

# **LQ064A5CG01**

## **TFT-LCD Module**

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DEVICE SPECIFICATION FOR

**TFT - LCD    module**

MODEL No.    LQ064A5CG01

CUSTOMER'S APPROVA

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## (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) system standards.

Module geometry (Mechanical specification) : Table 1

## (2) Features

- 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 6.4" 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) and control circuit responsive to composite video signal.
- The inverter circuit having-within for the backlight lighting-up(dimming is available)
- The backlight going-out function having-within at the signalless time
- An anti-glare (AG 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

- The construction form figure : See Fig.1
- Outline dimensions of TFT-LCD module : 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	11,2320	Pixels	
	1440(H) × 234(V)	dots	
Active area	129.6 (H) × 97.6 (V)	mm	
Screen-size (Diagonal)	16 [ 6.4" ]	cm	
Dot pitch	0.090(H) × 0.417(V)	mm	
Dot configuration	R·G·B Stripe configuration		
Outline dimension	153.0(W) × 122.0(H) × 21.0(D)	mm	【Note 4-1】
Mass	365 ± 10	g	

【Note 4-1】 This measurement is typical, and see Fig.2 for the details .

## (5) Input / Output terminal

## 5-1) TFT-LCD panel driving section

Table 2

Pin No.	Symbol	i/o	Description	Remarks
1	DMO	o	The voltage output for the dimming light control	【Note5-1】
2	DMI	i	The electric current return signal for the dimming light control	【Note5-2】
3	HVR	i	Turning the direction of horizontal and vertical scanning	【Note5-3】
4	VIN	i	power supply voltage (9~16V)	
5	GND	—	power GND	
6	VBS	i	Composite video signal(NTSC)	
7	GND	—	signal GND	
8	BRT	i	Brightness adjusting terminal	【Note5-4】
9	TEST	i	Generally, when using, connect with the DMO terminal.	【Note5-5】
10	GND	—	Frame GND	

【Note5-1】 The voltage output of 5.3 V.

Don't use for a thing except the recommendation dimming circuit and the purpose of the connection to 9<sup>th</sup>PIN.

【Note5-2】 The backlight dimming light is possible easily in inserting resistance between the 1st terminal and this terminal. As for outside the putting resistance, from 0Ω to 800kΩ is recommended.

【Note5-3】 When this terminal is 'Low', it will be normal and when it is 'High', it will display reversely on horizontal and vertical direction.

【Note5-4】 Brightness is 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.

【Note5-5】 When connecting this terminal with GND, regardless of the input existence or non-existence of the image signal, the backlight lights up.

## (6) Absolute maximum ratings

Table 3

GND=0V、T<sub>a</sub>=25℃

Parameter		Symbol	MIN	MAX	Unit	Remarks
Protect operating voltage		V <sub>pro</sub>	+16.3	—	V	
Analog input signals		V <sub>i</sub>	—	2.0	V <sub>p-p</sub>	【Note 6-1】
Digital input signals		V <sub>I</sub>	−0.3	+5.4	V	【Note 6-2】
Adjusting terminal voltage		V <sub>adj</sub>	−0.3	+5.1	V	【Note 6-3】
Storage temperature		T <sub>stg</sub>	−40	+95	°C	【Note 6-4】
Operating temperature	Surface of panel	Top1	−30	+85	°C	【Note 6-4, 5, 6】
	Environment	Top2	−30	+60	°C	【Note 6-6, 7】

【Note 6-1】 VBS terminals(Video signal)

Input impedance : 75Ω

【Note 6-2】 HVR terminal

【Note 6-3】 BRT 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 4

GND=0V, Ta=25°C

Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Power supply voltage		VIN	+9.0	+13.8	+16.0	V	
Analog input voltage	Amplitude	VBS	0.7	1.0	2.0	Vp-p	【Note7-1】
	DC component	Vdc	-0.1	0	+1.0	V	【Note7-2】
Digital input voltage	Hi	Vih	+3.5	-	+5.0	V	【Note7-3】
	Lo	Vil	0	-	+1.5	V	
Input horizontal sync. component	frequency	fH(N)	15.13	15.73	16.33	kHz	【Note7-4】
	pulse width	$\tau$ HI(N)	4.2	4.7	5.2	$\mu$ s	
	rising time	$\tau$ rHI1	-	-	0.5	$\mu$ s	
	falling time	$\tau$ fHI1	-	-	0.5	$\mu$ s	
Input vertical sync. component	frequency	fV(N)	fH/284	fH/262	fH/258	Hz	【Note7-5】
	pulse width	$\tau$ VI(N)	-	3H	-	$\mu$ s	
	rising time	$\tau$ rVI	-	-	0.5	$\mu$ s	
	falling time	$\tau$ fVI	-	-	0.5	$\mu$ s	
Terminal voltage applicable to brightness		Vbrt	+2.0	+2.1	+2.3	V	

【Note7-1】 VBS terminal (composite video signal)

Input impedance : 75  $\Omega$ 

【Note7-2】 VBS terminals

【Note7-3】 HVRV terminals

Input impedance : >10k $\Omega$ 

【Note7-4】 VBS (horizontal sync. component)

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

## 7-2 )Power consumption

Table 5

Ta=25°C

Parameter	Symbol	Voltage	MIN.	TYP.	MAX.	Unit	Remarks
Supply current	Iin10	VIN=+13.8V	—	750	850	mA	Backlight on
	Iin0	VIN=+13.8V	—	150	220	mA	Backlight off

## 7-3) Display time range

Displaying the following range within video signals.

(a) Horizontally

: 10.9 ~ 61.2  $\mu$ s

from the falling edge of H-sync.

(b) Vertically

: 21 ~ 254 H

from the falling edge of V-sync.(odd field)

20.5~253.5H

from the falling edge of V-sync.(even field)



(8)Optical characteristics

Table 6 Ta=25℃

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		$\Delta \theta 11$	$CR \geq 5$	60	65	-	° (degree)	【Note 8-1, 2, 3】
		$\Delta \theta 12$		35	40	-	° (degree)	
		$\Delta \theta 2$		60	65	-	° (degree)	
Contrast ratio		CRmax	Optimal	100	-	-		【Note 8-2, 3】
Response time	Rise	$\tau r$	$\theta = 0^\circ$	-	30	60	ms	【Note 8-2, 4】
	Fall	$\tau d$		-	50	100	ms	
Luminance		Y		260	350	-	cd/m <sup>2</sup>	【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.

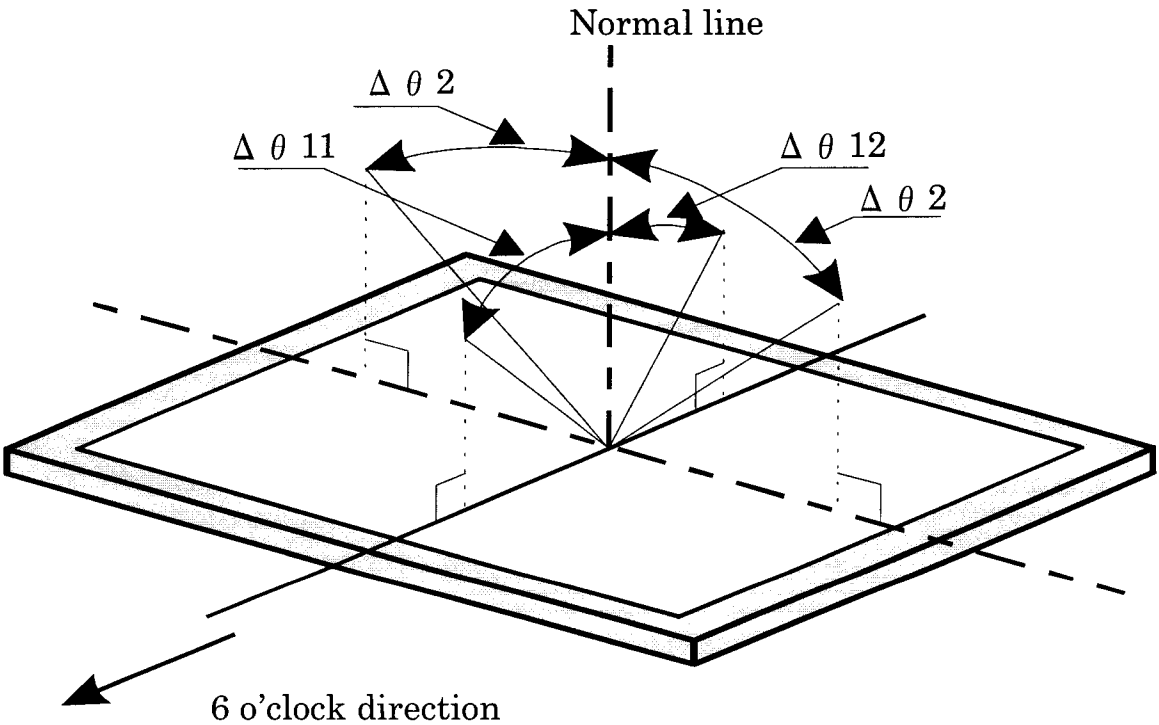


Fig. (i) definition for viewing angle

【Note 8-2】 Applied voltage condition:

- (1) VDC is adjusted so as to attain maximum contrast ratio.
- (2) Brightness adjusting voltage (BRT) is open.
- (3) Input video signal of standard black level and 100% white level.

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

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

【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".

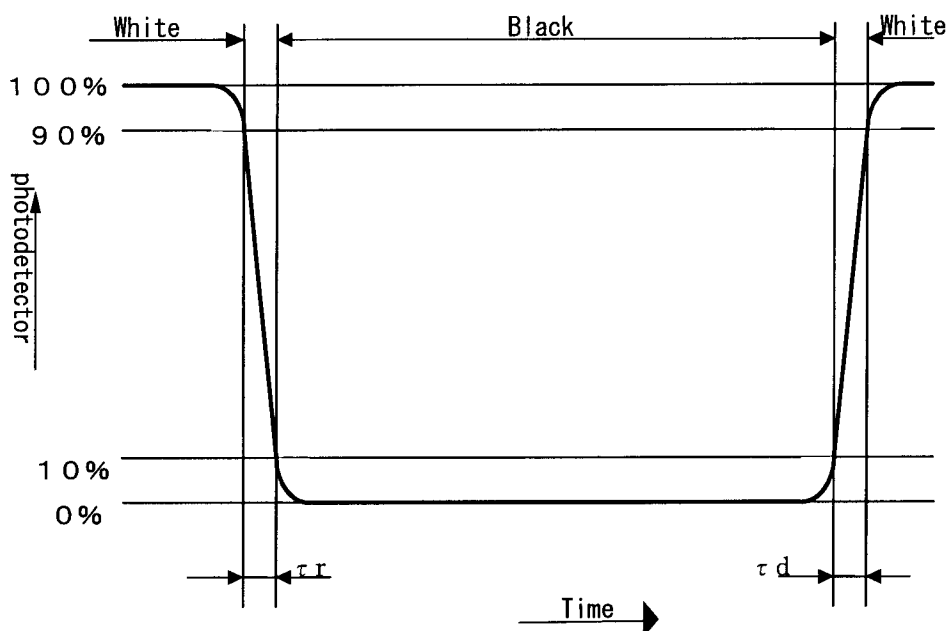


Fig. (ii)

【Note 8-5】 Measured on the center area of the panel at a viewing cone  $1^\circ$  by TOPCON luminance meter BM-7. (After 30 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.

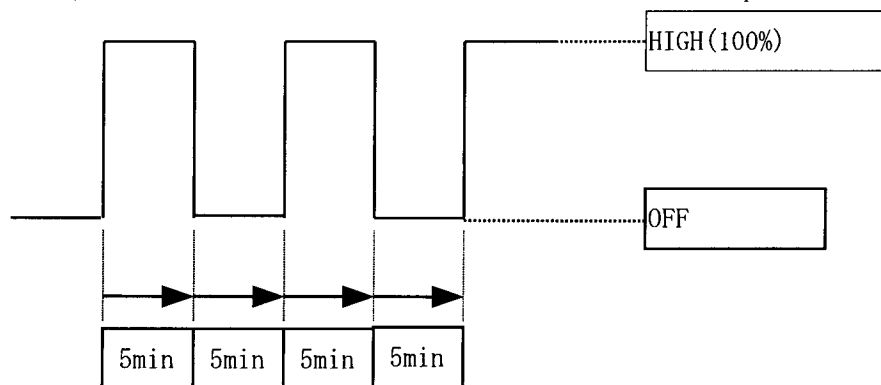
(operation conditions)

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.

(condition)

Ambient temperature:  $-30^\circ\text{C}$



## (9) Mechanical characteristics

## 9-1) External appearance

Do not exist extreme defects. (See Fig. 2)

## 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 (10 pin)

I/O connector of module driving

Symbol	Used Connector	Corresponding connector	Manufacture
CN1	53014-1010	51004-1000	molex

## (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 four holes at the side of the module.

On mounting the module, 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 dirt.

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 1M $\Omega$  or more on the tile  
(conductive mat or conductive paint on the tile)

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

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

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

③When 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.

④Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.

⑤TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Handle with care.

⑥Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

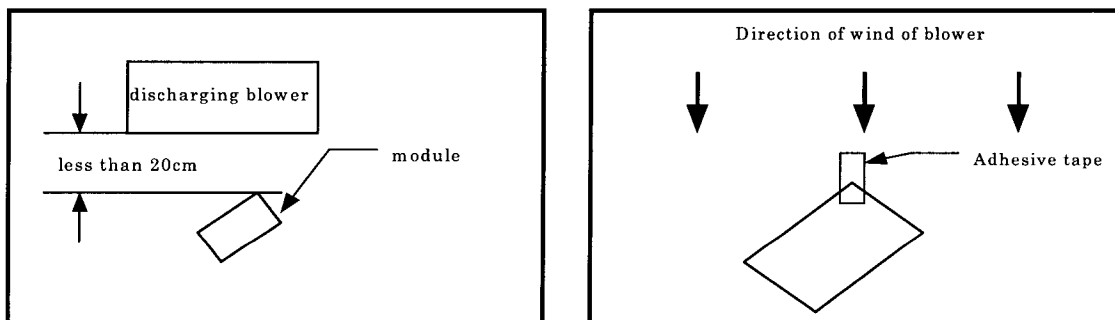


Fig . (iii)

## 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,

to do not interfere surrounding appliances.

## 11-5) Others

- ① Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays.
- ② Store 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.
- ③ The 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.
- ④ Observe all other precautionary requirements in handling general electronic components.

## (12) Shipping requirements

12-1) Packing form is shown in Fig. 5.

### 12-2) Carton storage condition

- ① Number of layers of cartons in pile : 10 layers max.
- ② Environmental condition :
  - Temperature            0°C to 40°C
  - Humidity                60 %PH or less (at 40°C)  
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

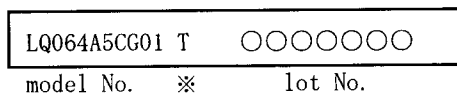
Reliability test conditions for the TFT-LCD module are shown in Table 7.

## (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



※This code distinguishes new TAC from old.

T: New TAC, blank: Old TAC

contents of lot No.    the 1st figure ·· production year    (ex. 1999 : 9)  
                          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··

Reliability Test Conditions for TFT-LCD module

Table 7

No	Test items	Test condition
1	High temperature storage test	Ta=+95°C 240h
2	Low temperature Storage test	Ta=-40°C 240h
3	High temperature And high humidity Operating test	Tp=+60°C (90~95%RH) 240h
4	High temperature Operating test	Tp=+85°C 240h
5	Low temperature Operating test	Ta=-30°C 240h
6	Electrostatic Discharge test	$\pm 200V \cdot 200pF(\Omega)$ , Once for each terminal
7	Shock test	980m/s <sup>2</sup> ·6ms, $\pm X$ , $\pm Y$ , $\pm Z$ 3 times for each direction (JIS C0041, A-7 Condition C)
8	Vibration test	Frequency range : 8~33.3Hz Stroke : 1.3mm Sweep : 33.3Hz~400Hz Acceleration : 28.4m/s <sup>2</sup> 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	-30°C~+85°C, 200cycles (0.5h) (0.5h)

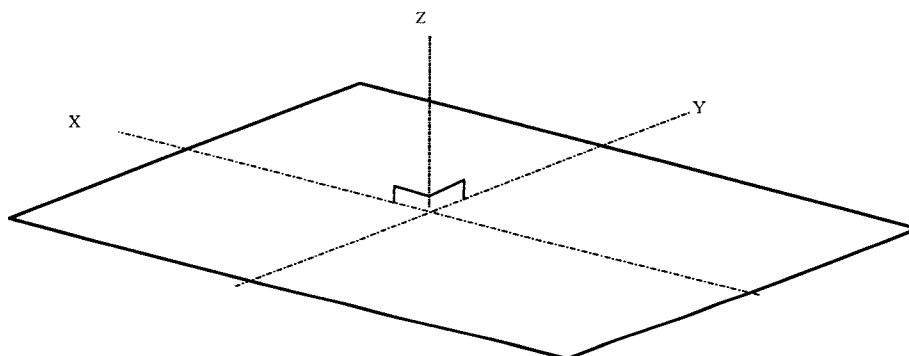
Ta = Ambient temperature

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:



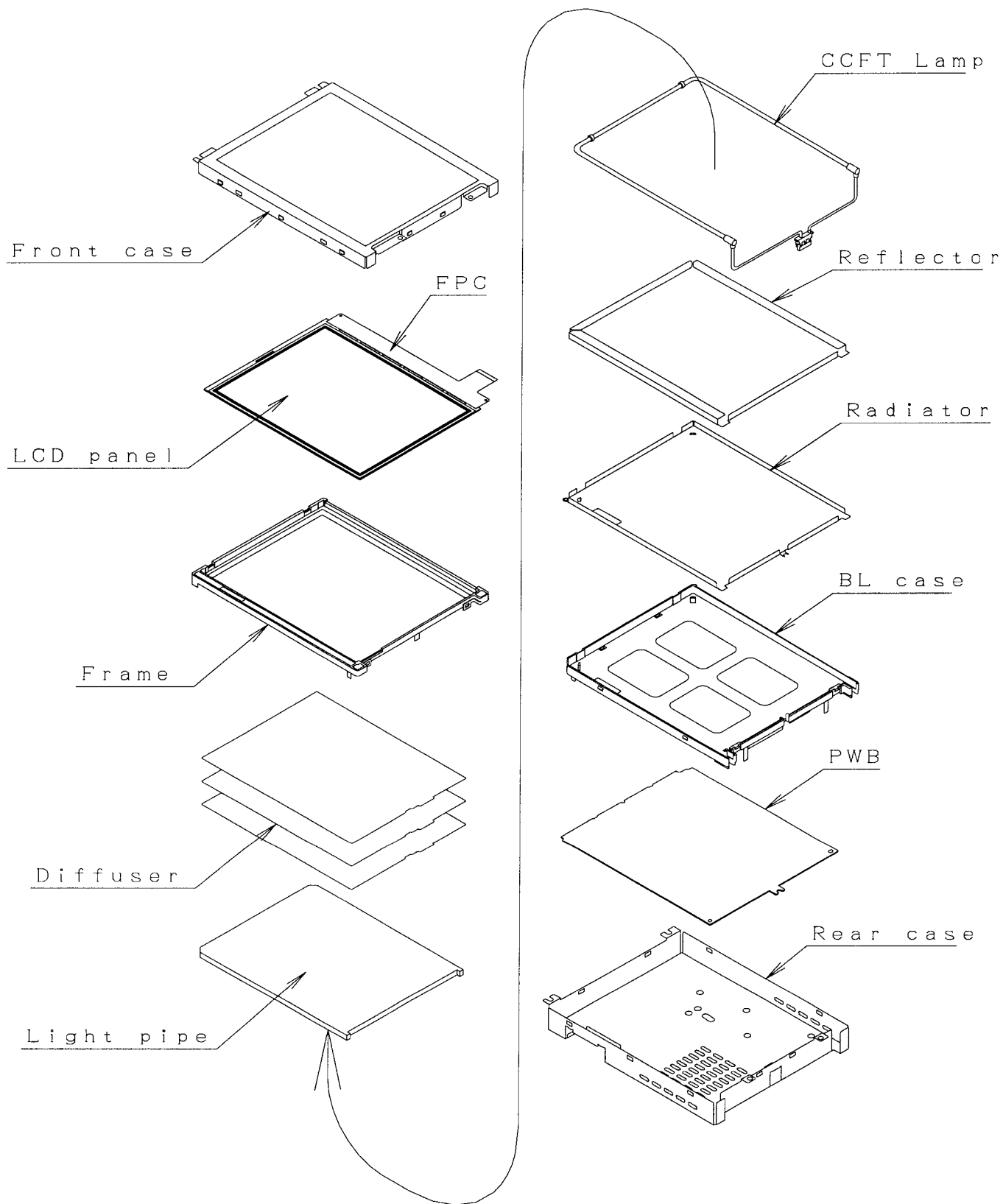
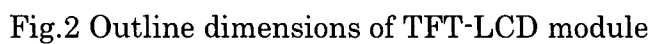


Fig.1 Construction of TFT-LCD module





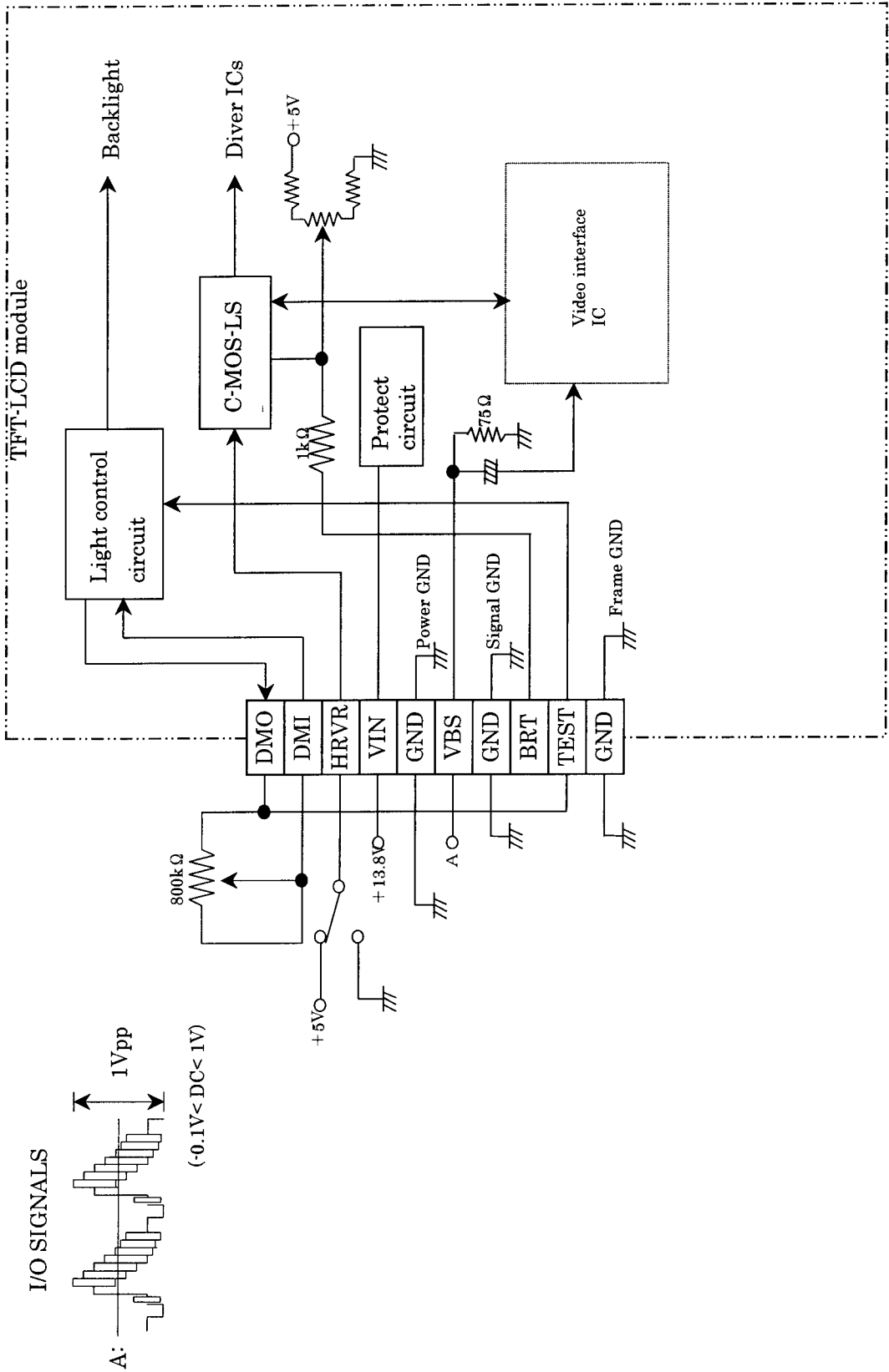


Fig.3 Recommended circuit of TFT-LCD module

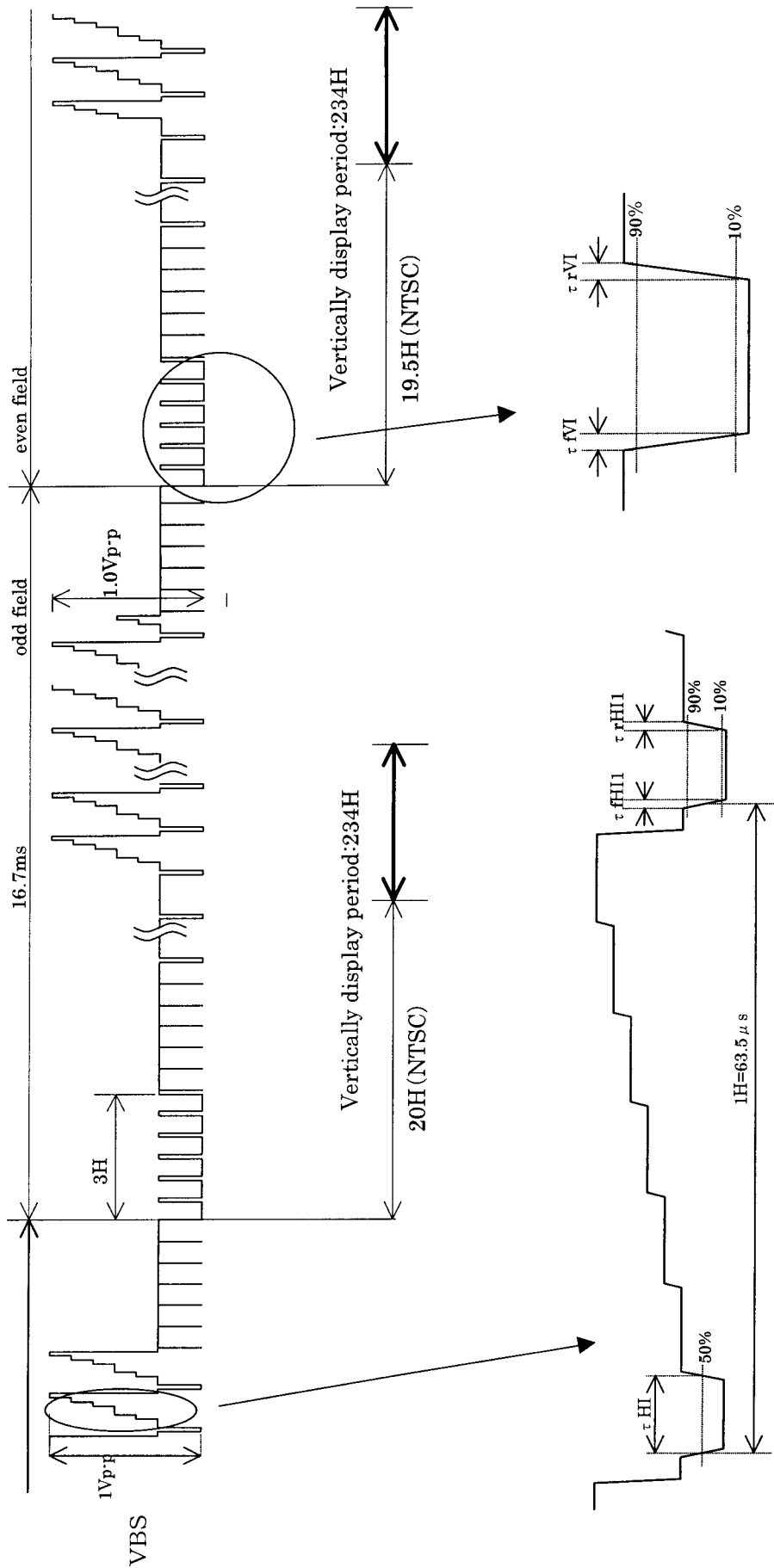


Fig.4 Input signal waveforms

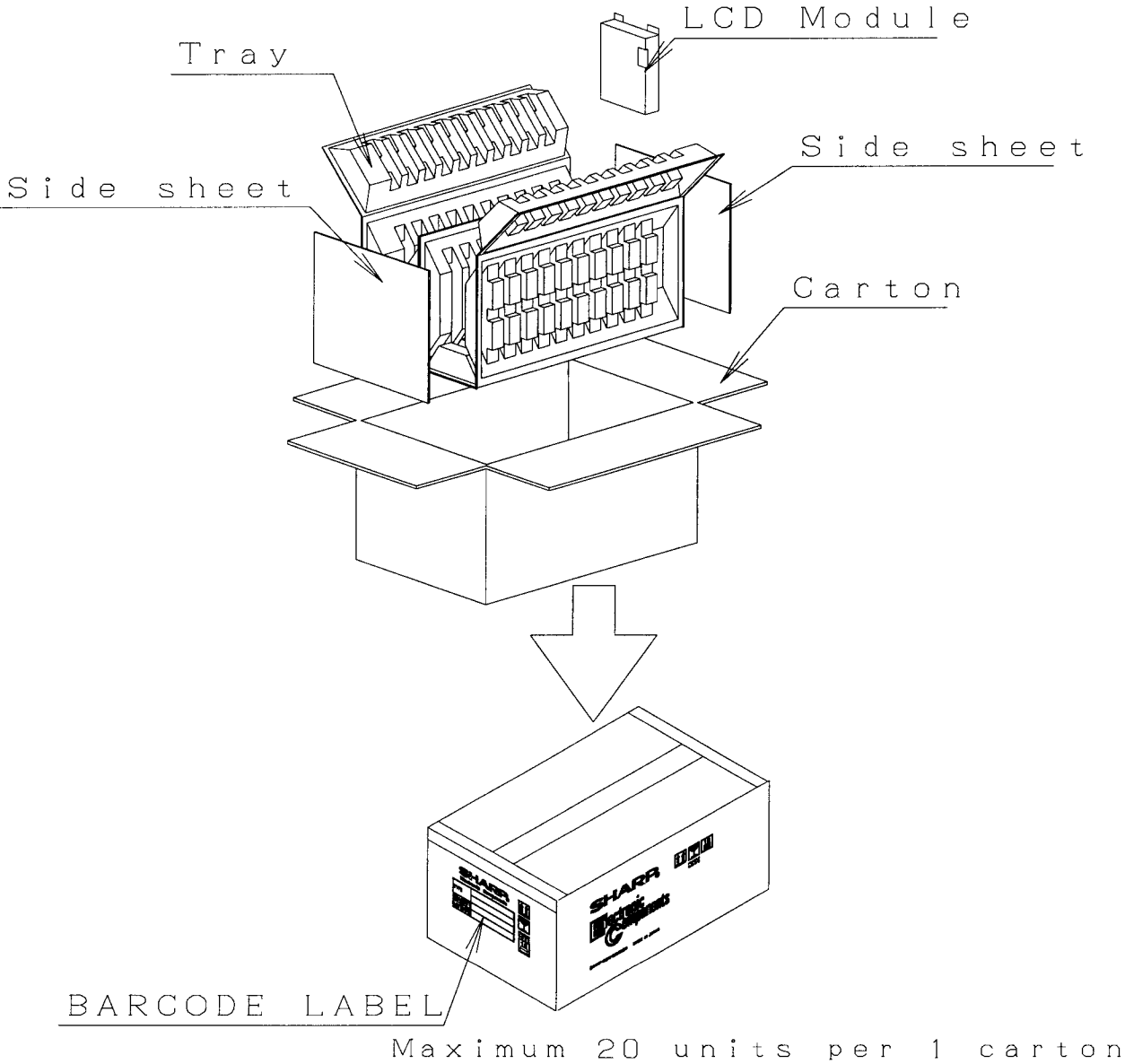


Fig.5 Packing form

(Appendix-1)

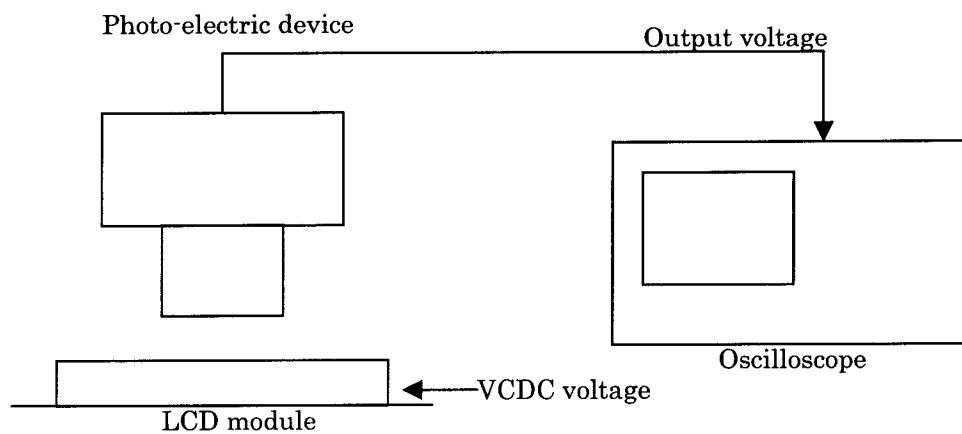
Adjusting Method of Optimum Common electrode DC Bias Voltage

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:

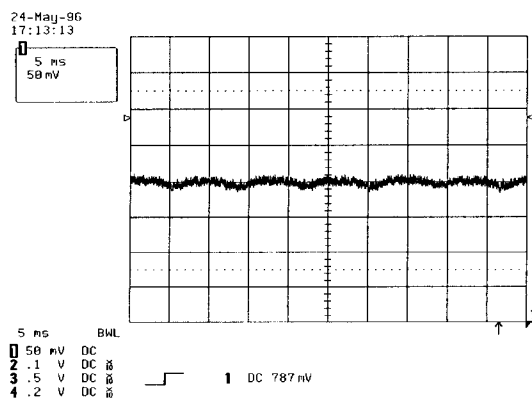
## Measurement of flicker method

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

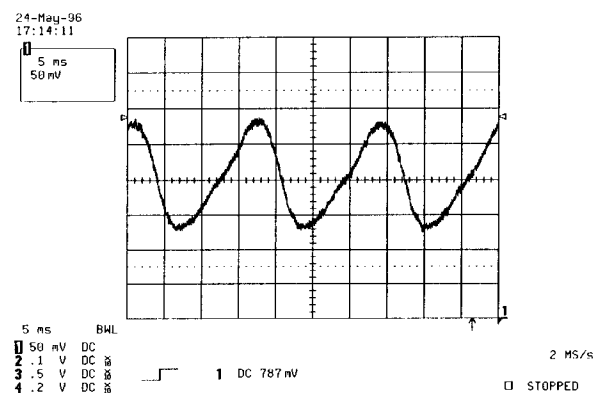
Fig.A Measurement system

## 《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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