

ENGINEERING SPECIFICATIONS

LIQUID CRYSTAL DOT MATRIX DISPLAY MODULE

LCM 5520-24NAK (320 X 240 dots)

5"7 F- STN
Nonglare type

Converter type n°: CFP39-1

(TENTATIVE)

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HISTORY OF CHANGES

[illegible]

NOTE

FEATURES

- (1) F-STN LCD (B/W mode)
- (2) Negative display (display dots--white, background--black)
- (3) Transmissive type (with backlight system)
- (4) 1/240 duty multiplexing drive
- (5) Viewing direction: 12 o'clock

MECHANICAL CHARACTERISTICS

Item	Specification	Unit
External dimensions	167(W)×110(H)×11max.	mm
Structure	320(W)×240(H)	dot
Dot size	0.33(W)×0.33(H)	mm
Dot pitch	0.36(W)×0.36(H)	mm
Active area	121(W)×92(H)	mm
Weight	205	g

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	MIN.	MAX.	Unit
Power supply for logic	$V_{DD}-V_{SS}$	0	7.0	V
Power supply for LCD driver	$V_{DD}-V_{EE}$	0	30.0	V
Input voltage	V_I	V_{SS}	V_{DD}	V
Operating temperature	Top	5	40	°C
Storage temperature	Tstg	-20	60	°C
Humidity (Ambient temperature : Ta) * Remark : No dew	Ta ≤ 40°C	85% RH max.		
	Ta > 40°C (Below max. temp.)	Below max. absolute humidity of 40°C 85% RH		

ELECTRICAL CHARACTERISTICS

Ta=25°C, $V_{DD}=5.0V \pm 5\%$, $V_{EE}=-23.0 \pm 1.0V$, $V_{SS}=0V$

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input logic level	V_{IH}		0.7 V_{DD}	—	V_{DD}	V
Input logic level	V_{IL}		V_{SS}	—	0.3 V_{DD}	V
Clock frequency	f_{CLZ}	$f_{FLM}=73Hz$	—	1.4	—	MHz
Current consumption	I_{DD}	$f_{CLZ}=1.4MHz$ D0~D3=GND $V_O=-19.0V$	—	5.0	10.0	mA
	I_{EE}		—	4.0	8.0	mA

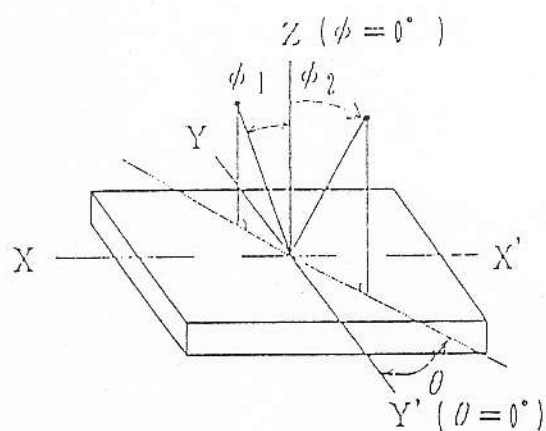
OPERATING VOLTAGE FOR LC DRIVING

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Operating voltage (1/240 duty)	$V_{DD}-V_O$	Ta=5°C	—	—	28.0	V
		Ta=25°C	—	24.0	—	V
		Ta=40°C	20.0	—	—	V

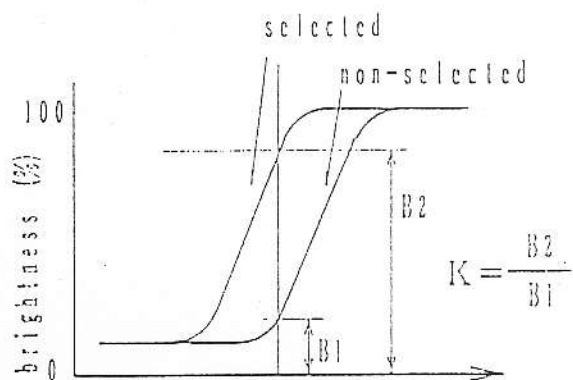
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	$\phi_1 \sim \phi_2$	$K \geq 1.4, \theta = 0^\circ$ #2	40	—	—	deg.
	θ	$K \geq 1.4, \phi = 20^\circ$ #1	± 30	—	—	deg.
Contrast ratio	K	$\phi = 0^\circ, \theta = 0^\circ$ #3	8.0	—	—	—
Rise time	tr	$\phi = 0^\circ, \theta = 0^\circ$ #4	—	150	200	ms.
Fall time	tf	$\phi = 0^\circ, \theta = 0^\circ$ #4	—	150	200	ms.

■ DEFINITION

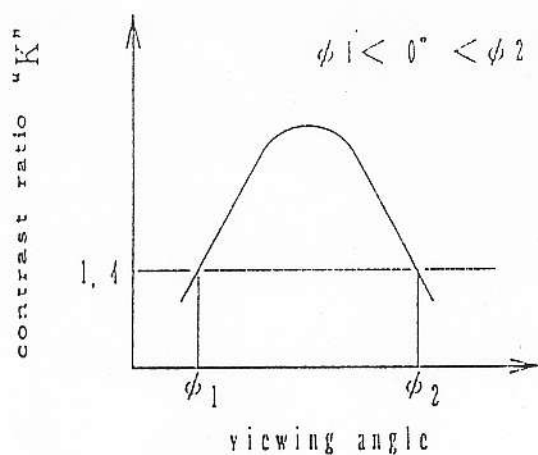
#1. θ and ϕ



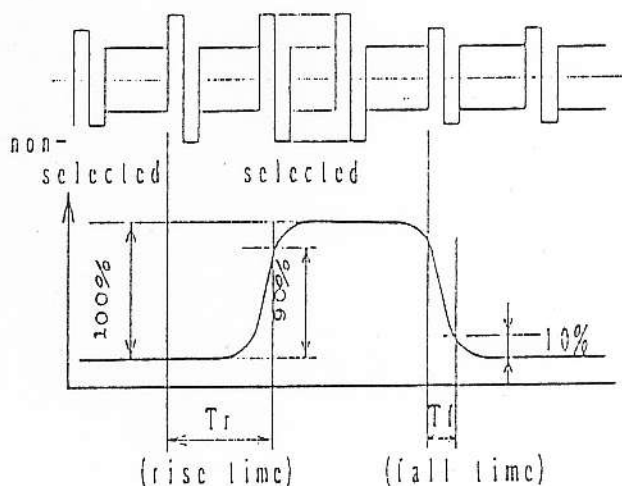
#3. contrast ratio "K"



#2. ϕ_1 and ϕ_2



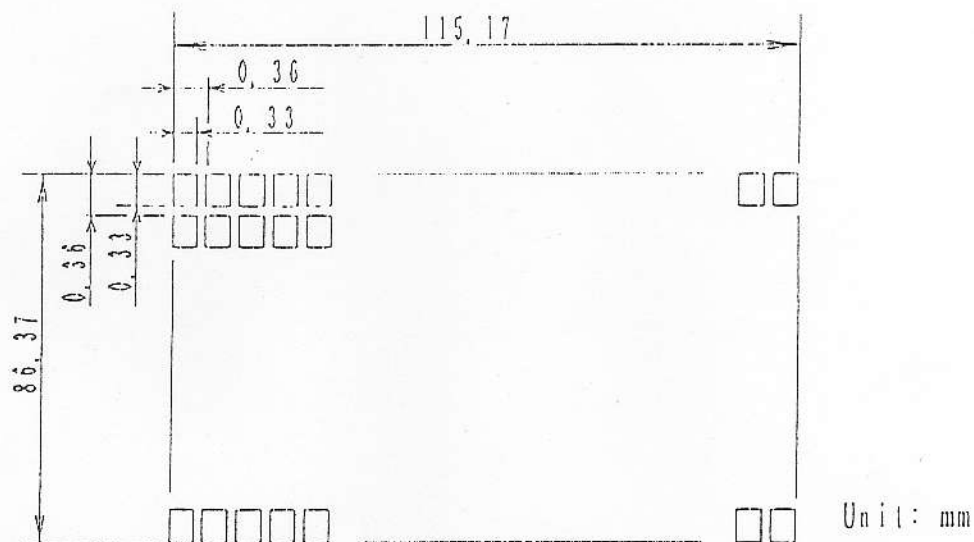
#4. response time



INTERNAL PIN CONNECTION

Pin No.	Symbol	Function
1	V _O	Operating voltage for LC driving.
2	V _{EE}	-23V (Power supply for LC driving.)
3	D0	Data 0 H---ON(White) L---OFF(Blue)
4	D1	Data 1 H---ON(White) L---OFF(Blue)
5	D2	Data 2 H---ON(White) L---OFF(Blue)
6	D3	Data 3 H---ON(White) L---OFF(Blue)
7	D-OFF	Display enable signal. H---ON L---OFF
8	V _{SS}	GND
9	V _{DD}	+5V (Power supply for Logic.)
10	CL2	Clock signal for shifting the serial data
11	CL1	The CL1 latches the serial data
12	FLM	The FLM signal indicates the beginning of each display cycle.

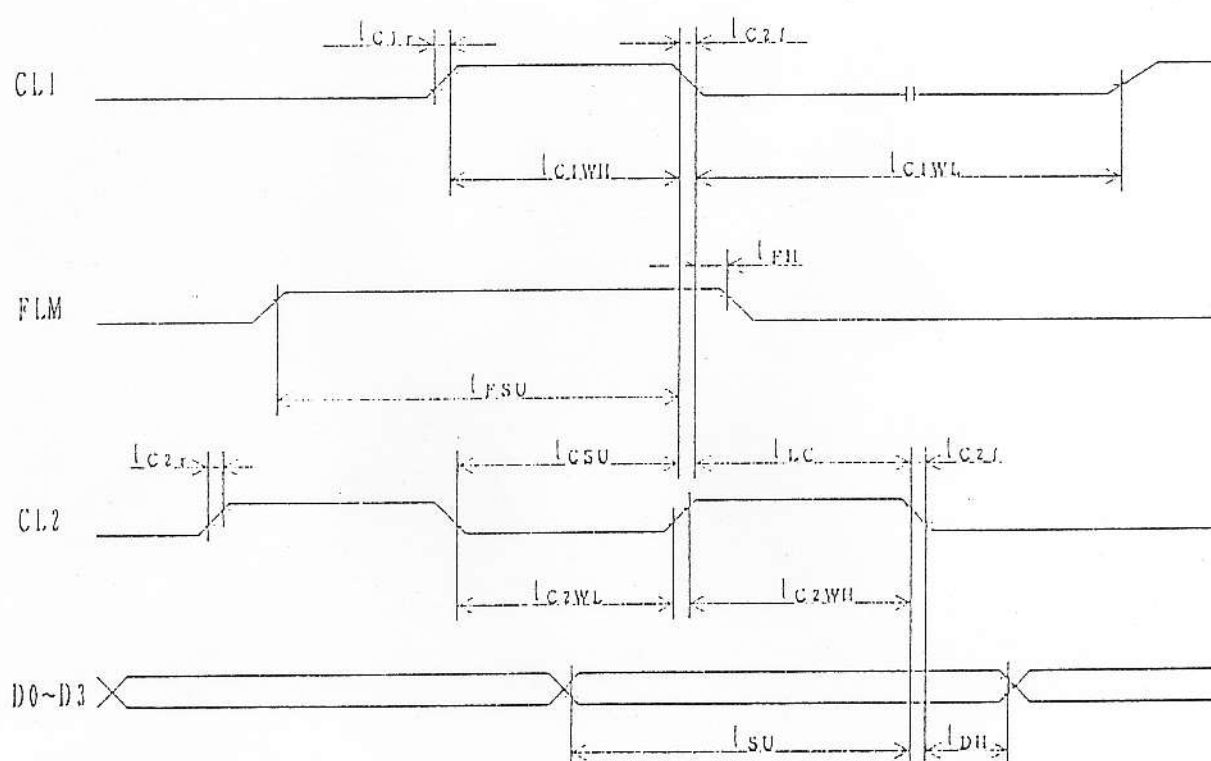
DISPLAY PATTERN



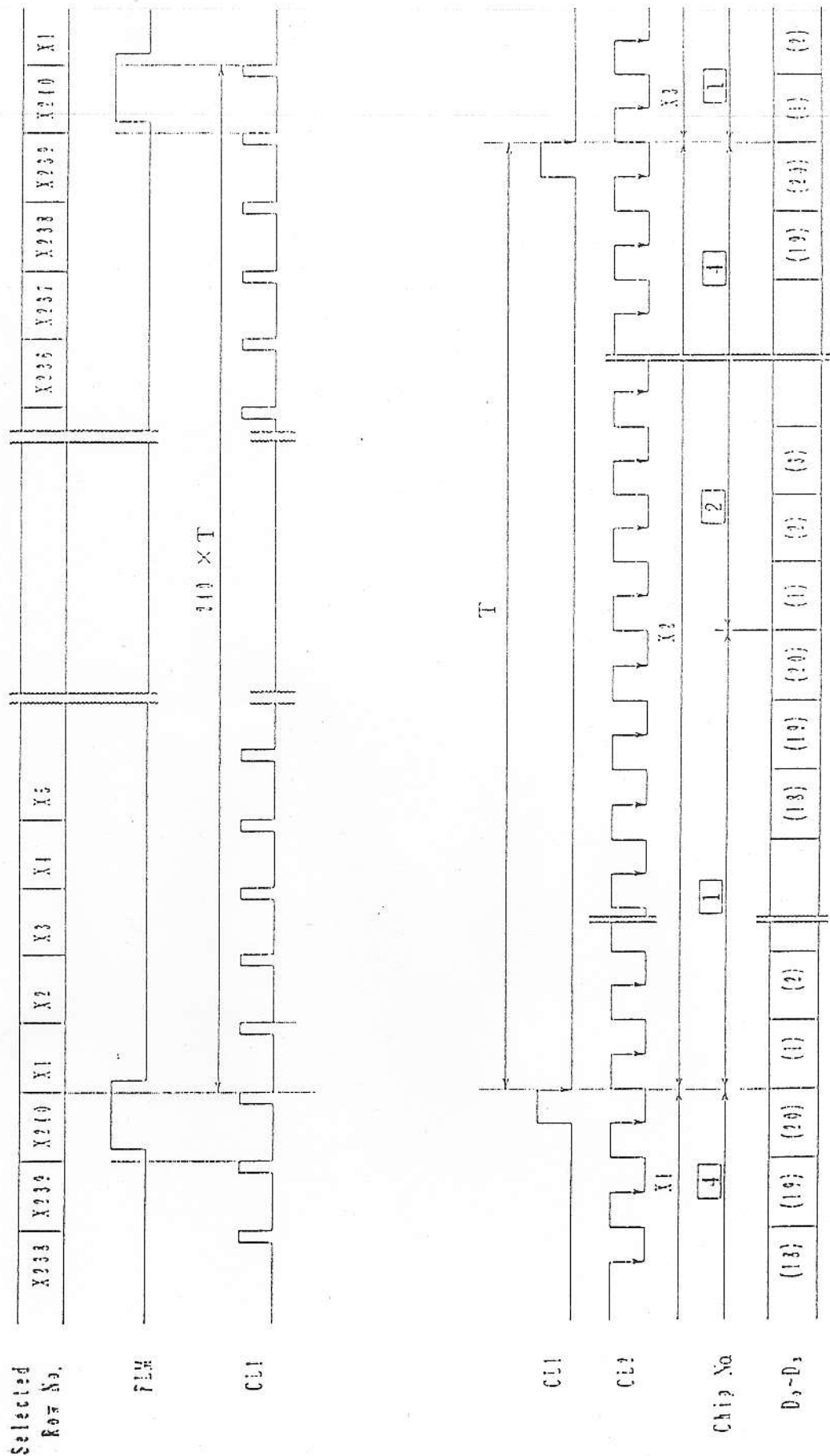
Item	Symbol	Min.	Typ.	Max.	Unit
Clock frequency (CL2)	f_{CL2}	—	—	8.0	MHz
Clock frequency (CL1)	f_{CL1}	—	—	$f_{CL2} \times 20$	KHz
Clock pulse width (CL2, High level)	t_{C2WH}	45	—	—	ns
Clock pulse width (CL2, Low level)	t_{C2WL}	45	—	—	ns
Clock pulse width (CL1, High level)	t_{C1WH}	50	—	—	ns
Clock pulse width (CL1, Low level)	t_{C1WL}	1.0	—	—	μs
Clock set up time	t_{CSU}	80	—	—	ns
Data set up time	t_{SU}	20	—	—	ns
Data hold time	t_{DH}	20	—	—	ns
FLM set up time	t_{FSU}	100	—	—	ns
FLM hold time	t_{FH}	100	—	—	ns
Rising, Falling time (CL2)	t_{C2r}, t_{C2f}	—	—	15	ns
Rising, Falling time (CL1)	t_{C1r}, t_{C1f}	—	—	15	ns
CL1 → CL2 time	t_{LC}	80	—	—	ns

H : 0.7V_{DD}

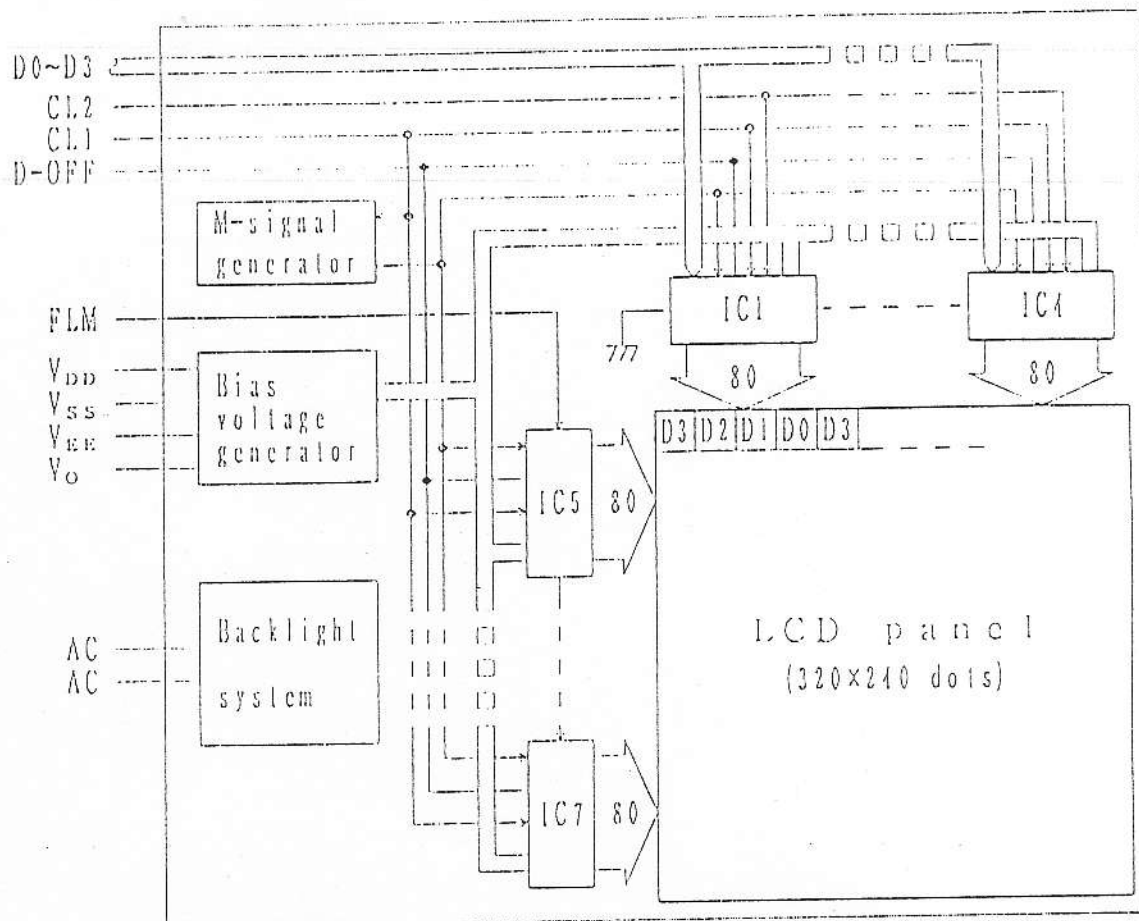
L : 0.3V_{DD}



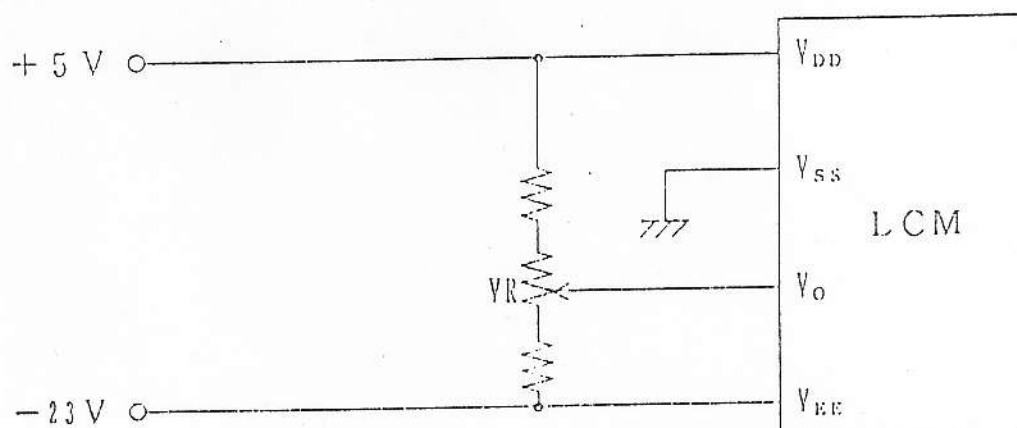
INTERFACE TIMING CHART



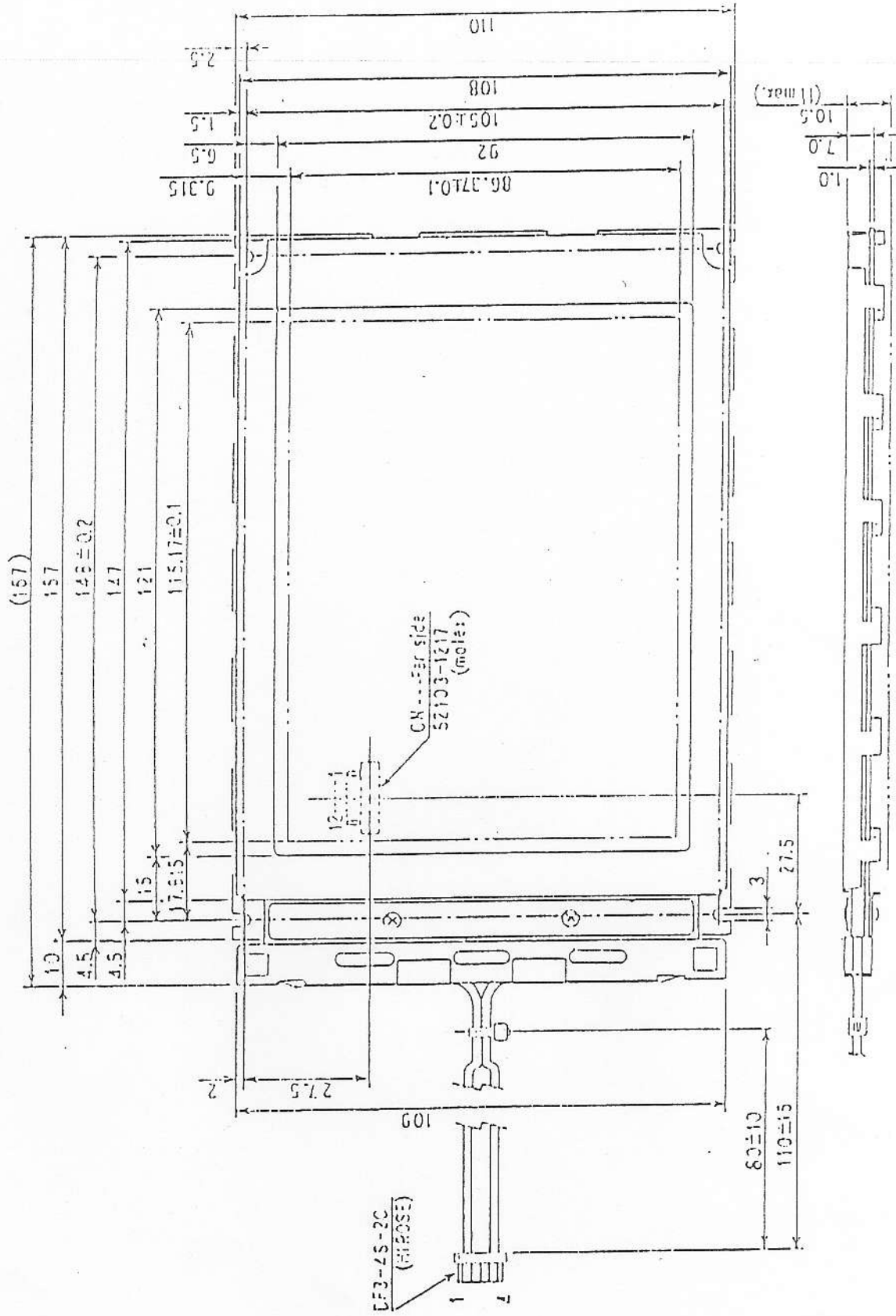
BLOCK DIAGRAM



POWER SUPPLY



EXTERNAL DIMENSIONS



Unit: mm
Tol: ±0.5

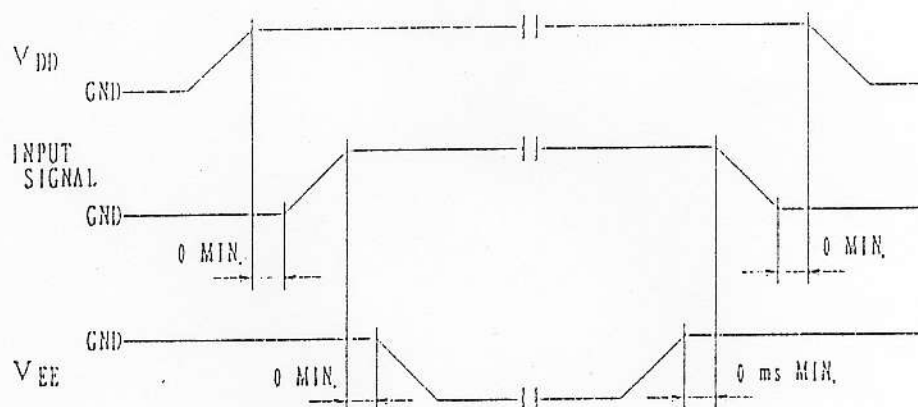
PRECAUTIONS FOR USE

1. Handling

- ① Do not touch, press or rub the display panel with a hard tool or stuff such as tweezers since polarizers on the surface are easily scratched.
- ② Do not use organic solvents to clean the display panel as these solvents may adversely affect polarizers. Dust may be removed by adhesive tape or with absorbent cotton and petroleum benzine.
- ③ The processing or deformation of the claw of the metal frame may have effect on the connection of the LSI output signal and cause the abnormal display.
- ④ If the pressure is applied to the metal frame or PCB, LC cells or the backlight lamp may be damaged or abnormal display may occur. When installing the module, the holes for fixing should be used.
- ⑤ Do not touch electrode terminals of PCB, LSI leads or conductive rubbers.
- ⑥ Avoid using or storing the module under the conditions of high temperature or high humidity. If it is operated with drops of water or condensation, it causes the abnormal display or the corrosion of the electrodes. When in storage, this module should be packaged in a conductive polyethylene bag and placed in relatively low temperature (5 to 30°C), shielded from the direct sunlight or fluorescent lamp.

2. Operation

- ① Do not connect or disconnect modules to or from the main system while power is being supplied.
- ② Use the module within specified temperature; lower temperature causes the retardation of blinking speed of the display; higher temperature makes overall display discolor. When the temperature gets to be within normal limits, the display will operate normally.
- ③ Adjust the LC driving voltage so that the display shows optimum contrast.
- ④ If the DC voltage is applied to the LCD panel, the electrochemical reaction will be induced, which reduces the lifetime rapidly. Follow the on/off sequence shown below to prevent a latch-up of CMOS LSI or DC application to the LCD module.



3. Servicing

- ① Do not disassemble. We shall not be held responsible in case that, after being disassembled, the module does not work due to failure in reassembly.
- ② Care should be taken not to charge static electricity, as the circuit of this module contains CMOS LSIs. A workman's body should be static protected by use of an earth-band. Working clothes for such personnel ought preferably to be of static protected material.
- ③ When the electrically powered driver is used for installing the module, never fail to ground it. In cleaning by the vacuum cleaner, do not bring the sucking mouth near the module; static electricity of the electrically powered driver or the vacuum cleaner may destroy the module.

QUALITY CRITERIA

Inspection Item	Conditions	Criteria
1. Lighting off appearance of display area a. Black spot, Foreign matter, White spot (circle)	Visual inspection ϕ : Average diameter	$\phi > 0.5$ mm : None $0.3 < \phi \leq 0.5$ mm : 1 pce or less $0.2 < \phi \leq 0.3$ mm : 2 pcs or less $0.15 < \phi \leq 0.2$ mm : 5 pcs or less $\phi \leq 0.15$ mm : Ignore
b. Black spot, Foreign matter (linear)	Length : L Width : W	* $W > 0.15$ mm $W \times L > 0.3$ mm ² : None $W \times L \leq 0.3$ mm ² : 1 pce or less * $0.05 < W \leq 0.15$ mm $L > 5.0$ mm : None $2.0 < L \leq 5.0$ mm : 1 pce or less $0.5 < L \leq 2.0$ mm : 2 pcs or less $L \leq 0.5$ mm : Ignore * $0.03 < W \leq 0.05$ mm $L > 10.0$ mm : None $5.0 < L \leq 10.0$ mm : 2 pcs or less $L \leq 5.0$ mm : Ignore * $W \leq 0.03$ mm : Ignore
c. Scratch or wrinkle on polarizer	Length : L Width : W	* $W > 1.0$ mm $W \times L > 10.0$ mm ² : None $W \times L \leq 10.0$ mm ² : 1 pce or less $0.3 < W \leq 1.0$ mm $L > 10.0$ mm : None $5.0 < L \leq 10.0$ mm : 1 pce or less $L \leq 5.0$ mm : Ignore * $W \leq 0.3$ mm : Ignore
d. Bubble on polarizer	ϕ : Average diameter	$\phi > 0.5$ mm : None $0.3 < \phi \leq 0.5$ mm : 3 pcs or less $0.15 < \phi \leq 0.3$ mm : 6 pcs or less $\phi \leq 0.15$ mm : Ignore

Inspection Item	Conditions	Criteria
e. Bruise on polarizer	ϕ : Average diameter	$\phi \leq 0.3$ mm : 2 pcs or less each on both sides
f. Uneven color (rainbow)		No distinct uneven color(rainbow)
g. Bubble, Foreign matter	ϕ : Average diameter	$\phi > 0.5$ mm : None $0.3 < \phi \leq 0.5$ mm : 3 pcs or less $0.2 < \phi \leq 0.3$ mm : 6 pcs or less $\phi \leq 0.2$ mm : Ignore
2. Lighting on appearance of display area :	Display voltage has the figure which shows right contrast for practical use.	
a. White spot, Black spot, Pin hole; distinct	ϕ : Average diameter	$\phi > 0.5$ mm : None $0.3 < \phi \leq 0.5$ mm : 1 pce or less $0.2 < \phi \leq 0.3$ mm : 2 pcs or less $0.15 < \phi \leq 0.2$ mm : 5 pcs or less $\phi \leq 0.15$ mm : Ignore
b. Black spot, White spot; indistinct	ϕ : Average diameter	$\phi > 1.5$ mm : None $1.0 < \phi \leq 1.5$ mm : 2 pcs or less $0.5 < \phi \leq 1.0$ mm : 5 pcs or less $\phi \leq 0.5$ mm : Ignore
c. Center spark, White spot		Negotiable
d. White line, Black line, Scratch; distinct	Length : L Width : W	* $W > 0.5$ mm : None * $W \leq 0.5$ mm, $L \leq 3$ mm : 3 pcs or less
e. White line, Black line, Scratch; indistinct	Length : L Width : W	$W \leq 2$ mm, $L \leq 15$ mm

Inspection Item	Conditions	Criteria
f. White star(apply for white spot that disappears at power off)	ϕ : Average diameter Length : L Width : W	$\phi > 1.5$ mm : None $1.0 < \phi \leq 1.5$ mm : 2 pcs or less $0.5 < \phi \leq 1.0$ mm : 5 pcs or less $\phi \leq 0.5$ mm : Ignore $W \leq 1$ mm $L \leq 15$ mm
g. Uneven contrast		Do not lose product value(Do not have the problem practically)
h. Thick dot or thin dot		0.05 mm or less
3. CFL board lighting on appearance	Visual inspection	
a. Black spot; distinct	ϕ : Average diameter	$\phi > 0.5$ mm : None $0.2 < \phi \leq 0.5$ mm : 8 pcs or less $\phi \leq 0.2$ mm : Ignore
b. Black spot, White spot; indinsinct	ϕ : Average diameter	$\phi > 0.7$ mm : None $0.3 < \phi \leq 0.7$ mm : 3 pcs or less $\phi \leq 0.3$ mm : Ignore
c. Foreign matter, Smear(linear)	Width : $W \leq 50 \mu\text{m}$ Length : L	$L > 12.0$ mm : Ignore $1.0 < L \leq 12.0$ mm : 6 pcs or less $L \leq 1.0$ mm : Ignore