PRODUCT SPECIFICATIONS

SHARP®

Integrated Circuits Group

LQ070T5CR01

Color TFT LCD Module

(Model No.: LQ070T5CR01)

Spec No.: LCY-01019

Issue Date: April 6, 2001

PREPARED BY: DATE	SHARP	SPEC No. LCY-01019
APPROVED BY: DATE		FILE No.
		ISSUE: Apr. 6. 2001
		PAGE : 24 pages
	LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION **SPECIFICATION**	APPLICABLE GROUP LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ070T5CR01

CUSTOMER'S APPROVA

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C O N T E N T S

(1) Introduction

The SHARP Color TFT-LCD module is an active matrix LCD (Liquid Crystal Display) produced by making the most of Sharp's expertise in liquid-crystal and semiconductor technologies.

The active device is amorphous silicon TFT (Thin Film Transistor). The module accepts full color video signal conforming to the NTSC(M) and PAL(B·G) system standards.

Module geometry(Mechanical specification): Table 1

(2) Features

- Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide screen systems.
- By adopting an active matrix drive, a picture with high contrast is realized.
- Through the use of TN-normally white mode, an image with highly natural color reproduction is realized.
- The 7.0" screen produces a high resolution image that is composed of 112,320 pixel elements in a stripe arrangement.
- Built-in video interface circuit (including chroma demodulator, picture tone) and control circuit responsive to NTSC composite video signal and NTSC/PAL analog RGB signal.
- The inverter circuit having-within for the backlight lighting-up(dimming is available)
- An anti-glare and low-reflection (AGLR with wide viewing angle) surface polarization plate is used.
- Viewing angle: 6 o'clock
- An inverted video display in the vertical as well as horizontal directions is possible.

(3) Construction and Outline

- Outline dimensions of TFT-LCD module : See Fig. 1
- The construction form figure : See Fig. 2
- The module consists of a TFT-LCD panel, drivers, control PWB mounted with electronic circuits, backlight, frame, front and rear shielding cases.

(4) Module geometry(Mechanical specification)

Table 1

Parameter	Specification	Unit	Remarks
Display format	112,320	Pixels	
	1440(H) × 234(V)	dots	
Active area	154.1 (H)×87.0 (V)	mm	
Screen-size (Diagonal)	17.7 [7.0"]	cm	
Dot pitch	0.107(H)×0.372(V)	mm	
Dot configuration	R·G·B Stripe configuration		
Outline dimension	170.0(W)×104.0(H)×18.0(D)	mm	【Note 4-1】
Mass	320(Max)	g	

【Note 4−1】 This measurement is typical, and see Fig.1 for the details .

(5)Input / Output terminal

5-1)TFT-LCD panel driving section

Table 2

Pin No.	Symbol	i/o	Description	Remarks
1	HSY	i/o	Input/output horizontal sync. signal(low active)	【Note5-1】
2	VSY	i/o	Input/output vertical sync. signal(low active)	【Note5-2】
3	PWMS	o	The voltage output for the dimming light control	【Note5-3】
4	NTP	i	Selection for NTSC or PAL	【Note5-4】
5	HRV	i	Turning the direction of horizontal scanning	【Note5-5】
6	VRV	i	Turning the direction of vertical scanning	【Note5-6】
7	MODS	i	Selection for display mode	【Note5-7】
8	MODW	i	Selection for display mode	【Note5-7】
9	MODN	i	Selection for display mode	【Note5-7】
10	VCC	i	power supply voltage (7～9 V)	
11	VBS	i	Composite video signal	
12	BRT	i	Brightness adjusting terminal	【Note5-8】
13	VR	i	video signal(Red)	
14	VG	i	video signal(Green)	
15	VB	i	video signal(Blue)	
16	GND1	i	signal GND	
17	CONT	i	Contrast adjusting terminal	【Note5-8】
18	COLOR	i	Color adjusting terminal	【Note5-8】
19	TINT	i	Tint adjusting terminal	【Note5-8】
20	GND1	i	signal GND	
21	CLKC	i	Change the input/output direction of CLK,HSY,VSY	【Note5-9】
22	CLK	i/o	Input/output clock signal	【Note5-10】
23	VSW	i	Selection video signal of Composite or RGB	【Note5-11】
24	PWMI	i	Input signal for backlight dimming	
25	VBL	i	power supply voltage for Back light	
26	VBL	i	power supply voltage for Back light	
27	GND2	i	Back light GND	
28	GND2	i	Back light GND	

'High' and 'Low' refer to table 5 [digital input voltage].

【Note5-1】 When CLKC="Hi", the output is a horizontal synchronizing signal synchronized by the SYN signal. When CLKC="Lo", the module is synchronized via the horizontal synchronizing signal input at this terminal.

【Note5-2】 When CLKC="Hi", the output is a vertical synchronizing signal synchronized by the SYN signal. When CLKC="Lo", the module is synchronized via the vertical synchronizing signal input at this terminal.

【Note5-3】 The PWM signal is a dedicated signal used to adjust the frequency for backlight adjustment PWM backlight adjustment is easily accomplished by combining the HSY and PWM signals.
Please note that the PWM signal should only be used when a standard NTSC or PAL is input.
See Fig.5 for details.

【Note5-4】 NTP="Hi" : NTSC system
NTP="Lo" : PAL system

【Note5-5】 HRV="Hi" : Regular video
HRV="Lo" : Horizontally inverted video

【Note5-6】 VRV="Hi" : Regular video
VRV="Lo" : Vertically inverted video

【Note5-7】 Display mode settings are given in Table 3.

【Note5-8】 Adjusted by the DC voltage supplied to this pin.
They are adjusted to the optimum value on shipping, but, they can be re-adjusted by external circuit.

【Note5-9】 CLKC="Hi" : CLK,HSY and VSY terminals are in the output mode.
CLKC="Lo" : CLK,HSY and VSY terminals are in the input mode.

【Note5-10】 When CLKC="Hi",the output level is low.
When CLKC="Lo", module operation is based on the input clock signal. This signal should correspond to sampling timing of the horizontal direction image. NTP,MODS,MODW and MODN should be "Hi" then CLKC="Lo".
【Note5-11】 Selects input signals, composite or analog RGB.
When VSW is "Lo", composite video signal is selected.(input terminal is No.11:VBS)
When VSW is "Hi", analog RGB signal ia selected.(input terminal is No.11:VBS and No.13 to No.15:VR,VG,VB)

Table 3 Display Method and Characteristics

MODS	MODW	MODN	Display mode	Characteristics	Source	example
H	H	H	Full mode	The picture is displayed with uniform enlargement in the horizontal direction, and the horizontal retrace line of the input signal cannot be seen. If the video sampling frequency of the image is fixed and a 4:3 video signal is displayed, the picture will be prominently oblong.	4:3 signal, Navigation signal	Fig.3-1
H	H	L	Wide 1 mode	A 4:3 video signal is displayed with less feeling of incongruity than that in the full screen mode. Since the video horizontal sampling frequency is modulated in the horizontal direction, the degree of perfect roundness in the center of the screen is improved over that of the full screen mode.	4:3 signal	Fig.3-2
H	L	H	Normal mode	When displaying a 4:3 video signal, the displayed image is slightly less than perfectly round and the horizontal retrace line period is displayed at the two edges of the screen. With respect to the video horizontal sampling frequency, the center portion of the screen is slightly lower and the two edges become slightly higher. With respect to the horizontal retrace line period, a far better display is achieved than that of masking of the video signal by the VCS signal timing.	4:3 signal	Fig.3-3
H	L	L	Cinema mode	A letter-box type image (16:9 signal) is displayed over the central width of the screen. In the horizontal direction, full screen display is utilized. Due to the display being extended in the vertical direction, a slightly less than perfectly round image is displayed.	letter box type wide signal(16:9signal)	Fig.3-4
L	H	H	Wide 2 mode	In the horizontal direction, the Wide 1 display mode is employed. Due to the display being extended in the vertical direction, the portion of the picture in the center of the screen is slightly less than perfectly round. Also due to extending in the vertical direction, the upper and lower potions of the image are not displayed.	4:3 signal	Fig.3-5
L	H	L	test	This mode is unusable as it is the test mode.	—	—
L	L	H	test	This mode is unusable as it is the test mode.	—	—
L	L	L	test	This mode is unusable as it is the test mode.	—	—

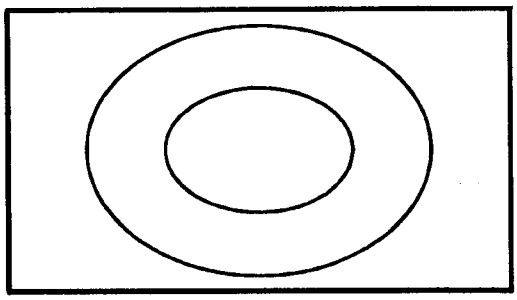


Fig.3-1 Full mode

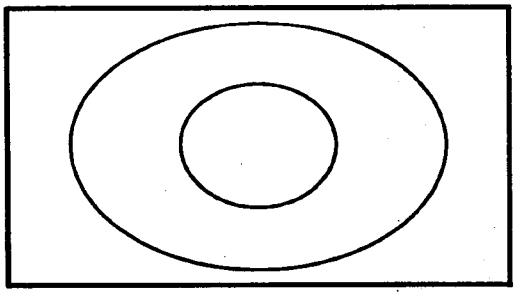


Fig.3-2 Wide 1 mode

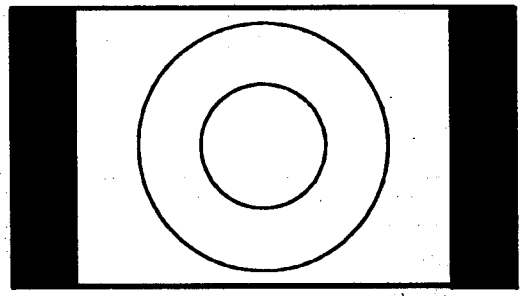


Fig.3-3 Normal mode

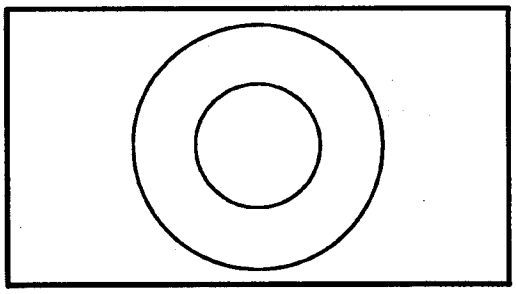


Fig.3-4 Cinema mode

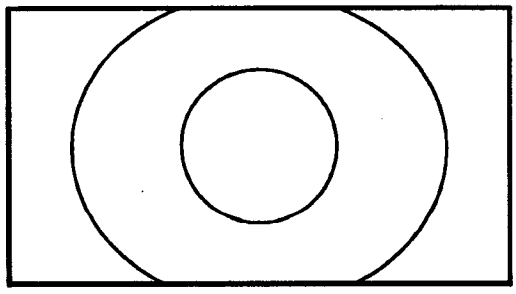


Fig.3-5 Wide 2 mode

(6) Absolute maximum ratings

Table 4 GND=0V、Ta=25℃

Parameter		Symbol	MIN	MAX	Unit	Remarks
Positive power supply voltage		VIN	+7.0	+9.0	V	
Analog input signals		Vi	−	2.0	Vp-p	【Note 6-1】
Digital input signals		VI	−0.3	+5.4	V	【Note 6-2】
Adjusting terminal voltage		Vadj	−0.3	+5.4	V	【Note 6-3】
Storage temperature		Tstg	−40	+95	℃	【Note 6-4】
Operating temperature	Surface of panel	Top1	−30	+85	℃	【Note 6-4, 5, 6】
	Environment	Top2	−30	+60	℃	【Note 6-6, 7】

【Note 6-1】 VBS, VR, VG, VB terminals (Video signal)

【Note 6-2】 NTP, HRV, VRV, MODS, MODW, MODN, CLKC, VSW terminals

【Note 6-3】 BRT, CONT, COLOR, TINT terminals

【Note 6-4】 The temperature of panel surface must not exceed this rating.

【Note 6-5】 Maximum wet-bulb temperature must be less than 58℃. No dew condensation.

【Note 6-6】 The operating temperature assure only driving. Contrast, response time, the other display quality is judgment at 25℃.

【Note 6-7】 The temperature around considering that the backlight lighting-up generates heat. (The reference value)

(7)Electrical characteristics

7-1)Recommended operating conditions

Table 5 GND=0V, Ta=25℃

Parameter			Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Power supply voltage			VIN	+7.0	+8.0	+9.0	V	
Analog input voltage	Amplitude		V1	0.7	1.0	2.0	Vp-p	【Note7-1】
	Amplitude		V2	0	0.7	2.0	Vp-p	【Note7-2】
	DC component		Vidc	-0.1	0	+1.0	V	【Note7-3】
Digital input voltage	Hi		Vih	+3.5	-	+5.0	V	【Note7-4】
	Lo		Vil	0	-	+1.5	V	
Input horizontal sync. component	frequency	NTSC	fH(N)	15.13	15.73	16.33	kHz	CLKC="Hi"
		PAL	fH(P)	15.03	15.63	16.23	kHz	
	pulse width	NTSC	τ HI(N)	4.2	4.7	5.2	μs	【Note7-5】
		PAL	τ HI(P)	4.2	4.7	5.2	μs	
	rising time		τ rHI1	-	-	0.5	μs	
	falling time		τ fHI1	-	-	0.5	μs	
Input vertical sync. component	frequency	NTSC	fV(N)	fH/284	fH/262	fH/258	Hz	CLKC="Hi"
		PAL	fV(P)	fH/344	fH/312	fH/304	Hz	
	pulse width	NTSC	τ VI(N)	-	3H	-	μs	【Note7-6】
		PAL	τ VI(P)	-	2.5H	-	μs	
	rising time		τ rVI	-	-	0.5	μs	
	falling time		τ fVI	-	-	0.5	μs	
Input clock	frequency		fCLI	9.3	9.5	9.7	MHz	CLKC="Lo"
	Hi pulse width		τ WH	20.0	-	-	ns	
	Lo pulse width		τ WL	20.0	-	-	ns	
	rising time		τ rCLI	-	-	10.0	ns	
	falling time		τ fCLI	-	-	10.0	ns	
Input horizontal sync. signal	frequency		fHI	fCLI/650	fCLI/608	fCLI/590	kHz	CLKC="Lo"
	pulse width		τ HI	1	5	9	μs	
	rising time		τ rHI2	-	-	0.05	μs	
	falling time		τ fHI2	-	-	0.05	μs	
Input vertical sync. signal	frequency		fVI	50	fHI/262	fHI/258	Hz	CLKC="Lo"
	pulse width		τ VI	1H	3H	5H	μs	
Data setup time			tSU1	25	-	-	ns	
Data hold time			tHO1	25	-	-	ns	
Data setup time			tSU2	1.0	-	-	μs	
Data hold time			tHO2	1.0	-	-	μs	
Terminal voltage applicable to brightness			Vbrt	+2.0	+2.1	+2.3	V	

【Note7-1】 VBS terminal (composite video signal) Input impedance : 75Ω

【Note7-2】 VR,VG,VB terminals (Analog RGB)

【Note7-3】 VBS,VR,VG,VB terminals

【Note7-4】 HSY,VSY,NTP,HRV,VRV,MODS,MODW,MODN,CLKC,CLK,VSW terminals
Input impedance : >10kΩ

【Note7-5】 VBS (horizontal sync. component)

【Note7-6】 VBS (vertical sync. component)

7-2)Power consumption

Table 6 Ta=25℃

Parameter	Symbol	Voltage	MIN.	TYP.	MAX.	Unit	Remarks
Supply current	Icc	VIN=+8.0V	−	220	300	mA	
Lamp power consumption	IL	VIN=+8.0V	−	750	850	mA	Dimmer=100%

7-3) Display time range

Displaying the following range within video signals.

(1) NTSC(M) mode (NTP='Hi',CLKC='Hi')

(a1) Horizontally : 13.0 ～ 63.3 μs from the falling edge of HSY. (full,wide1,2,cinema)

(a2) Horizontally : 7.6 ～ 68.8 μs from the falling edge of HSY. (normal)

(b1) Vertically : 20 ～ 253 H from the falling edge of VSY. (full,wide1,normal)

(b2) Vertically : 49 ～ 224 H from the falling edge of VSY. (cinema)

(b3) Vertically : 42 ～ 228 H from the falling edge of VSY. (wide2)

(2)PAL(B･G) mode (NTP='Lo',CLKC='Hi')

Displaying the following range within video signals.

(a1) Horizontally : 13.0 ～ 63.3 μs from the falling edge of HSY. (full,wide1,2,cinema)

(a2) Horizontally : 7.6 ～ 68.8 μs from the falling edge of HSY. (normal)

(b1) Vertically : 26～298 H from the falling edge of VSY. (full,wide1,normal)

However, the video signals of (14n+12)H,(14n+20)H/Even field.
(14n+17)H,(14n+23)H/Odd field (n=1,2･･･, 20)
are not displayed on the module.

(b2) Vertically : 40～284 H from the falling edge of VSY. (cinema)

However, the video signals of (42n)H,(42n+22)H/Even field.
(42n+13)H,(42n+35)H/Odd field (n=1,2･･･, 6)
are not displayed on the module.

(b3) Vertically : 35～289 H from the falling edge of VSY. (wide2)

However, the video signals of (22n+14)H,(22n+24)H/Even field.
(22n+21)H,(22n+31)H/Odd field (n=1,2･･･,12)
are not displayed on the module.

(3) External clock mode (NTP='Hi',CLKC='Lo')

Displaying the following range within video signals.

(a) Horizontally : 103 ～ 582 clk from the falling edge of HSY.
(clk means input external clock.)

(b) Vertically : 20 ～ 253 H from the falling edge of VSY.

(8)Optical characteristics

Table 7

Ta=25℃ VIN=VBL=+8V

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		△θ11	CR≧5	60	65	-	° (degree)	【Note 8-1, 2, 3】
		△θ12		45	50	-	° (degree)	
		△θ2		60	65	-	° (degree)	
Contrast ratio		CRmax	Optimal	60	-	-		【Note 8-2, 3】
Response time	Rise	τr	θ＝0°	-	30	60	ms	【Note 8-2, 4】
	Fall	τd		-	50	100	ms	
Luminance		Y		260	350	-	cd/m²	【Note 8-5】
White chromaticity		x	Dimmer=100%	0.263	0.313	0.363		【Note 8-5】
		y		0.279	0.329	0.379		
Lamp life time	+25℃	-	continuation	10,000	-	-	hour	【Note 8-6】
	-30℃	-	intermission	2,000	-	-	time	【Note 8-7】

【Note 8-1】 Viewing angle range is defined as follows.

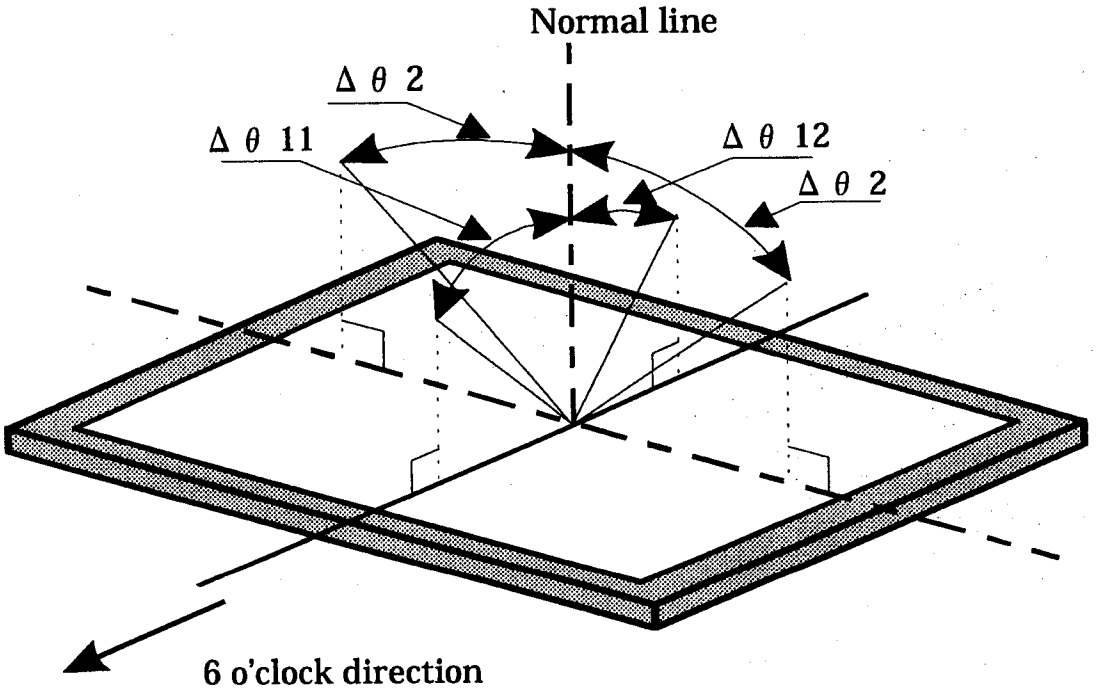


Fig. (i) definition for viewing angle

【Note 8-2】 Applied voltage condition:

(1) VCDC is adjusted so as to attain maximum contrast ratio.
(2) Adjusting voltage (BRT, CONT, COLOR, TINT) is open.
(3) Input video signal of standard black level and 100% white level.

【Note 8-3】 Contrast ratio is defined as follows:

$$\text{Contrast ratio (CR)} = \frac{\text{Photodetector output with LCD being "white"}}{\text{Photodetechor output with LCD being "black"}}$$

【Note 8-4】 Response time is obtained by measuring the transition time of photodetector output, when input signals are applied so as to make the area "black" to and from "white".

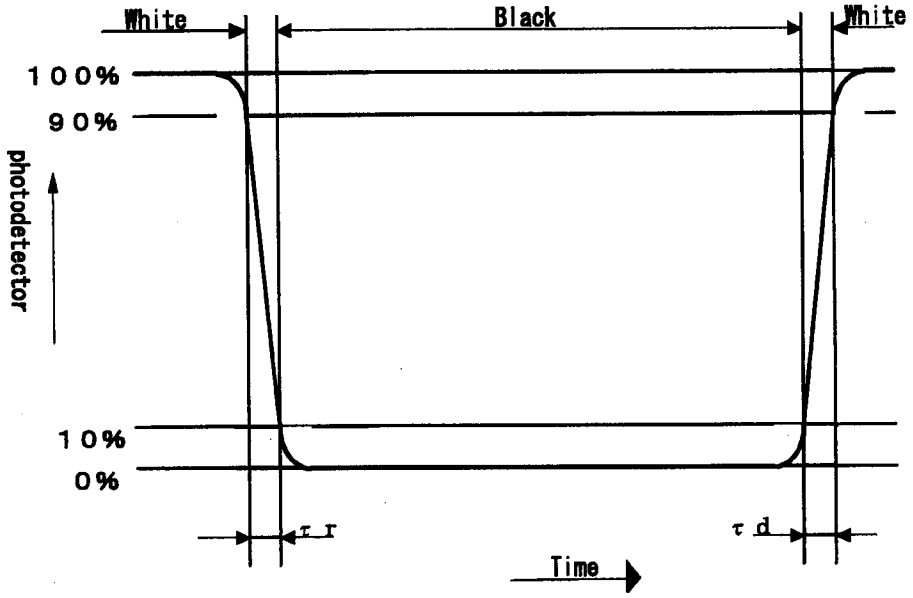


Fig. (ii)

【Note 8-5】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter BM-7. (After 10 minutes operation)

【Note 8-6】 Lamp life time is defined as the time when the brightness of the panel not to become less than 50% of the original value.
(operation conditions)
Current dimming: PWM dimming 100%~5%

【Note 8-7】 The intermittent cycles is defined as a time when brightness not to become under 50% of the original value under the condition of following cycle. (See Fig. (iii.)
(condition) Ambient temperature:-30℃

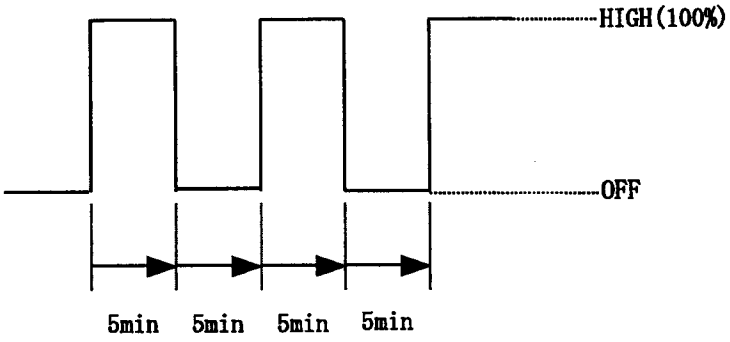


Fig. (iii)

(9)Mechanical characteristics

9-1) External appearance

Do not exist extreme defects. (See Fig. 1)

9-2) Panel toughness

The panel shall not be broken, when 19N is pressed on the center of the panel by a smooth sphere having 15 mm diameter.

Caution: In spite of very soft toughness, if, in the long-term, add pressure on the active area, it is possible to occur the functional damage.

9-3) Input/output connector performance

A) Input/output connectors for the operation of LCD module (28 pin)

Table 8. I/O connector of module driving

Symbol	Used Connector	Manufacture
CN1	006208500028600	Kyocera elco co.

(10) Display quality

The display quality of the color TFT-LCD module shall be in compliance with the incoming Inspection Standard.

(11) Handling instructions

11-1) Mounting of module

The TFT-LCD module is designed to be mounted on equipment using the mounting tabs in the four corners of the module at the rear side.
On mounting the module, as the M2.5 tapping screw (fastening torque is 0.35 through 0.45N·m) is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.
To pushing module, (ex. touching switch etc.) causes disordered image.
So taking care not to conduct directly for LCD module.
Please power off the module when you connect the input/output connector.

11-2) Precautions in mounting

① Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
Protective film (Laminator) is applied on the surface to protect it against scratches and dirts.
It is recommended to peel off the laminator immediately before the use, taking care of static electricity.

② Precautions in peeling off the laminator

A) Working environment

When the laminator is peeled off, static electricity may cause dust to stick to the polarizer surface. To avoid this, the following working environment is desirable.

a) Floor: Conductive treatment of 1MΩ or more on the tile
(conductive mat or conductive paint on the tile)

b) Clean room free from dust and with an adhensive mat on the doorway

c) Advisable humidity:50%～70%　　Advisable temperature:15℃～27℃

d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

B) Working procedures

a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm. (See Fig. (iv.)

b) Attach adhensive tape to the laminator part near discharging blower so as to protect polarizer against flaw. (See Fig. (iv).)

c) Peel off laminator, pulling adhesive tape slowly to your side taking 5 or more second.

d) On peeling off the laminator, pass the module to the next work process to prevent the module to get dust.

e) Method of removing dust from polarizer

- Blow off dust with N2 blower for which static electricity preventive measure has been taken.
- Since polarizer is vulnerable, wiping should be avoided.
  But when the panel has stain or grease, we recommend to use adhesive tape to softly remove them from the panel.

⑶When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirties, wipe the part, breathing on it.

⑷Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.

⑸TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Handle with care.

⑹Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

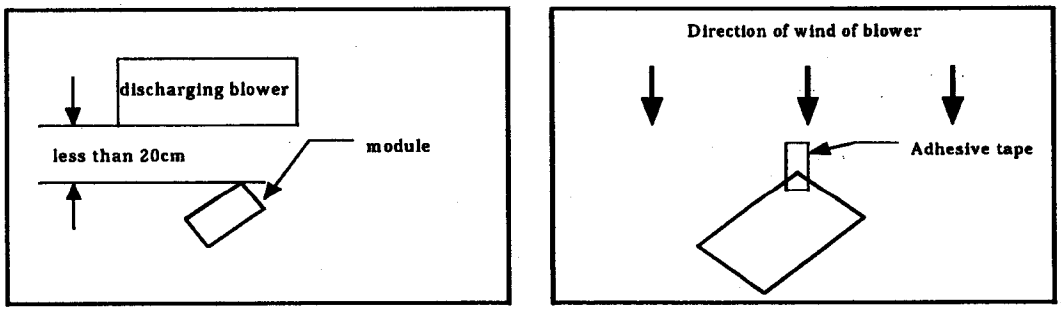


Fig . (iv)

11-3) Precautions in adjusting module

Adjusting volumes on the rear face of the module have been set optimally before shipment. Therefore, do not change any adjusted values.

If adjusted values are changed, the specifications described here may not be satisfied.

11-4) Caution of product design

The LCD module shall be protected against water salt-water by the waterproof cover.
Please take measures to interferential radiation from module,
not to interfere surrounding appliances.

11-5) Others

①Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays.

②Store the module at a temperature near the room temperature. At lower than the rated storage temperature, liquid crystal solidifies, causing the panel to be damaged. At higher than the rated storage temperature, liquid crystal turns into isotropic liquid and may not recover.

③The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around. If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is injurious, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.

④Observe all other precautionary requirements in handling general electronic components.

(12) Shipping requirements

12-1) Packing form is shown in Fig. 6.

12-2) Carton storage condition

① Number of layers of cartons in pile : 7 layers max.

② Environmental condition

· Temperature	0℃ to 40℃
· Humidity	60 %PH or less (at 40℃) No dew condition even at a low temperature and high humidity
· Atmosphere	Harmful gases such as acid and alkali which corrode electronic components and wires must not be detected.
· Storage period	About 3 months
· Opening of package	To prevent TFT-LCD module from being damaged by static electricity, adjust the room humidity to 50%PH or higher and provide an appropriate measure for electrostatic earthing before opening the package.

(13) Reliability test conditions

Reliability test conditions for the TFT-LCD module are shown in Table 9.

Reliability Test Conditions for TFT-LCD module

Table 9

No	Test items	Test condition
1	High temperature storage test	Ta=+95℃ 240H
2	Low temperature storage test	Ta=-40℃ 240H
3	High temperature and high humidity operating test	Tp=+60℃(95%RH) 240H
4	High temperature operating test	Ta=+85℃ 240H
5	Low temperature operating test	Ta=-30℃ 240H
6	Electrostatic discharge test	±200V·200pF(0Ω), Once for each terminal
7	Shock test	980m/s²·6ms, ±X, ±Y, ±Z 3 times for each direction (JIS C0041, A-7 Condition C)
8	Vibration test	Frequency range : 8～33.3Hz Stroke : 1.3mm Sweep : 33.3～400Hz Acceleration : 28.4m/s² Cycle : 15 minutes X, Z 2 hours for each directions, 4 hours for Y direction (total 8 hours) 【caution】 (JIS D1601)
9	Heat shock test	-40℃～ +95℃, 200cycles (0.5H) (0.5H)

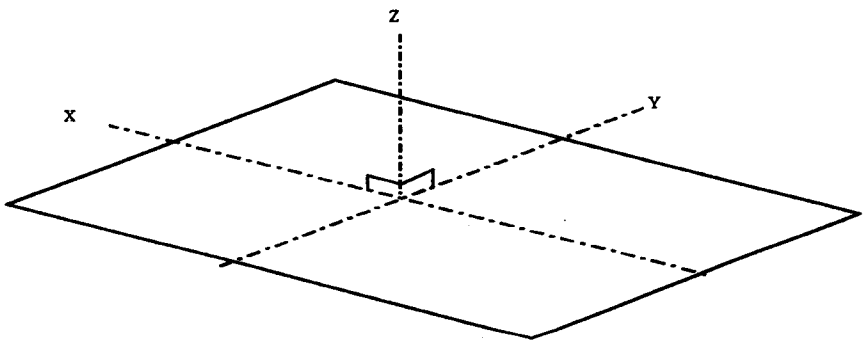
Ta = Ambient temperature

Tp = Panel temperature

【Evaluation result criteria】

Under a display quality test conditions with normal operation state, there shall be no change which may affect practical display function.

【Caution】 X, Y, Z directions are shown as follows:



(14) Others

14-1) Indication of lot number

The lot number is shown on a label. Attached location is shown in Fig.3(Outline Dimensions).

Indicated contents of the label

LQ070T5CR01	OOOOOOO
Model No.	lot No.

Contents of lot No. the 1st figure ·· production year (ex. 2001 : 1)
the 2nd figure ·· production month 1, 2, 3, ·····, 9, X, Y, Z
the 3rd～7th figure ·· serial No. 00001～
the 8th figure ·· revision marks A, B, C···

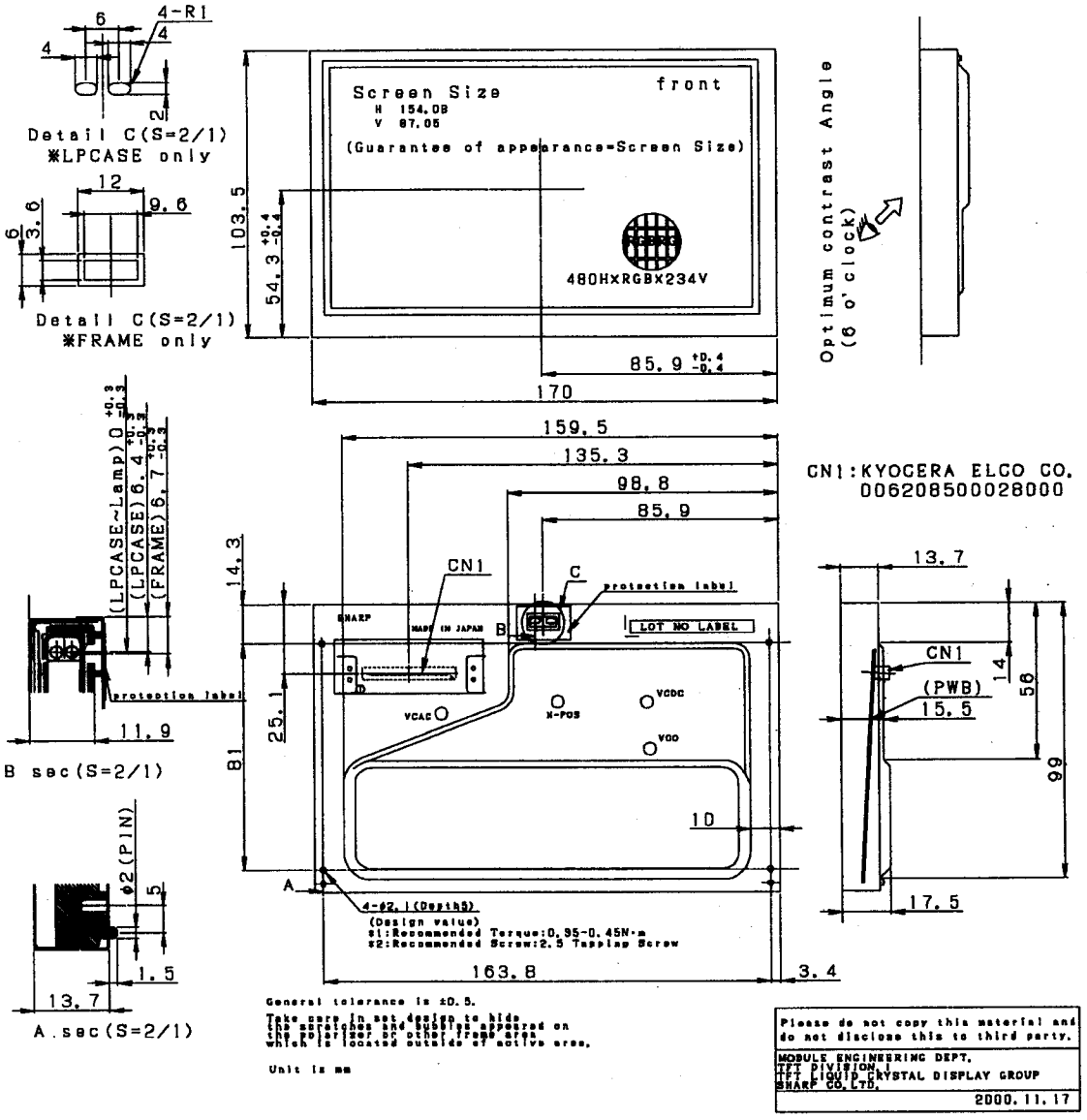


Fig.1 Outline dimension of TFT-LCD module

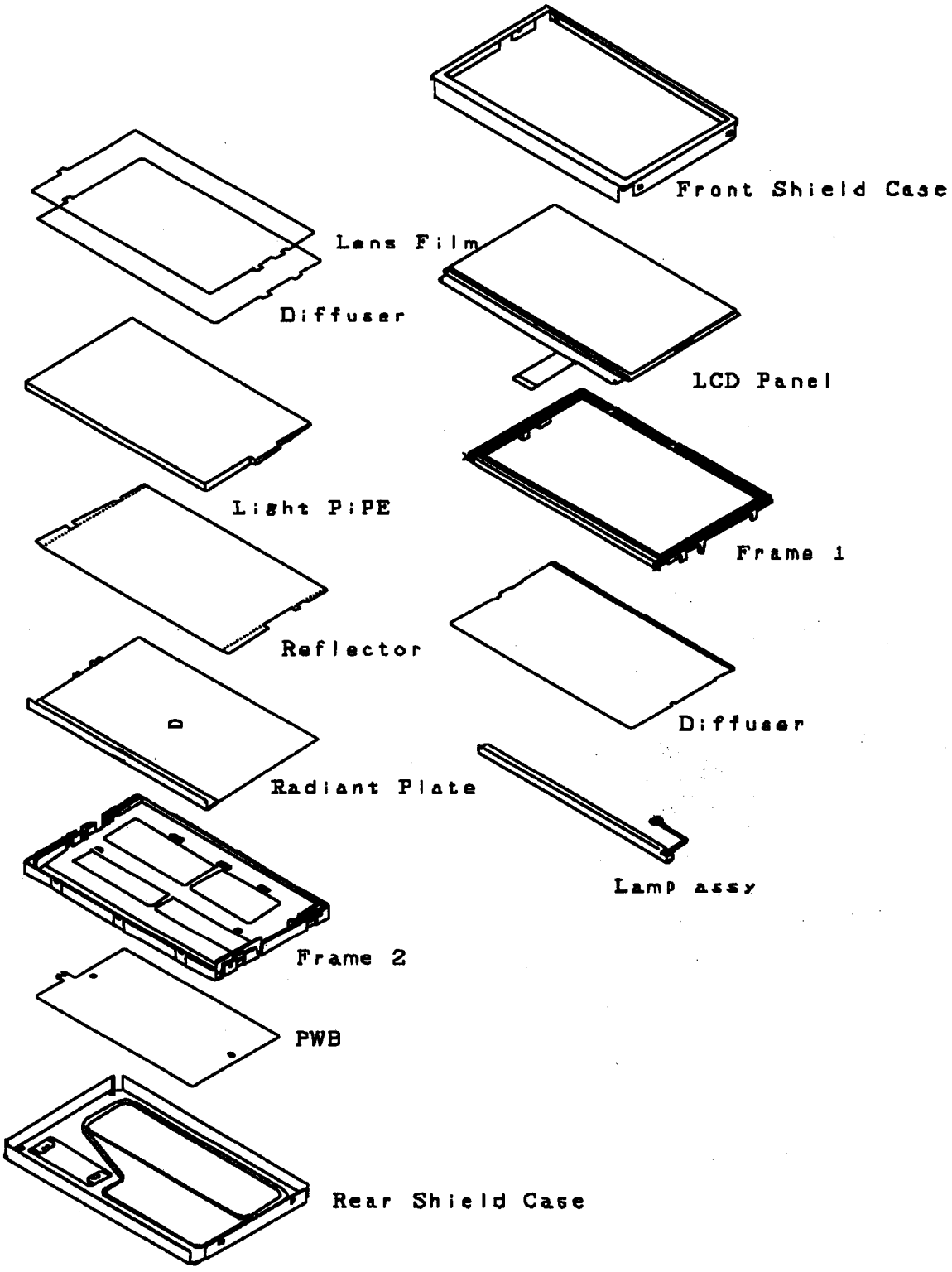


Fig. 2 The construction of TFT-LCD module

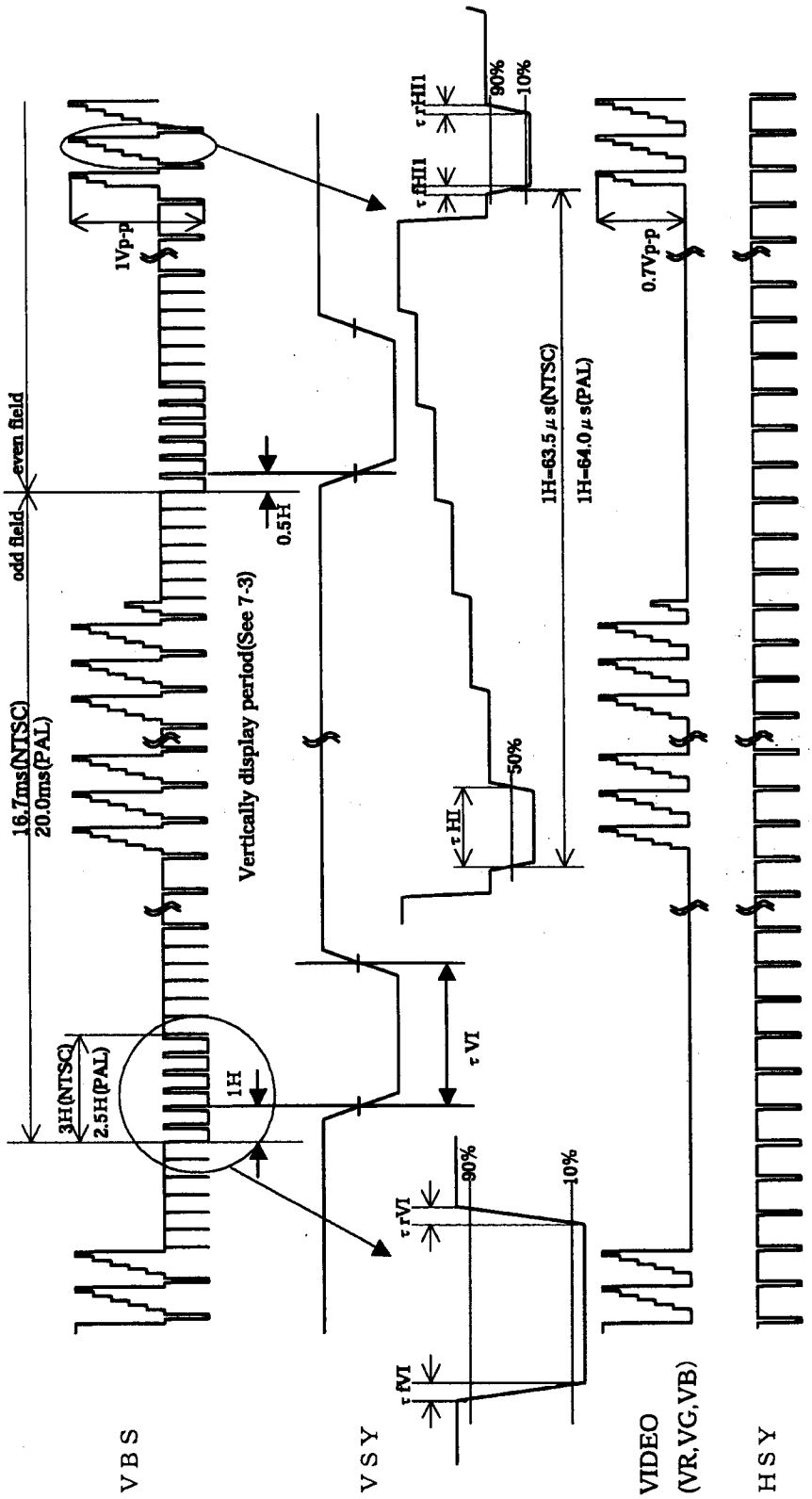


Fig.4 Input signal waveforms

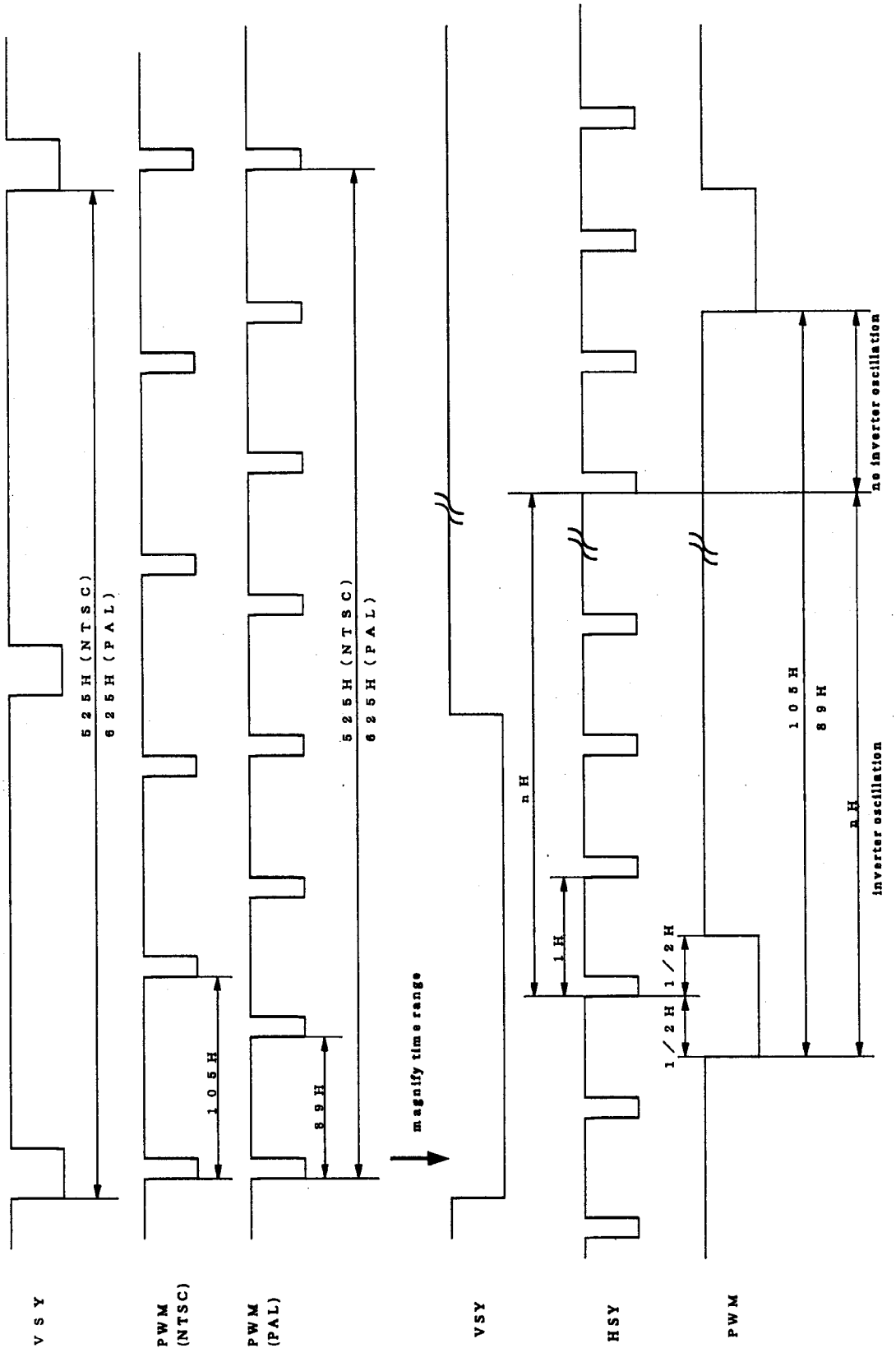


Fig. 5 PWM dimming timing

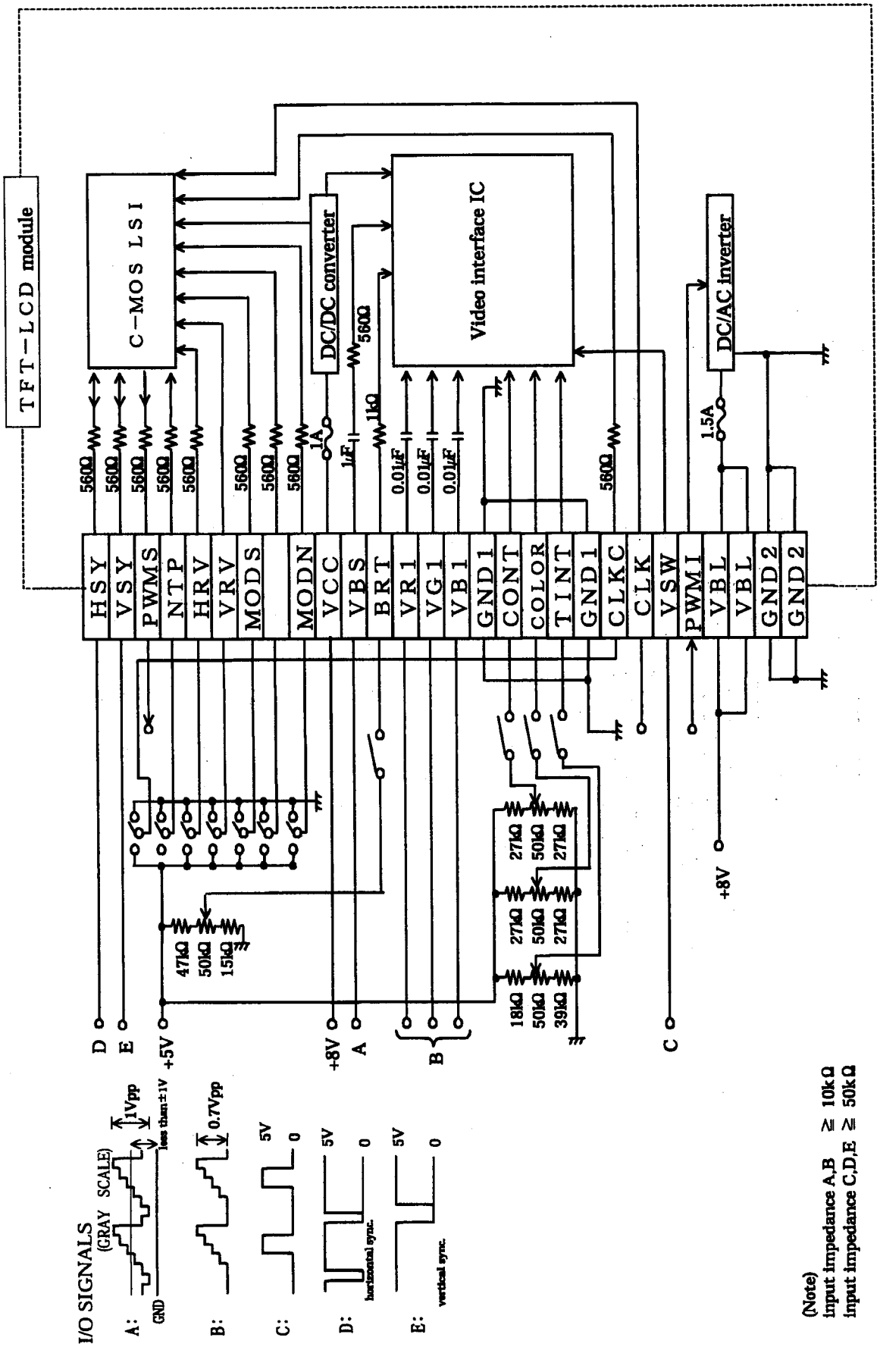


Fig.6 Recommended circuit of TFT-LCD module

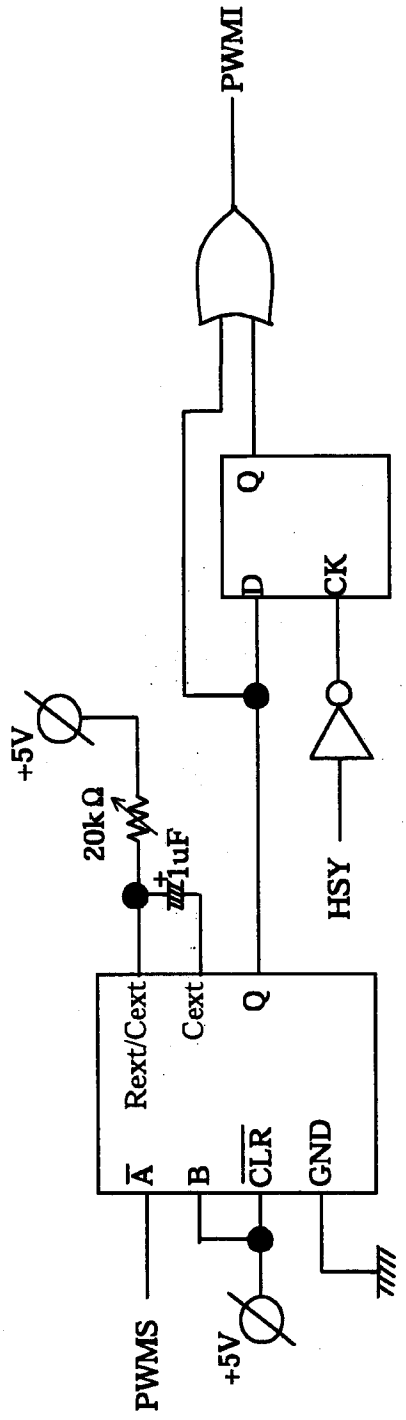


Fig7. recommended circuit of PWM dimming

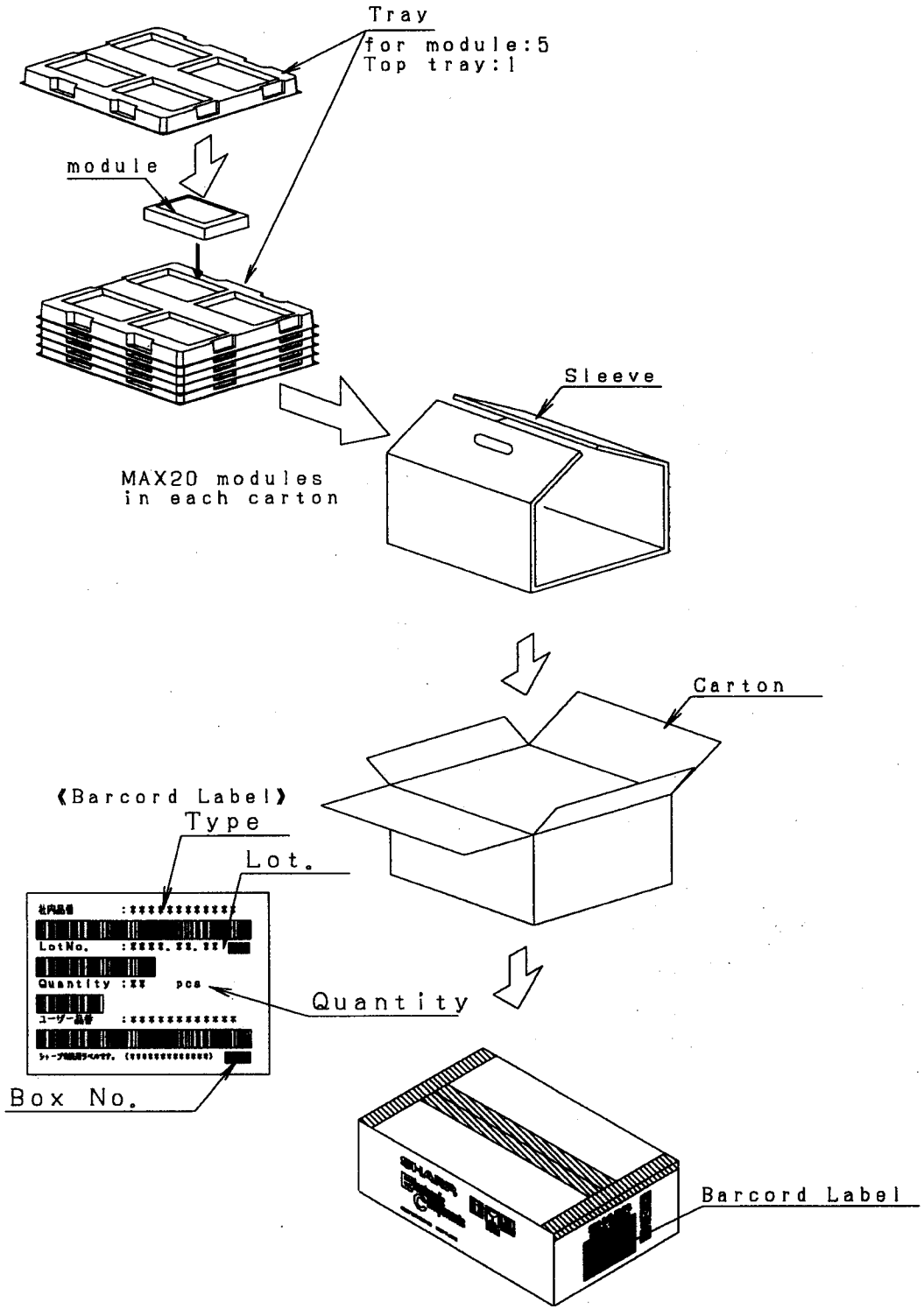


Fig.8 Packing form

(Appendix-1)

Adjusting Method of Optimum Common electrode DC Bias Voltage

To obtain optimum DC bias Voltage of common electrode driving signal, photo-electric devices are very effective, and the accuracy is within 0.1V.(in visual examination method, the accuracy is about 0.5V because of the difference among individuals.)

To obtain optimum common electrode DC bias voltage, there is a measurement method as follows:

Measurement of flicker method

DC bias voltage is adjusted so as to minimize NTSC:60Hz(30Hz)/PAL:50Hz(25Hz)flicker.

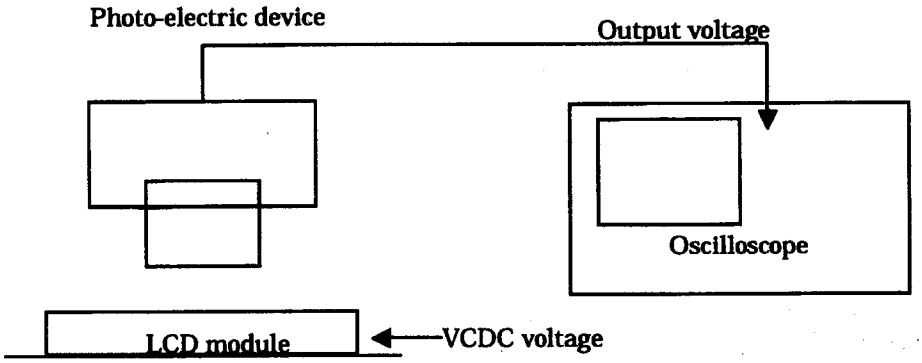
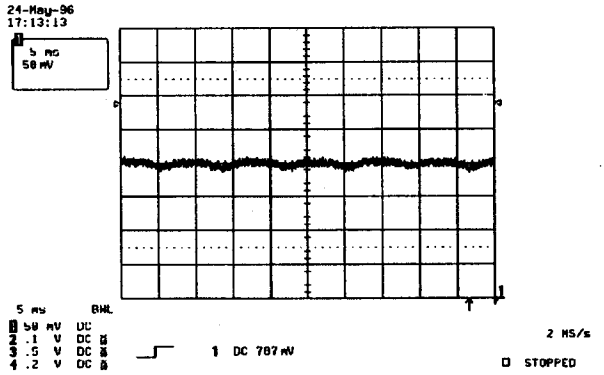


Fig.A Measurement system

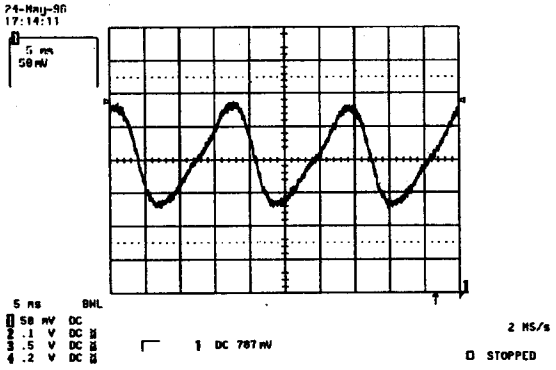
《Measurement of flicker》

Photo-electric output voltage is measured by an oscilloscope at a system shown in Fig.A

DC bias voltage must be adjusted so as to minimize the 60Hz(30Hz)[NTSC]/50Hz(25Hz)[PAL] flicker with DC bias voltage changing slowly.(Fig.B)



DC bias : Optimum



DC bias : Optimum +1V

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