SPECIFICATIONS   FOR
LCD   MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	**AR-3242H-CIQW(3.8")**
APPROVED BY	
DATE	

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Contents
2002/5/23	New Release

1   Features

(1) Display format : 3.8 inch screen size, 320(RGB)X240 dots, 1/240 duty.

(2) Construction : Color STN LCD, Common & Segment Driver, PCB & LED Backlight.

(3) Display type : Color STN, Transflective, 6 o'clock view

(4) High contrast ratio

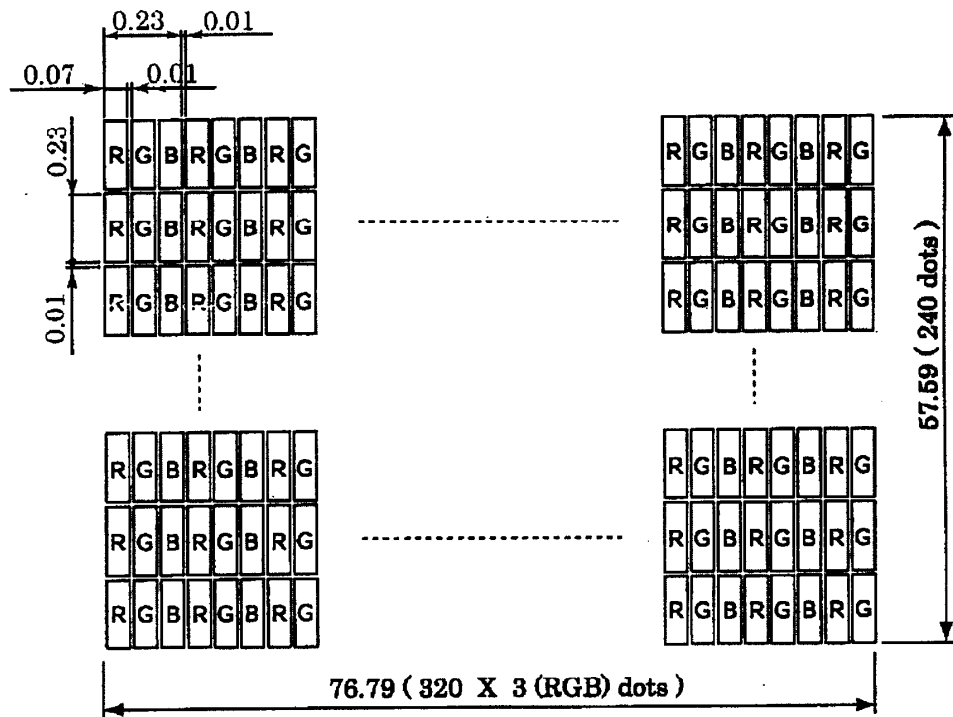(5) Compact size and thickness.

(6) Normal temperature type.

2   Mechanical specifications

2-1 Dimensions and weight

Item	Specifications	Unit
Module size	90.6 (W) x 72.4 (H) x 8.46(D) max	mm
Viewing area	78.7 (W) x 59.4(H)	mm
Weight	58 typical	g

2-2 Dot size & Dot pitch   (Unit : mm)

3 Absolute max. ratings and environment

3-1 Electrical Absolute maximum ratings

Ta=25°C   GND=0V

Item	Symbol	Min.	Max.	Unit	Remarks
Supply voltage	VD3	0	+5.0	V	Note 1
Signal voltage	VIN	0	VD3	V	Note 2

Note 1: If the LSI is used beyond the above maximum ratings, it may be permanently damaged. It should always be used within its specified operation range for normal operation to prevent malfunction or degraded reliability.

Note 2: DISP, FRAME, DF, LOAD, CP, D7~0

3-2 Environmental absolute maximum ratings

Item	Specifications	Remarks
Storage temperature	Max. +70°C Min. -20°C	Note 1: Non-condensing
Operating temperature	Max. +50°C Min. -10°C	Note 1: Non-condensing

Note 1：Ta$\leqq$+40°C   Max.90%RH Max.

Ta＞+40°C   Absolute humidity must be lower then humidity of 40°C 90%RH.

4 Electrical specifications

4-1 Electrical characteristics

Item		Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Remark
Supply voltage		VD3		3.1	3.3	3.5	V	
Input signal voltage	H level	VSH		0.9VD3	-	VD3	V	Note1
	L level	VSL		0	-	0.1VD3		
Frame frequency		fFRAME		-	70	-	Hz	
Current Consumption		ID3	Ta=25°C VD3=3.3V fFRAME=70Hz DF=13 Lines Duty=1/241 CRmax	-	2.2	4.5	mA	Note2

Note 1: DISP, FRAME, DF, LOAD, CP, D7~0

Note 2: Display patterns of current consumption are as follows.

ID3　Typical value: Display of character "A" of 40 rows X 24 lines on whole screen.

Max value:　Display of hatching of 8 dots horizontally X 1 dot vertically.

4-2 contrast adjustment (VOL1, VOL2, VOL3)

The contrast of LCD differs depending on the charges in visual angle, ambient temperature and supply voltage. So, make adjustment by operating control knob where necessary. The recommended resistance value of adjusting volume is 100K Ohm.

When the resistance value of VOL1-VOL2 is increased, the display becomes light.
When the resistance value of VOL2-VOL3 is increased, the display becomes dark.

5 Optical characteristics

Optical characteristics. Refer to Note 1 to 6

LCD driving condition: Ta=25°C, VD3=3.3V, VD2=3.0V, VM=1.5V, GND=0V

Contrast max., FRAME=70Hz, DF=13Lines, Duty=1/241

5-1 Optical Characteristics (1)

Item		Symbol	Mode	Min.	Std.	Max.	Unit	Conditions
Response time (TBD)		tON	-	-	370	555	ms	$\theta=0$, $\varphi=0$
		tOFF	-	-	220	330	ms	
Contrast ratio		CR	Reflective	-	6	-	-	$\theta=0, \varphi=0$, LED:off Light:on
			Transparent	-	9	-		$\theta=0, \varphi=0$, LED:on Light:off
Visual Angle	Vertical	$\theta 1$	Reflective	\multicolumn{3}{c}{$-25\leq\theta 1\leq+40$}	deg	$\varphi=0$,CR$\geq$1.5 LED:off Light:on
			Transparent	\multicolumn{3}{c}{$-35\leq\theta 1\leq+45$}		$\varphi=0$,CR$\geq$1.5 LED:on Light:off
	Horizontal	$\theta 2$	Reflective	\multicolumn{3}{c}{$-35\leq\theta 2\leq+35$}	deg	$\varphi=90$,CR$\geq$1.5 LED:off Light:on
			Transparent	\multicolumn{3}{c}{$-40\leq\theta 2\leq+40$}		$\varphi=90$,CR$\geq$1.5 LED:on Light:off
Visual angle direction priority		-		6:00		

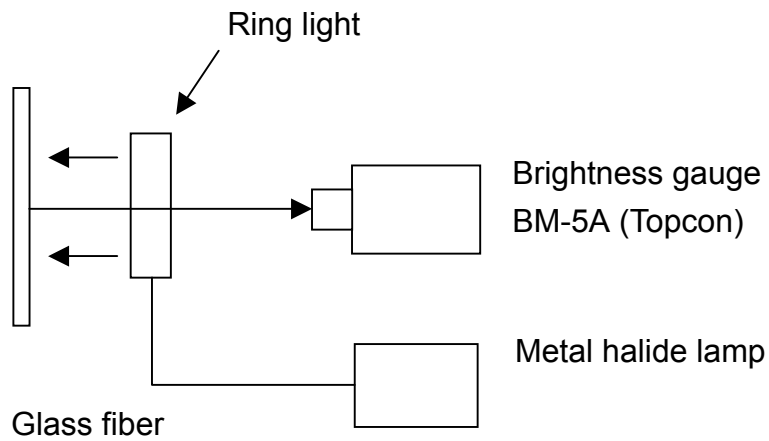**NOTE 1: Driving conditions**

VD3=3.3V

FRAME=70Hz

Duty=1/241, DF=13 Lines (Alternative LCD driving voltage period)

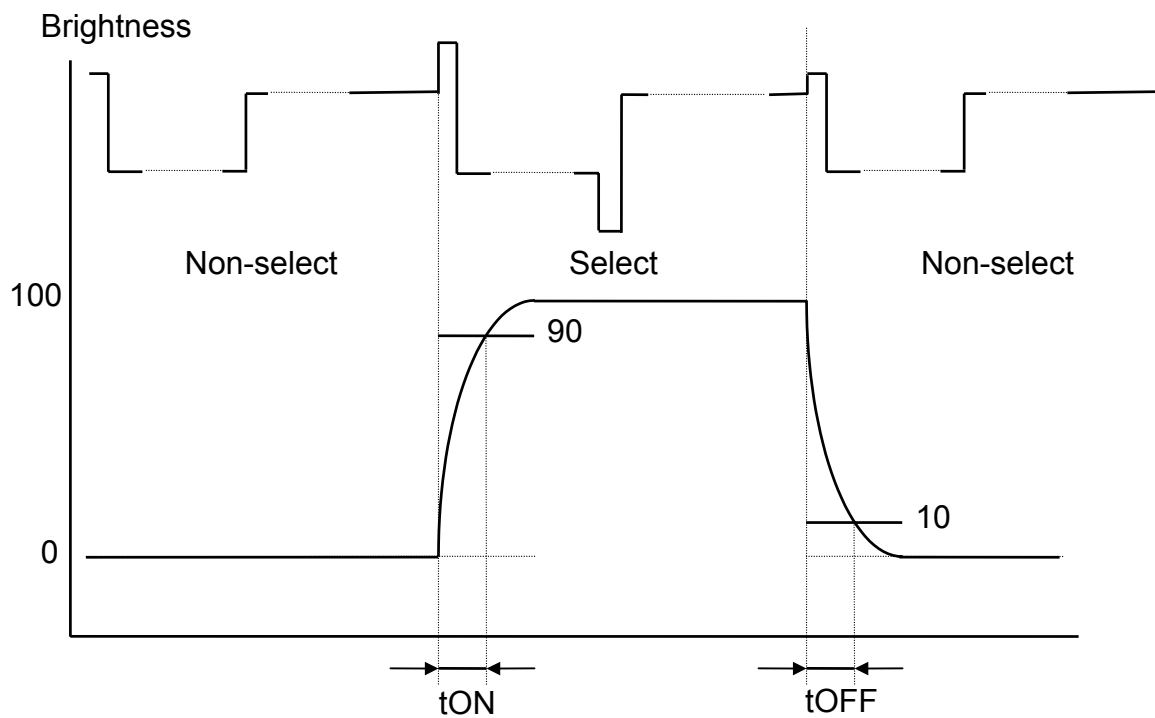Display Pattern : all screen On and OFF
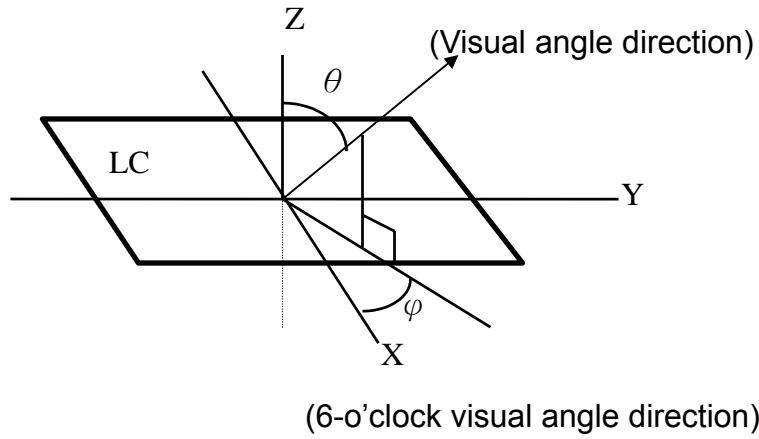
Adjusted to Contrast Maximum
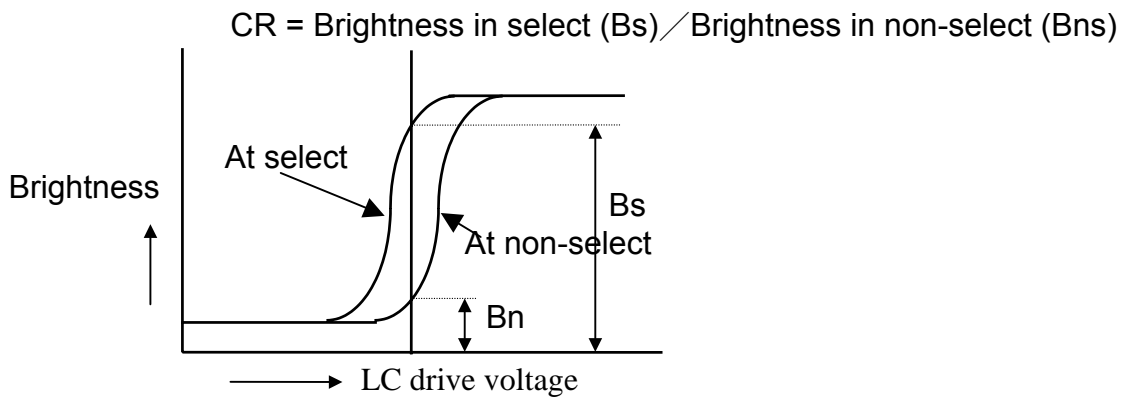
NOTE 2: Optical characteristic measurement system

Ring light

Brightness gauge
BM-5A (Topcon)

Metal halide lamp

Glass fiber

NOTE 3: Response tome definition

Brightness

Non-select

Select

Non-select

100

90

0

10

tON

tOFF

NOTE 4: $\varphi \cdot \theta$ **definition**

Z

θ

(Visual angle direction)

LC

Y

φ

X

(6-o'clock visual angle direction)

NOTE 5: Contrast definition

CR = Brightness in select (Bs)／Brightness in non-select (Bns)

At select

Brightness

Bs

At non-select

Bn

LC drive voltage

NOTE 6: Visual angle direction priority

12 : 00

9 : 00

LCD screen

3 : 00

6 : 00
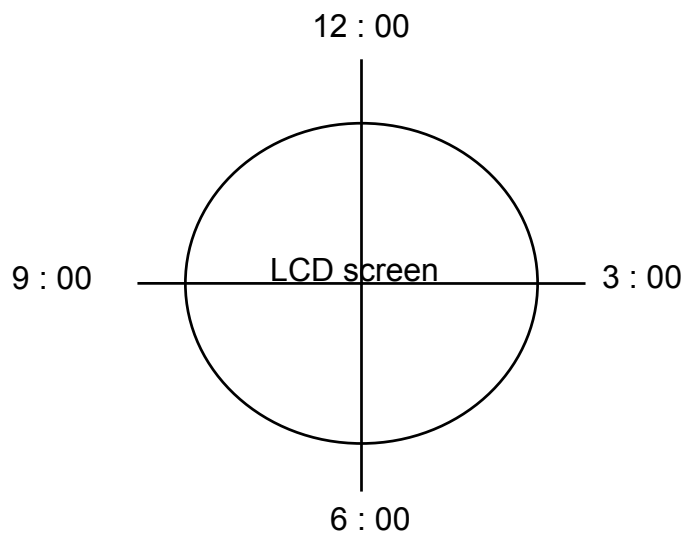
6 Block Diagram

6-1 Block Diagram

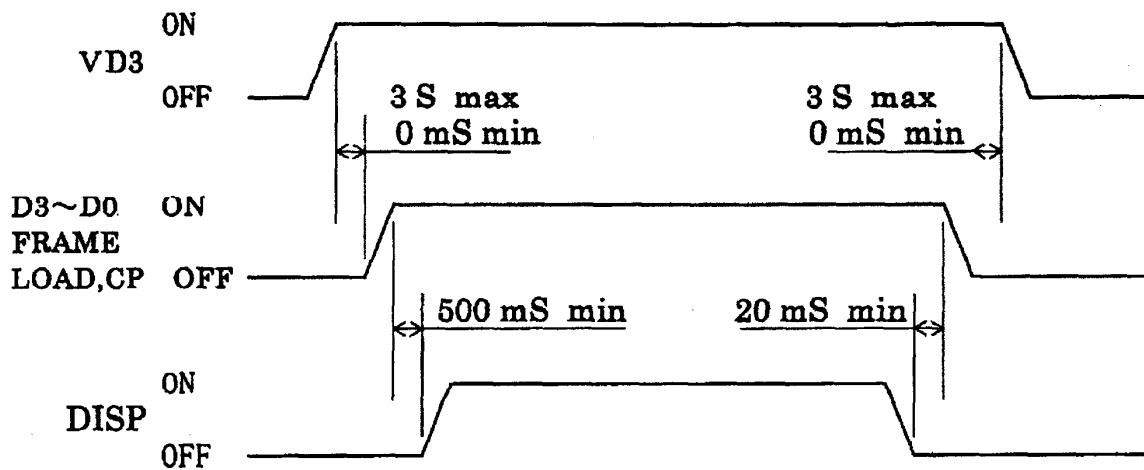|	
Display Type:	Color STN transflective type
Dot Structure:	320 x RGB x 240 Dots graphics display
Driving method:	1/240(Min.) Duty Multiplex drive
Back light:	LED
Surface Texture:	Glare
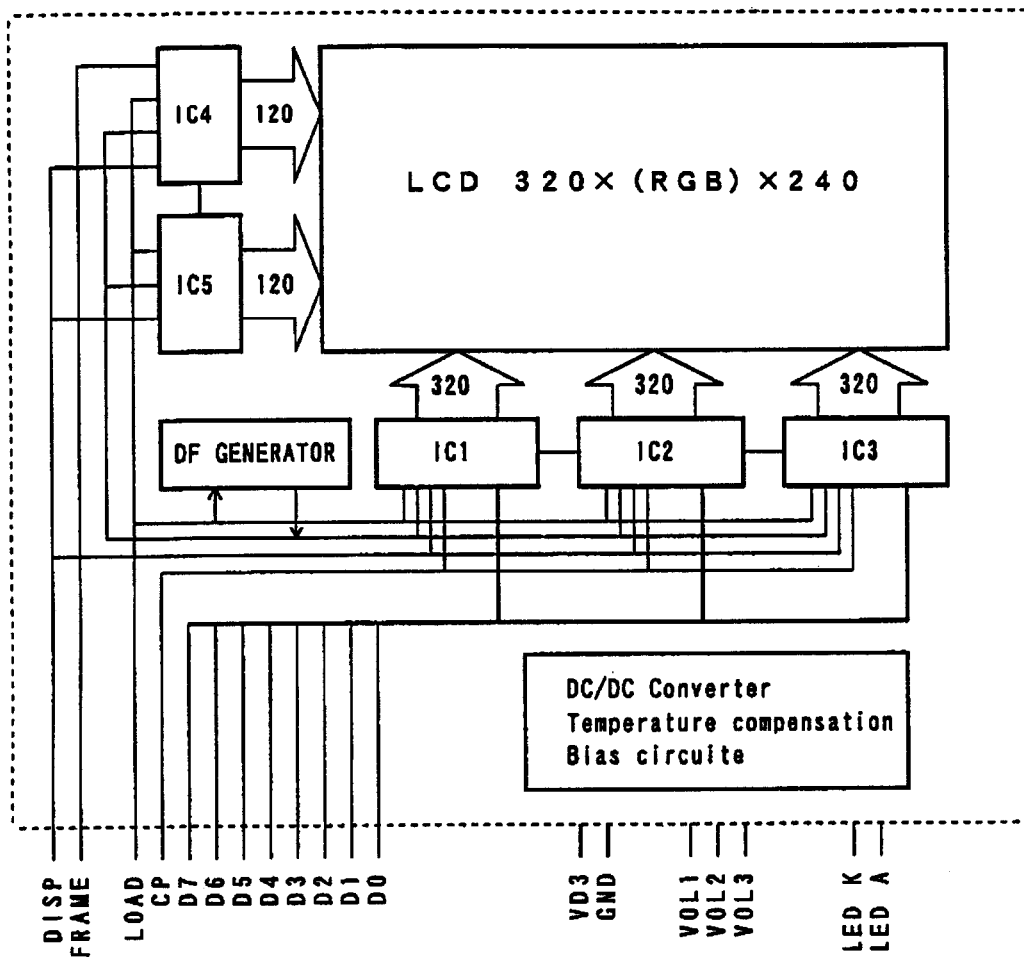
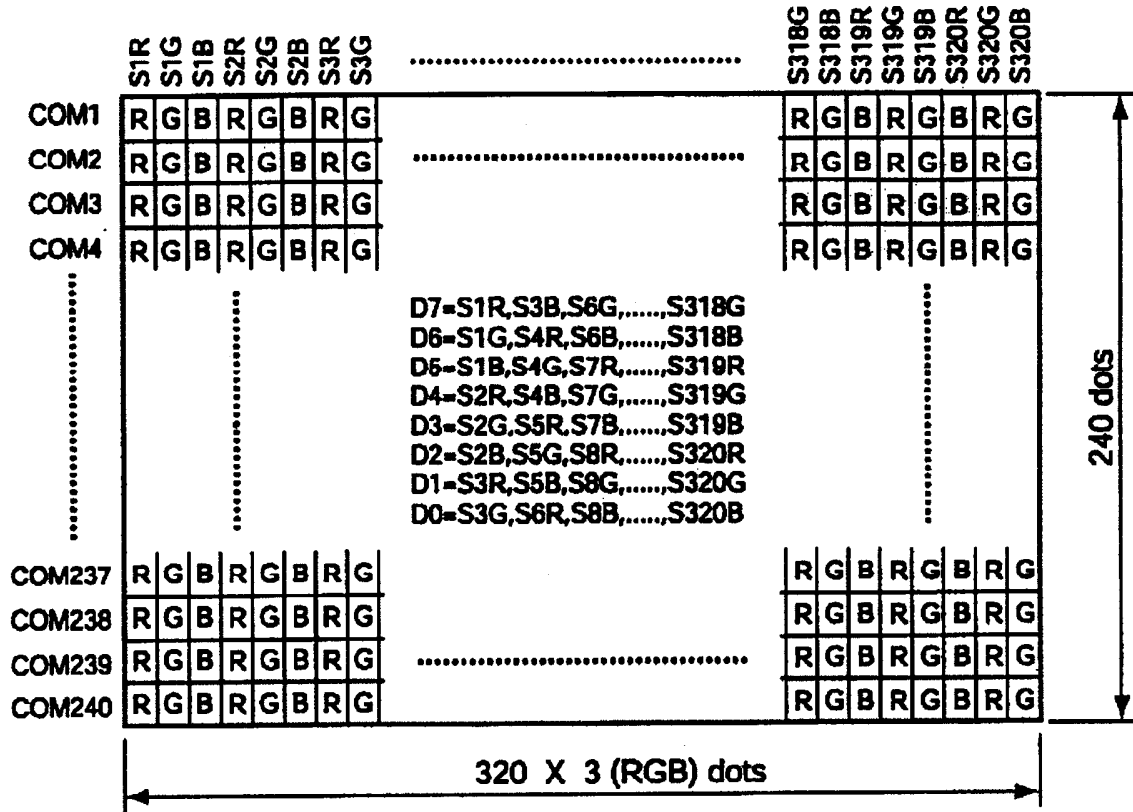## 6-2 Power Circuit
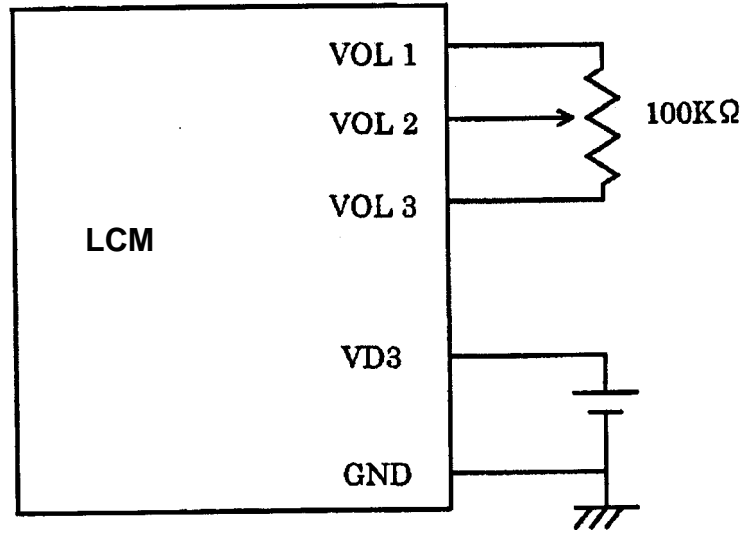
6-3 Power Sequence

7 Interface specifications

7-1 Terminal pin assignment of CN1

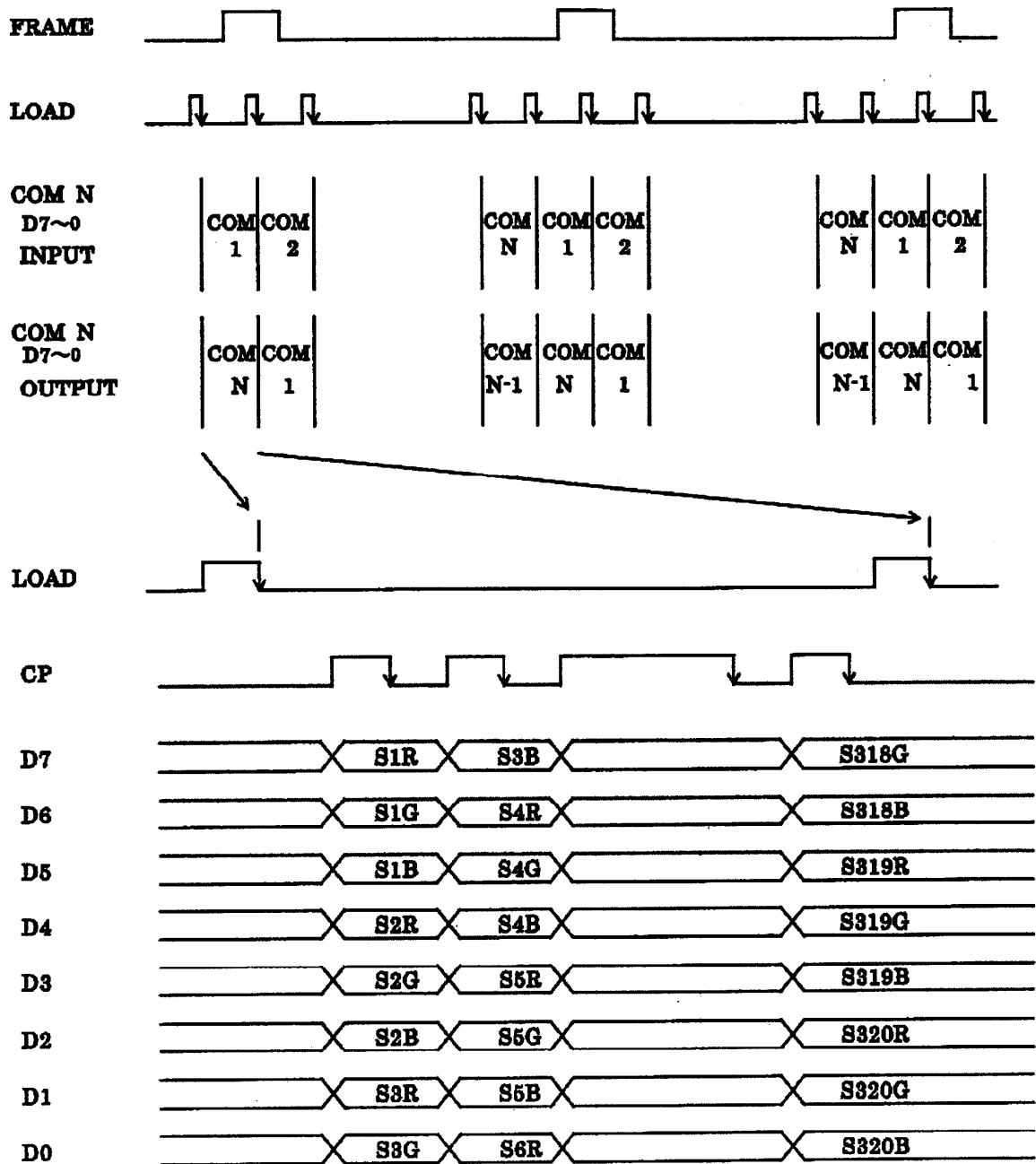| No.	Terminal	I/O	Functions
1	VD3	IN	Power supply for logic circuit
2	GND	IN	GND-terminal for analog circuit
3	DISP	IN	Display control signal VD3 level : Normal GND level : Display off
4	FRAME	IN	LCD COM electrode scanning data
5	NC (DF)	-	LCD AC driving signal. (Note1)
6	LOAD	IN	LCD SEG electrode driving voltage output clock. LCD COM electrode scanning data shift clock
7	CP	IN	Display data input clock
8	D0	IN	Display Data
9	D1		
10	D2		
11	D3		
12	D4		
13	D5		
14	D6		
15	D7		
16	VOL1	OUT	Terminal for contrast adjustment variable resister (Higher voltage)
17	VOL2	IN	Terminal for contrast adjustment variable resister (middle voltage)
18	VOL3	OUT	Terminal for contrast adjustment variable resister (Lower voltage)
19	LED K	IN	LED driving supply ; Cathode.
20	LED A	IN	LED driving supply ; Anode.

Note1 : DF signal is generated inside the LCD module.

It is recommended to give a liquid crystal driving signal at a cycle not applying DC voltage to LCD panel. If DC voltage is applied to LCD panel, It results in any unfavorable effect, e.g., deterioration in characteristics of liquid crystal substance or abnormality of partial display.

7-2 Relationships of DATA input signal and LCD screen division.

	S1R	S1G	S1B	S2R	S2G	S2B	S3R	S3G	...	S318G	S318B	S319R	S319G	S319B	S320R	S320G	S320B
COM1	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM2	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM3	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM4	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM237	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM238	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM239	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G
COM240	R	G	B	R	G	B	R	G		R	G	B	R	G	B	R	G

D7=S1R,S3B,S6G,......,S318G
D6=S1G,S4R,S6B,......,S318B
D5=S1B,S4G,S7R,......,S319R
D4=S2R,S4B,S7G,......,S319G
D3=S2G,S5R,S7B,......,S319B
D2=S2B,S5G,S8R,......,S320R
D1=S3R,S5B,S8G,......,S320G
D0=S3G,S6R,S8B,......,S320B

240 dots

320 X 3 (RGB) dots

7-4 Timing diagram (1/N Duty)

FRAME								
LOAD								
COM N D7~0 INPUT	COM 1	COM 2		COM N	COM 1	COM 2		COM N	COM 1	COM 2
COM N D7~0 OUTPUT	COM N	COM 1		COM N-1	COM N	COM 1		COM N-1	COM N	COM 1
LOAD								
CP								
D7	S1R	S3B						S318G
D6	S1G	S4R						S318B
D5	S1B	S4G						S319R
D4	S2R	S4B						S319G
D3	S2G	S5R						S319B
D2	S2B	S5G						S320R
D1	S3R	S5B						S320G
D0	S3G	S6R						S320B

Note : LOAD signal should be inputted with constant interval.

8   Timing Characteristics

VD3-GND = 3.3V±0.1V、 VCC-VSS=3.3V±0.1V

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
CP cycle time	tcp		170	—	—	ns
CP pulse width	tW(CH)		70	—	—	ns
	tW(CL)		70	—	—	ns
LOAD pulse width	tW(LH)		500	—	—	ns
	tW(LL)		10	—	—	μs
LOAD to CP time	tLC		120	—	—	ns
CP to LOAD time	tCL		120	—	—	ns
Data setup time D3~D0 to CP	tDSU		55	—	—	ns
Data hold time CP to D3~D0	tDHD		55	—	—	ns
LOAD to FRAME time	tLF		500	—	—	ns
FRAME to LOAD time	tFL		500	—	—	ns
FRAME setup time FRAME to LOAD	tSU(FR)		500	—	—	ns
FRAME hold time LOAD to FRAME	tHD(FR)		500	—	—	ns
CP rise time	tR(CP)		—	—	20	ns
Cp fall time	tF(CP)		—	—	20	ns
LOAD rise time	tR(L)		—	—	20	ns
LOAD fall time	tF(L)		—	—	20	ns

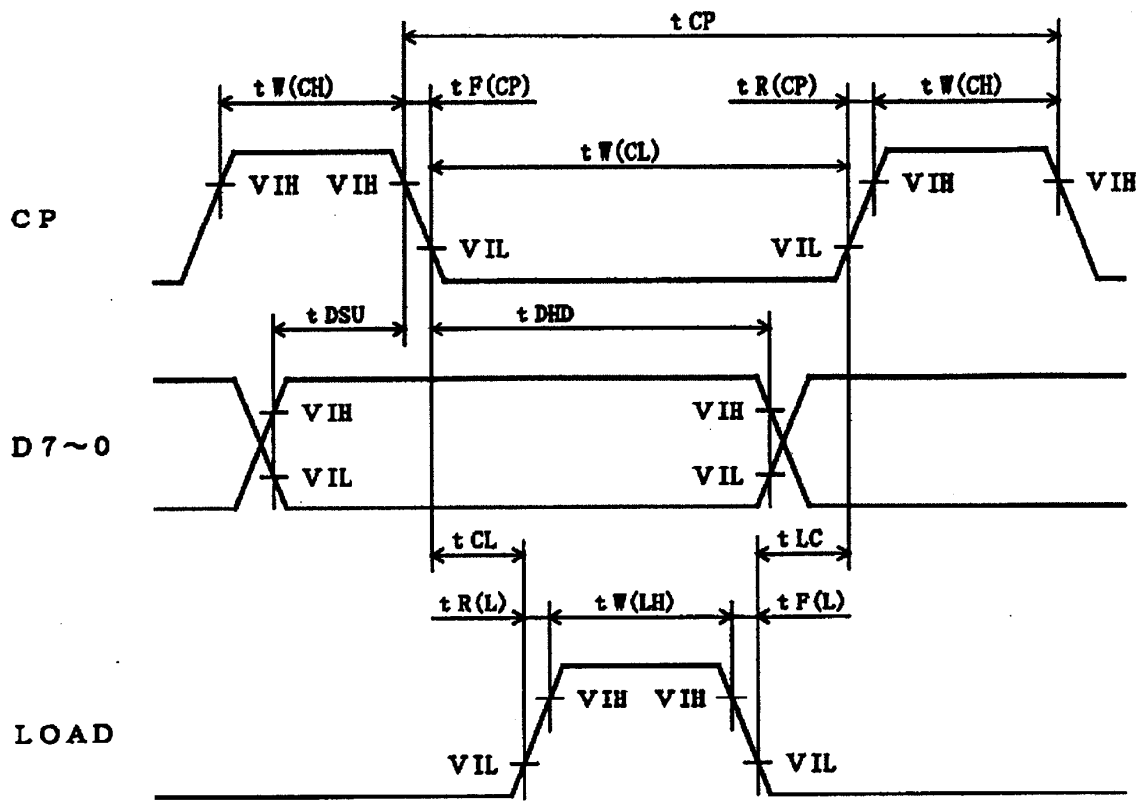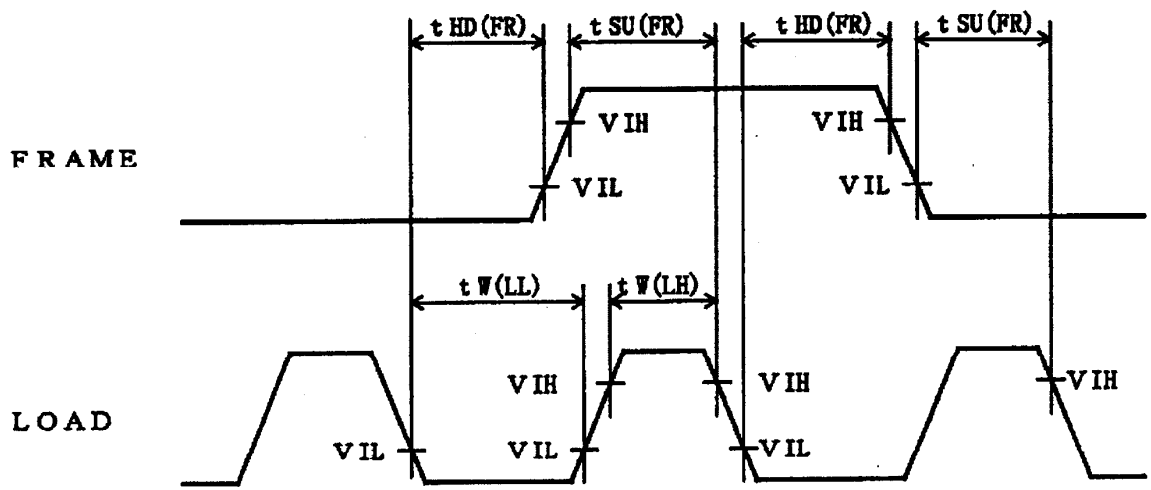Note :   LOAD signal should be inputted with constant interval.

Fig. 6-3

9　Use precautions

9-1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

9-2 Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

9-3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

9-4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.

2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.

3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.

4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.

5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.

6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.

7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs

when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

9-5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

10 Interface specifications

CN1 LIST

NO	NAME
1	VD3
2	GND
3	DISP
4	FRAME
5	DF
6	LOAD
7	CP
8	D0
9	D1
10	D2
11	D3
12	D4
13	D5
14	D6
15	D7
16	VOL1
17	VOL2
18	VOL3
19	LED K
20	LED A

NOTES
STN Colour
TRANSFLECTIVE TYPE
1/240Duty
SURFACE TEXTURE : GLARE
BACK LIGHT : LED
DO NOT SCALE THIS DRAWING

CONNECTOR : FH12-20S-0.5SH (HIROSE)
NAME LABEL
(PARTS AREA)
(POLARIZER)
(VIEWING AREA)
(DISPLAY AREA)
PATTERN SIDE (FPC or FFC)
VIEWING DIRECTION
DOT DETAILS (50/1)

SAFETY CAUTIONS **Strictly observe the following**	
WARNING	● Always turn off the power when installing or removing this product. Otherwise, you may get an electrical shock.
CAUTION	● Do not cover this product with paper or cloth or make it approach to flammable. Failure to do so may cause fire. ● Do not fall, hit, force or damage this product. Failure to do so may cause injury. ● When handling this product, keep it away from water and oil and do not handle with dirty hands or gloves. Failure to do so may cause breakage. ● Do not paint this product. Failure to do so may lead to overheat. ● Do not use this product in rain and water dropping and high humidity spaces. Failure to do so may cause breakage.

Request and notice about the contents of the descriptions in these product specifications and the use of the products

(1). If the products described in these product specifications are applicable to the article "Foreign Exchange and Foreign Trade Control Act," they must receive permission by the Japanese Government when they are exported or taken overseas.

(2). The products are intended for general applications — general electronic equipment (such as office equipment, communication equipment, measurement equipment and home appliances). If the special quality and reliability are required and the special applications (aircraft and space equipment, traffic-control equipment, combustion equipment, life-maintaining equipment, safety equipment etc) are planned — there is the possibility of danger that the human life will be threatened and the human body will be harmed when equipment breakdown or erroneous operation occurs — or any idea of use other than general applications is conceived, the customer shall be requested to ask us for this matter in advance.

(3). When developing the design, keep the spec items within the guarantee range such as the maximum ratings, operating power voltage and radiations. If adopted beyond the guarantee range, we will not be liable for any equipment failure resulting from the use of the improper quality product.