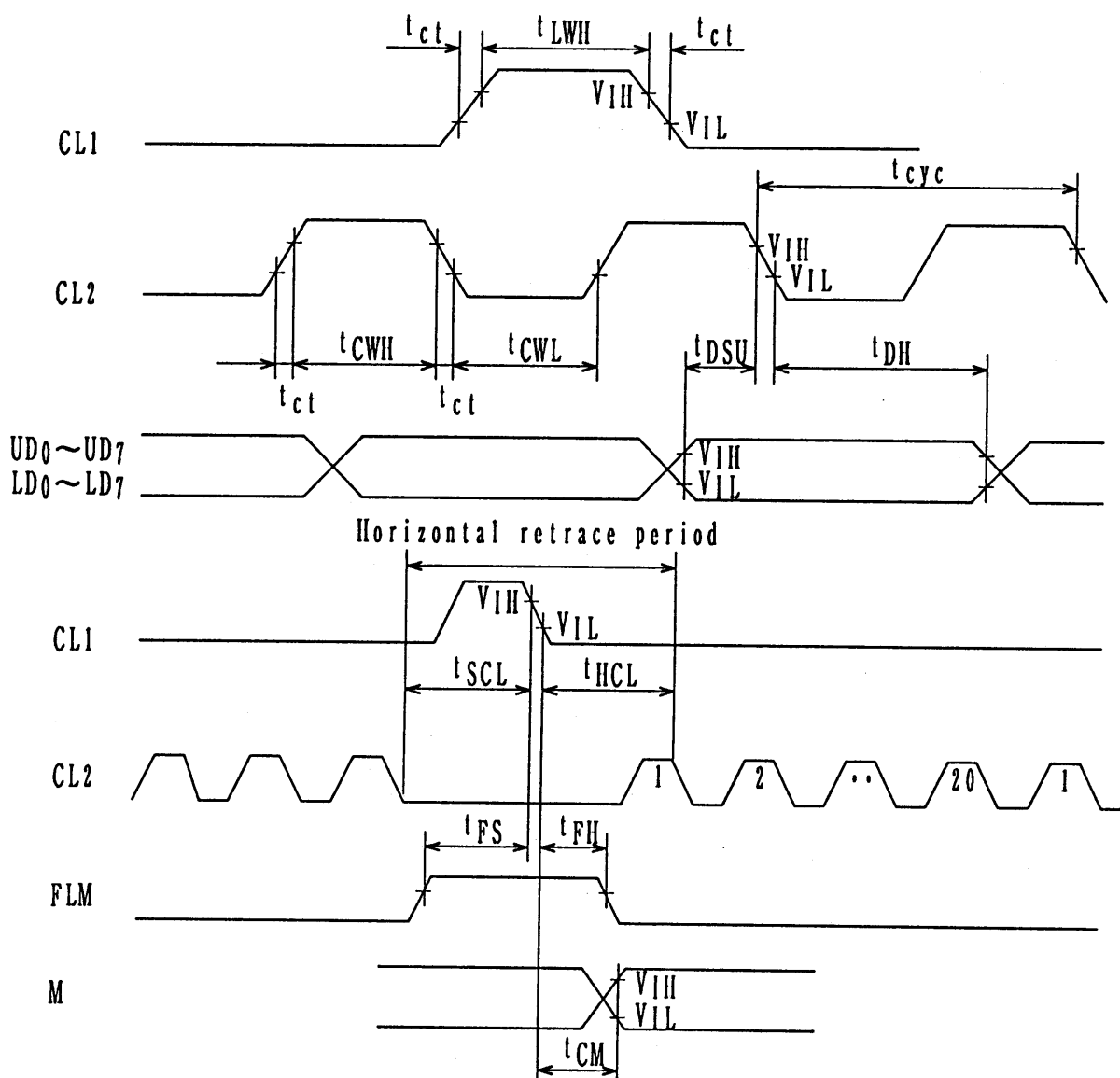
■ BLOCK DIAGRAM



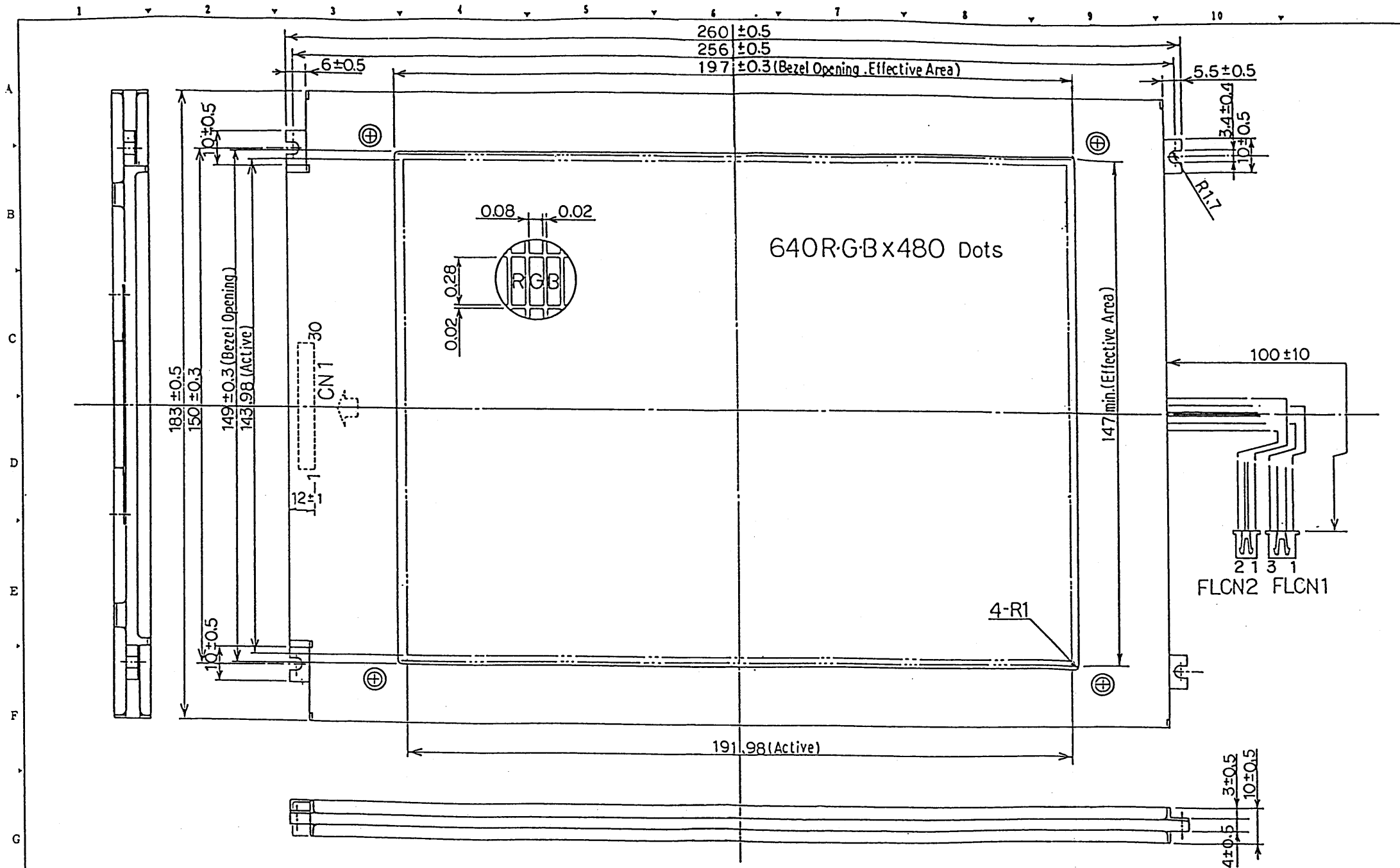
AC ELECTRICAL CHARACTERISTICS

Ta=25°C

Item	Symbol	min.	typ.	max.	Unit
Clock cycle time	t_{cyc}	82	—	—	ns
CL ₂ high level width	t_{cWH}	28	—	—	ns
CL ₂ low level width	t_{cWL}	28	—	—	ns
CL ₁ high level width	t_{LWH}	30	—	—	ns
CL ₂ setup time	t_{SCL}	30	—	—	ns
CL ₂ hold time	t_{HCL}	200	—	—	ns
Clock rise/fall time	t_{ct}	—	—	13	ns
Data setup time	t_{DSU}	28	—	—	ns
Data hold time	t_{DH}	20	—	—	ns
FLM setup time	t_{FS}	100	—	—	ns
FLM hold time	t_{FH}	30	—	—	ns
M phase difference	t_{CM}	—	—	300	ns
Frame frequency	f_{FLM}	—	73	—	Hz



[illegible]



■ Power Supply Sequence

Do not apply DC voltage to the LCD panel because that induces the electro-chemical reaction and reduces its life span. Please follow the power supply ON/OFF sequence to prevent DC driving of LCD or latch-up of CMOS LSI, as shown below.

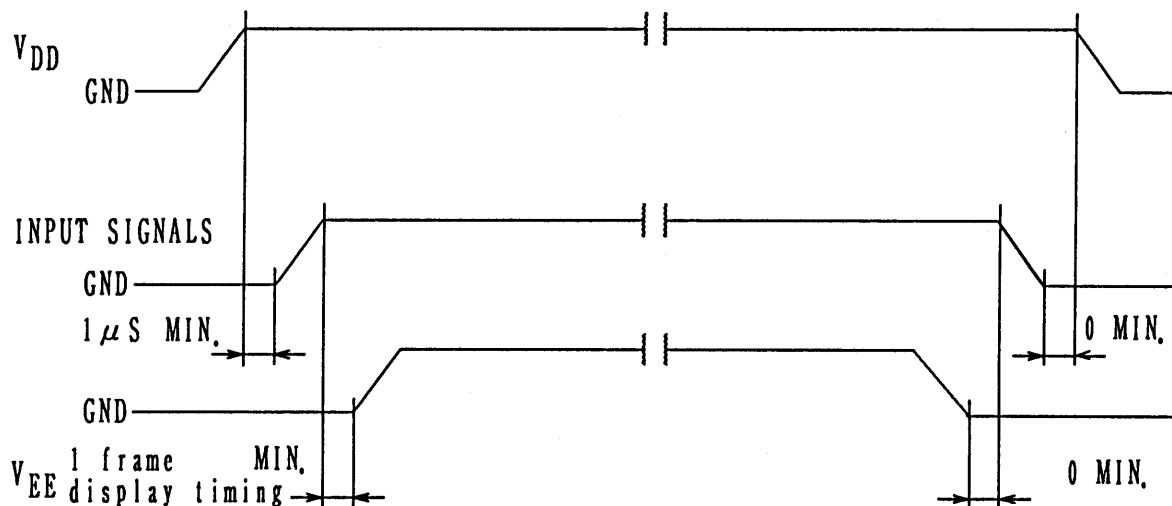


Fig.2 Power ON/OFF sequence

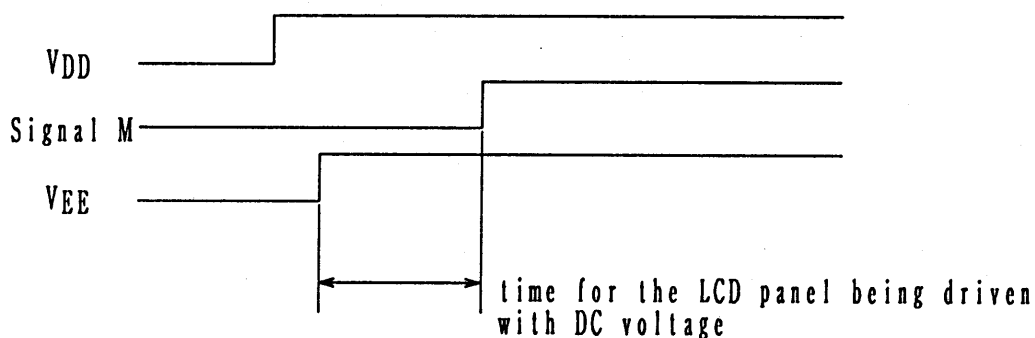


Fig. 3 Time for the LCD panel being driven with DC voltage

At power on, if LC driving power supply voltage (V_{EE}) is applied before LCD panel AC driving signal(M) is input to LC module, the LCD panel is driven with DC voltage in the meantime. (Refer to Fig. 3)

■ An example to prevent LCD DC apply by using DISPOFF

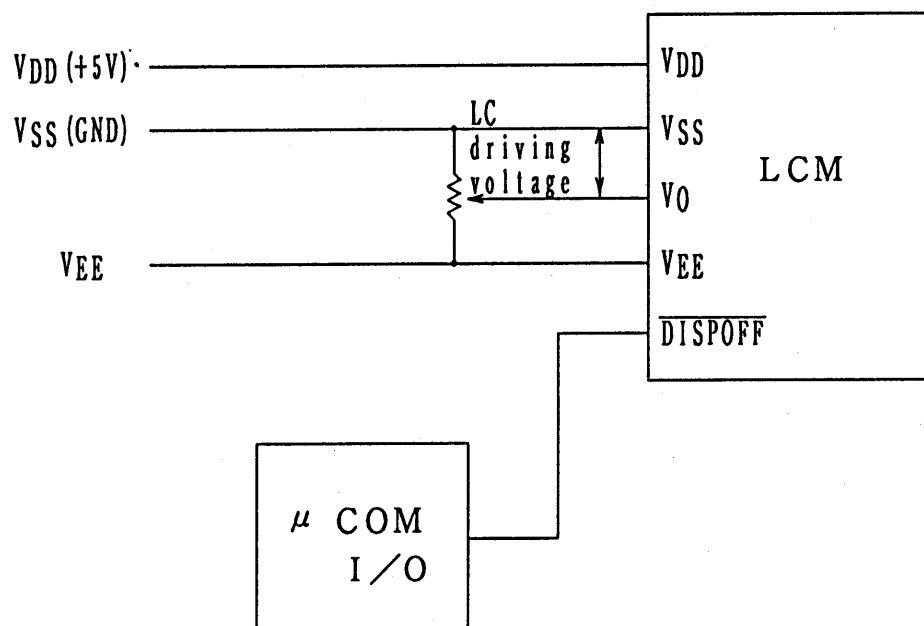


Fig. 4 An example to prevent LCD DC apply by using DISPOFF

Connect I/O port of micro-computer in the main system with DISPOFF and control it. Until initialization of LC control LSI is finished after power ON, signal(M) isn't generated, so that DC voltage is applied to the LCD panel.

(Refer to Fig. 3) During this time, switch I/O port(DISPOFF) to 'L' and force apply voltage to the LCD panel into 0V. After initialization of LC control LSI, switch I/O port(DISPOFF) to 'H', so that the LCD panel is returned to the normal driving voltage. (Refer to Fig. 5)

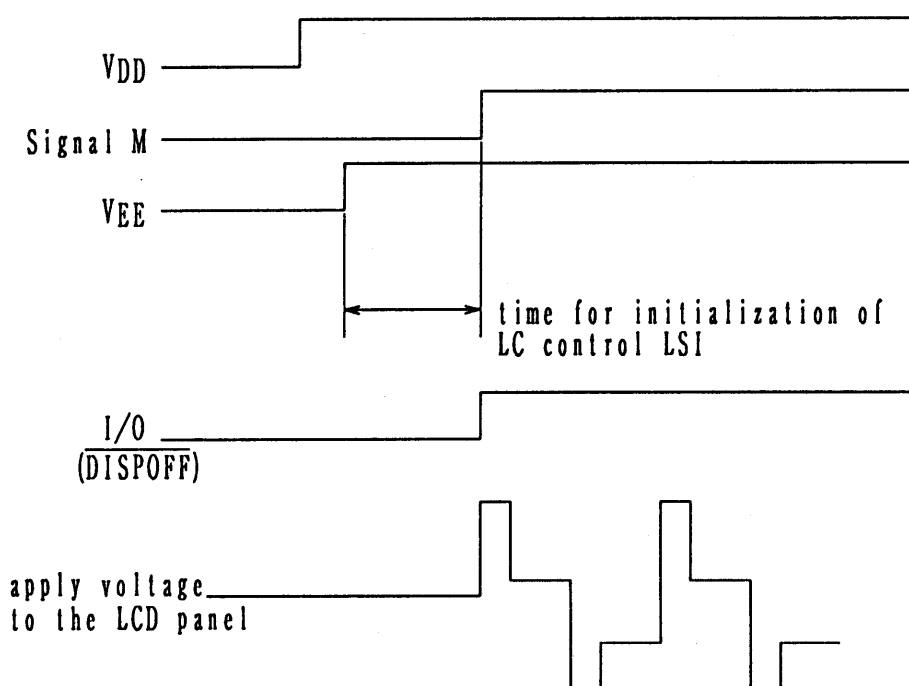


Fig. 5 Timing chart without DC apply to the LCD panel

■ PRECAUTION FOR USING

1. Handling

- (1) Do not touch, press or rub the display panel with a hard, stiff tool or the like (e.g. tweezers) since the polarizers on the surface are easily scratched.
- (2) Do not use organic solvents to clean the display panel as these solvents may adversely affect the polarizer. To clean the display panel dampen a bit of absorbent cotton with petroleum benzine and gently wipe the panel, or stick contaminations by using a scotch tape.
- (3) Do not touch terminals of electrodes of P.W.B. or LSI leads.
- (4) Avoid using or storing the LCM under high temperature and high humidity conditions. At the storing, it is recommended that the device is packaged in a conductive polyethylene bag and placed under the condition where the temperature is relatively lower (10 to 30°C), and the direct sunlight or fluorescent lamp must be cut off.
- (5) The casing for the module shall be designed taking account of the rise in temperature because of the heat from the backlight so that good quality of images can be provided on the screen.
- (6) Do not suck in, drink or hands off the liquid crystal when it is flown out of the display element due to it's damage.
Wipe the liquid crystal off and wash up with soap or alcohol immediately when hands, clothes, etc. are stuck.
- (7) Wash the liquid crystal with pure water for more than 15 minutes and have medical treatment by the doctor when it gets in the eyes.
- (8) Follow to the ordinances or the regulations set by the self-governing body in disposing of CFLs.

2. Operation

- (1) Do not connect or disconnect the LCM from the main system while power is being supplied.
- (2) If the operating temperature drops below the temperature limits, the blinking speed of the display will decrease, while if it rises above the prescribed limits, the entire display will turn black. When the temperature returns to within normal limits, the display will operate normally.
- (3) Adjust the operating voltage for driving (V_o) so that the display shows optimum contrast.

- (4) When supplying an M signal from the external unit to a graphic display of LCM, set the duty to $50\% \pm 1\%$. If the duty deviates too greatly from the value, a DC voltage will be applied to the liquid crystal, which could induce an electrochemical reaction and reduce the life of the LCM.

3. Workmanship

- (1) Never disassemble the module. After disassembling, in case that the module is assembled again and shows a disordered operation, the responsibility of the failure will not lie with vendor.
- (2) Care should be taken as not to be charged static electricity, as the circuit of the module contains a CMOS LSI. The workman's body should be grounded with an earth-band. The material which prevents static electricity should be selected for a working clothes.