BOSCH AUTOMOTIVE	Detail Specification for TFT-LCD Module LQ050A5AG03	1 036 905 251 Page - 1 -

Function	*Full Color Active Matrix LCD Module*
Supplier	*SHARP CORPORATION*
RB-Part Number	*6 033 EC0 632*
Issue Date	*21.10.2002*

Changes

Page	Item	Subject	Date

Signatures

Robert Bosch GmbH		Supplier	
Development CM-IS/END 9.7.03	Date	Supplier	Date
Purchase CM/PUR2	Date 10.07.2003	Production	Date
Quality Assurance CM/~~QA5~~ PUR 02	Date 15.7.03	Quality Assurance	Date
		Engineering Department 2 Mobile LCD Design Center Mobile LCD Group	Date 18.06.2003

Date: 18.06.2003 Supplier:

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CONTENTS

1 General

The purchase order documentation of Liquid Crystal Display Modules consists of:

a) This Detail Specification

b) General Specification of Liquid Crystal Display Modules BPV/AE0047.

2 Technical Specification

2.1 Liquid Crystal Display Panel

LCD technology:	*TN-mode*
LC material:	*ML006*
LC clearing point:	*96 °C*
Alignment Layer:	*ZL219*
Main viewing direction:	*12 o'clock*
Image mode:	*Normally white*
Polarizer front side	*Z2912*
Polarizer back side:	*Z2913*
Glass substrate front side:	*CC05*
Glass substrate back side:	*CC05*
Dimension of LCD front plane:	*CC05 107.88(H)x77.41(V)x0.7(D) mm*
Dimension of LCD back plane:	*CC05 111.50(H)x82.25(V)x0.7(D) mm*
Driver:	*LH1669 / LH1624*
Connection: FPC-Panel: *between HPC-Panel:* COG:	*FPC: H2126* *ACF: C2022* *ACF: C2053*
Cell gap:	*not disclosed*

2.1.1 Fab Locations of LCD Panel (Traceability)

Front end of line:	*Sharp, Tenri factory*
Back end of line:	*N-Tek*
COG process:	*Yamato Electronic Corp. - ISE factory*
Panel test:	*Yamato Electronic Corp. - ISE factory*

2.2 Printed Circuit Board Assembly

Mechanical dimensions and tolerances, partlists, circuit diagrams, and functional description are given by the attached documents, see Chap. 5.3.

2.2.1 Printed Circuit Board Technical Data:

Technology, No. of layers	*2 Layers*
PCB material	*FR4, glass epoxy, t=0,6 mm*
Top/bottom layer thicknesses	*18 µm*
Solder mask thickness	*150 µm*
Gold contact layer thickness	*0,05 µm*
Solder technology	*reflow*

2.2.2 Fab Locations of PCB

PCB supply	*Shikibo Electronics*
PCB assembly	*Hokuriku / Taiko*
Final test	*Hokuriku / Taiko*

2.3 Backlight Unit / Lamp

Mechanical dimensions and tolerances, parts list and lamp are specified by the attached documents, see Chap. 5.1, 5.2 and 5.3.

Technology:	*CCFL (semi self heating)*
Lamp part No.:	*P0089*
Nominal life time at +25°C and –30°C	*see Chap. 3.2*
Lamp color	*white, x = 0,295 y = 0,280*
Warm up time at –10°C	*see Chap. 3.2*
Recommended driving conditions of lamp	*see Chap. 3*

2.3.1 Fab Locations of Backlight Unit (Traceability)

Lamp supply	*Harison Toshiba Lighting*
Assembly	*Yamato (Subaru)*
Final test	*Yamato (Subaru)*

2.4 Display Module

2.4.1 Mechanical Specification

For the complete mechanical specification it is referred to BOSCH drawing:

No. 6 033 EC0 632 index 01, dated 21.10.2002

and the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (4), (9)

and parts lists, see attached documents, Chap. 5.3.

2.4.2 Packaging and Marking Specification

For the complete packaging specification it is referred to the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (12), (14)

2.4.3 Fab Locations Module Assembly

Module Assembly	*YAMATO Electronic Corp. – ISE factory*
Final test	*YAMATO Electronic Corp. – ISE factory*

2.4.4 Handling Instruction

For the complete handling instruction it is referred to the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (11)

3 Electrical and Optical Specification

For the complete electrical specification it is referred to the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (5), (7)

3.1 Module Absolute Maximum Ratings

For the absolut maximum ratings it is referred to the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (6)

The requested higher temperature ranges mentioned below, are not guaranteed by the supplier. According to the reliability test results (see Chap. 5.6) the modules withstand these temperatures.

Storage temperature	*-40<->90*	°C	*ambient temp.*
Functional temperature	*-40<->85*	°C	*ambient temp.*
Operational temperature	*-25<->70*	°C	*ambient temp.*

3.2 LCD – Electro Optical Characteristics

For the complete optical specification it is referred to the suppliers original data sheet:

Sharp Spec No. LCY-00010B, Issue date: Oct. 9.2002
Chapter (8)

Measurements of isocontrast diagram at –20°C, +25°C and at +70°C	*see App. 5.4*
Measurement of isocontrast diagram vs VSL and VSH at +25°C	*see App. 5.4*
Measurement of LCD response time, Tr+d at +25°C, and at –20°C	*see App. 5.4*
Measurements of the contrast optimum at –20°C, +25°C and at +70°C	*see App. 5.4*
Measurement of luminance uniformity: (min 5 points)	*see App. 5.5*
Measurement of color coordinates at +25°C	*see App. 5.5*
Measurement of luminance at –20°C, +25°C, and +70°C	*see App. 5.5*
Measurement of luminance start up characteristic at –20°C	*see App. 5.5*

3.3 Electrostatic Discharge (ESD)

a) Contact Discharge:

- +/-1,5 kV at C_i=150 pF and R_i=330 Ω
- 10 discharges/pin (time intervall >1s), both polarities
- module not activated

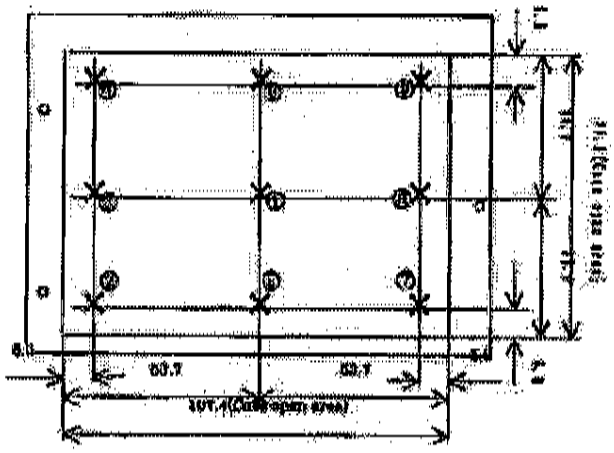
- +/-6 kV at C_i=150 pF and R_i=330 Ω
- 10 discharges/point (time intervall >1s), both polarities
- discharges on screen size according to sketch below
- module in operation

b) Air Discharge:

- +/-7 kV at C_i=150 pF and R_i=330 Ω
- 10 discharges/point (time intervall >1s), both polarities
- discharges on screen size according to sketch below
- module in operation

Defect criteria:

- during air discharge test and after completion of contact and air discharge tests, full functionality has to be fulfilled
- no remaining damage is allowed



ESD is applied in the sequence of numbers above

4 Drawing Numbers

LCD Module:

BOSCH Part Number	Supplier's Part ID-Number	BOSCH Drawing Number
6 033 EC0 632	*LQ050A5AG03*	*6 033 EC0 632*

5 Appendix

5.1 Bosch drawing

5.2 Suppliers LCD Module Data Sheet Incl. Incoming Inspection Standard

5.3 Parts lists and diagrams

5.4 Module Electro Optical characterisation data

5.5 Module illumination characterisation data

5.6 Reliability Test Results

5.7 Agreed deviation from General Specification BPV/AE0047 (Version 03)

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Weitere Ausführungen, Zeichnungen (FURTHER FOREIGN LANGUAGE DWGS

GV/ASTH (08.1998) W A2 GV/BS-Lr 06.1999

6 033 ECO 632

Rauheitsang. SURF.ROUGHN.	↕N12 A 059. DIN ISO 1302		
Kanten EDGES	↕N12A B42. DIN 6784		
Metr. IS O	ohne O berfl. W/O SURFACE	mit Oberfl. WITH SURFACE	
Aussengewinde EXT. THREAD			
Innengewinde INT. THREAD			

Nicht tolerierte Masse
NON TOLERANCED DIMENSIONS

0.5 ...3	> 3 ...6	> 6 ...30	> 30 ...120	> 120 ...400	> 400 ...1000
± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8

Rundungen, Fasen
RADII, CHAMFERS

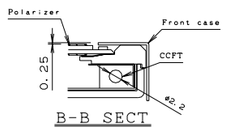
± 0.2	± 0.5	± 1	± 1	± 1	± 1

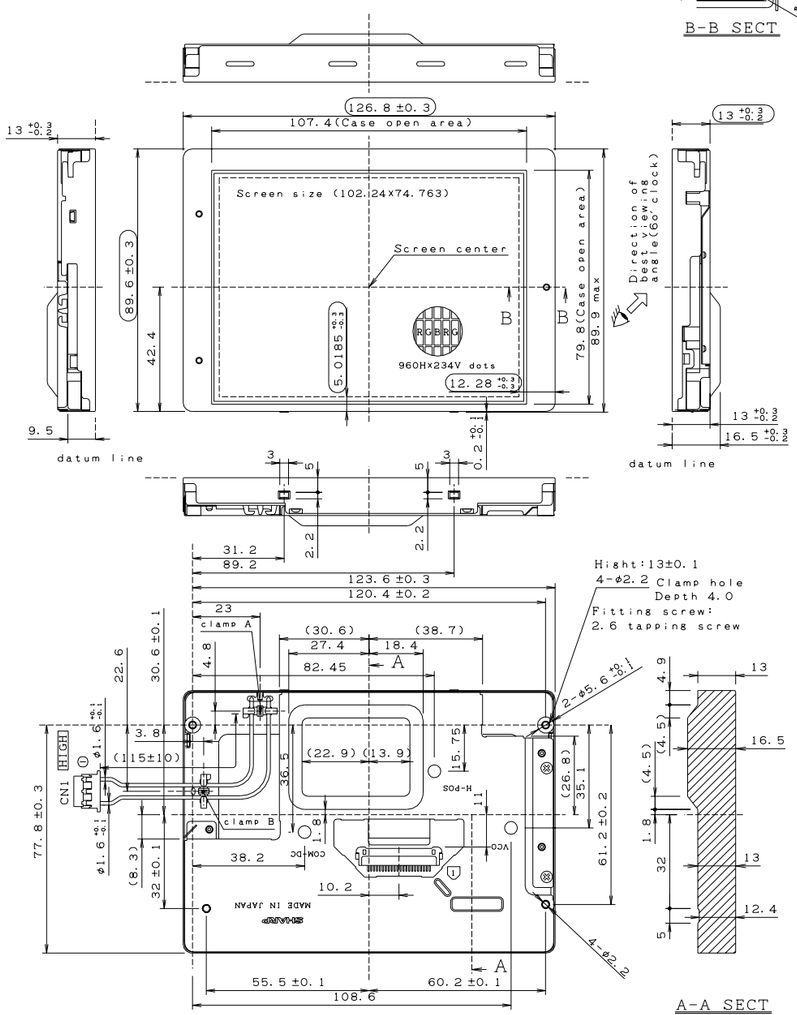
Winkel, Masse der kuerzeren Schenkel
ANGLES, DIM. OF THE SHORTER SIDE

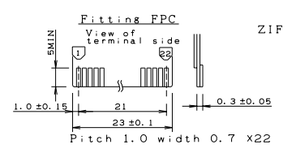
bis 10	> 10 ...50	> 50 ...120	> 120 ...400	> 400
± 1°	± 30'	± 20'	± 10'	± 5'

Form- und Lagetoleranzen
TOLERANCES OF FORM AND POSITION
ISO 2768-H (N13 B92/1)

ISO-Grenzmasse / ISO LIM. OF SIZE		
Mass/ SIZE ueber bis OVER TO	Toleranzklasse TOL. CLASS	Grenzmasse LIM. DEVIATIONS







ZIF connector type:006200227032800
(KYOCERA ELCO CORP.)

General Specification: BPV/AE 0047
Detail Specification: 1 036 905 251

Counterdrawing to Sharp Part No. LQ050A5AG03

note1) General tolerance is ±0.3.
note2) Unit is mm.
note3) Marking O:SPC data or mechanical dimension/tolerancewith limited samples to be measued.

Ers.f./ REPLACES										
01	ueberarbeitet	Kar	21.10.2002	Kar						
Nr NO	Aenderung CHANGE	gez. DWN.	gueltig VALID	gepr CHK.						

Ersatz/ REPLAC.BY

Fehl. Angaben/ MISS. DETAILS		Oberflaeche SURFACE	ISO E
1. Verwendung/ 1ST APPLICAT.	0 263 619 100		
Dokumentenart/ DOCUMENT TYPE			
Stueckliste besonderes Blatt/ PARTS LIST ON SEPARATE SHEET			

	Datum/ DATE	Name/ NAME
gez/ DWN	16.10.02	Kar
gep/ CHK		
ges/ APP		

Gr.St. VOLUME
Original:
DIN A2

Massstab SCALE 1:1
Gewicht WEIGHT
Stoff/ MAT'L
aus/ FROM
Benennung/ TITLE
Bildschirm
5" TFT Modul

BOSCH
Nr./ NO. 6 033 ECO 632
de/en
Blatt SHEET
Bl/ Sh

OBSERVE INSTRUCTIONS FOR FILLING OUT N12A D11/1

Ausfuelltanleitung N12A D11/1 beachten!

PREPARED BY: DATE	SHARP	SPEC No. LCY-00010B
		FILE No.
APPROVED BY: DATE		ISSUE: Oct. 9. 2002
		PAGE : 33 pages
	LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION SPECIFICATION	APPLICABLE GROUP LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT – LCD module

MODEL No. LQ050A5AG03

CUSTOMER'S APPROVA

DATE

BY

PRESENTED

BY H. Yakushigawa

H.YAKUSHIGAWA
Department General manager
Engineering Department.2
Mobile LCD Design Center
Mobile Liquid Crystal Display Group
SHARP CORPORATION

RECORDS OF REVISION

MODEL No : LQ050A5AG03

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LCY-00010	2000.11. 1.		-	-	1 st Issue
LCY-00010A	2001. 2. 9.	A	18,19	①Change of number of Table for reliability test from "Table 9" to "Table 11" (Not contents of test items changed)	2 nd Issue
			—	②Change of polarizer (TAC).	
			—	③Position of panel to be down.	
			—	④Additional facility for PCB assembly.	
			—	⑤Chang of Tape thickness to adhere between plastic frame and panel.	
LCY-00010B	2002.10. 9.	B	5,6,8	Table 5/6/8 Ta = 25℃→Top1 = -30～+85℃ [Change]	3rd Issue

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CONTENTS

(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.
It can withstand an intense environment, the outline dimension is suitable for an automobile display, compact size, compatible with 2DIN size.

(2)Features

- Dual mode type.[NTSC(M) and PAL(B･G) standards]
- MBK-PAL, or MaBiKi("thinning" in Japanese)-PAL which enables the 234-scanning lines panel to display a picture with virtually 273-scanning lines.
- TFT-active matrix-LCD drive system with high-contrast.
- 74,880 pixels (RGB Stripe configuration and full color) 5″ diagonal size.
- Slim, lightweight and compact
  ①Active area/Outline area＝70%　②Thickness : 16.5mm　③Mass : 180 g (Max)
- Built-in video interface circuit and control circuit responsive to two sets of standard R･G･B analog video signals.
- Reduced reflection as a result of low reflectance Black-Matrix and Anti-Glared front polarizer being adopted.
- It is possible to use both the simultaneous and the independent time sampling.
- An external clock mode is available.
- Optical viewing angle : wide view angle (6 o'clock direction.)
  (Customers can use this module as a '12 o'clock viewing direction type' by using a display rotating function to rotate right/left and up/down scanning direction electrically.)
- This module includes a high luminance edge light that is excellent at low temperature.
  (semi-self heating backlight system)
- It is possible to use the dimming frequency(PWM) for backlight.

(3)Construction and Outline

- Outline dimensions of TFT-LCD module: See Fig. 3
- The module consists of a TFT-LCD panel, driver ICs, control PWB mounted with electronic circuits, edge light, frame, front and rear shielding cases.

(Backlight driving DC/AC inverter is not built in the module.)

(4)Module geometry(Mechanical specification)

Tabel 1

Parameter	Specification	Unit	Remarks
Display format	74,880	Pixels	
	960(H) × 234(V)	dots	
Active area	102.2(H)× 74.8 (V)	mm	
Screen size (Diagonal)	13 [5"]	cm	
Dot pitch	0.1065(H)×0.3195(V)	mm	
Dot configuration	R•G•B Stripe configuration		
Outline dimension	126.8(W)×89.6(H)×16.5(D)	mm	【Note 4-1】
Mass	180(Max)	g	

【Note 4－1】This measurement is typical, and see Fig.3 for the details .

(5)Input/output terminals and their descriptions

5-1)TFT-LCD panel driving section

Table 2 (Hi means digital input voltage, Lo means GND.)

Pin No.	Symbol	i/o	Description	Remarks
1	HSY	i , o	Input/output horizontal sync. signal (low active)	【Note 5-1】
2	VSY	i , o	Input/output vertical sync. signal (low active)	【Note 5-2】
3	PWM	o	Terminal for output PWM of dimming back light.	【Note 5-3】
4	NTP	i	Terminal for display mode change of NTSC and PAL	【Note 5-4】
5	HRV	i	Turning the direction of horizontal scanning	【Note 5-5】
6	VRV	i	Turning the direction of vertical scanning	【Note 5-6】
7	VSW	i	Selection signal of two sets of video signals	【Note 5-7】
8	SAM	i	Terminal for sampling mode change	【Note 5-8】
9	V_{CDC}	i	DC bias voltage adjusting terminal of common electrode driving signal	【Note 5-9】
10	VSH	i	Positive power supply voltage	
11	VBS	i	Composite video signal for sync. separator	【Note 5-10】
12	BRT	i	Brightness adjusting terminal	【Note 5-11】
13	VR1	i	Color video signal (Red) 1	Positive (On when VSW=Hi.)
14	VG1	i	Color video signal (Green) 1	Ditto
15	VB1	i	Color video signal (Blue) 1	Ditto
16	VSL	i	Negative power supply voltage	
17	VR2	i	Color video signal (Red) 2	Positive (On when VSW=Lo.)
18	VG2	i	Color video signal (Green) 2	Ditto
19	VB2	i	Color video signal (Blue) 2	Ditto
20	GND	i	Ground	
21	CLKC	i	Change the input/output direction of CLK, HSY and VSY	【Note 5-12】
22	CLK	i , o	Input/output clock signal	【Note 5-13】

【Note 5-1】 If CLKC='Hi', this terminal outputs horizontal sync. signal in phase with VBS.
If CLKC='Lo', this terminal will be external horizontal sync. input terminal.

【Note 5-2】 If CLKC='Hi', this terminal outputs vertical sync. signal in phase with VBS.
If CLKC='Lo', this terminal will be external vertical sync. input terminal.

【Note 5-3】 PWM signal is used for the PWM dimmimg frequency and it is easy to get PWM signal dimming by combining both HSY and PWM signal. But please use this PWM signal just in case of inputting standard NTSC or PAL signal.

【Note 5-4】 This terminal is to switch display mode, and it is NTSC mode when NTP is 'High' and is PAL mode when NTP is 'Low'.

【Note 5-5】 When this terminal is 'High', it will be normal and when it is 'Low', it will display reversely on horizontal direction.

【Note 5-6】 When this terminal is 'High', it will be normal and when it is 'Low', it will display reversely on vertical direction.

【Note 5-7】 This terminal is to switch input for groups of R, G, B color video signals, and Input 1 (No. 13 to 15) is selected when VSW is 'High' and Input 2 (No. 17 to 19) is selected when VSW is 'Low'.

【Note 5-8】 This terminal is to switch sampling mode. It is the independent data-sampling timing at RGB dots when SAM is 'High' and it is the simultaneous data-sampling timing at RGB dots when SAM is 'Low'.

【Note 5-9】 This terminal is applicable to the DC bias voltage adjusting terminal of common electrode driving signal. If power supply voltage is typical, it is not necessary to re-adjust it, so use it in the open condition.
However, in the case that power supply voltage is changed, or power supply voltage is reduced, please adjust it externally to get the best contrast with a resistor you add to this terminal, or semifixed resistor, VCDC, in module. A recommended circuit is shown in Fig. 5.

【Note 5-10】 The sync. signal which will be input, is negative polarity, and is applicable to standard composite sync. signal, negative one, in the same pulse level.

【Note 5-11】 DC voltage supplied to this terminal, makes the brightness of screen adjustable, that is, the black level of video signal adjustable.
Although this is adjusted in the time of delivery to get the best display in the condition of open terminal, you will be able to re-adjust it externally with a resistor you add to this terminal, or a semifixed resistor, BRT, in module. A recommended circuit is shown in Fig. 5.

【Note 5-12】 CLKC='Hi' :CLK, HSY, VSY terminals are output mode.
CLKC='Lo' :CLK, HSY, VSY terminals are input mode.

【Note 5-13】 If CLKC='Hi', this terminal outputs the clock for source drivers.
If CLKC='Lo', this terminal will be external clock input terminal.

5-2) Functional maching and Input/Output mode

Table 3

	CLKC="Hi"		CLKC="Lo"	
Terminal	SAM="Hi"	SAM="Lo"	SAM="Hi"	SAM="Lo"
HSY	Output	Output	Input	Input
VSY	Output	Output	Input	Input
CLK	Output "Dot clock"	Output "Pixel clock"	Input "Dot clock"	Input "Pixel clock"

5-3)Backlight driving section

Table 4

terminals	No.	symbol	i/o	function	note
CN1	1	VL1	i	input terminal(hi voltage side)	【NOTE 5-14】
	2	NC	-	non connection	
	3	VL2	i	input terminal(low voltage side)	

【NOTE 5-14】low Voltage side of DC/AC inverter for backlight driving connects with Ground of inverter circuit.

(6) Absolute maximum ratings

Table 5

GND=0V、Top1= -30 ～ +85℃

Parameter		Symbol	MIN	MAX	Unit	Remarks
Positive power supply voltage		V_{SH}	-0.3	+9.0	V	
Negative power supply voltage		V_{SL}	-6.0	+0.3	V	
Analog input signals		Vi	—	2.0	Vp-p	【Note 6-1】
Digital input/output signals		VI	-0.3	+5.4	V	【Note 6-2】
DC bias voltage of common electrode driving signal		V_{CDC}	V_{SL}	V_{SH}	V	
Brightness adjusting terminal		V_{BRT}	0	+5.1	V	
Storage temperature		Tstg	-30	85	℃	【Note 6-3】
Operating temperature	surface of panel	Top1	-30	85	℃	【Note 6-3,4】
	environment	Top2	-30	60	℃	【 Ditto 】

【Note 6-1】 VBS, VR1, VG1, VB1, VR2, VG2, VB2 terminals(Video signal)

【Note 6-2】 NTP, HRV, VRV, SAM, VSW, HSY, VSY, CLKC, CLK terminals

【Note 6-3】 The temperature of all parts in module should not be exceeding this rating.

Maximum wet-bulb temperature should less than 58℃. No dew condensation.

【Note 6-4】 Operating temperature assure only driving.Contrast,response time,the other display quality is judgment at 25℃.

(7)Electrical characteristics

7-1) Recommended operating condition

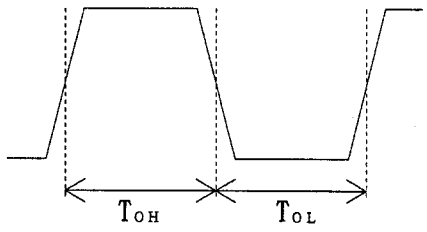
A) TFT-LCD panel driving section

Table 6 GND=0V、Topl= -30 ～ +85℃

Parameter			Symbol	MIN	TYP	MAX	Unit	Remarks
Positive power supply voltage			V_{SH}	+7.8	+8.0	+8.2	V	【Note 7-1】
Negative power supply voltage			V_{SL}	−5.2	−5.0	−4.8	V	
Analog input voltage	Amplitude		VBS	0.7	1.0	2.0	Vp-p	Input resister is over 10kΩ.
			Vi	-	0.7	-	Vp-p	【Note 7-2】
	DC component		Vi_{DC}	−1.0	0	+1.0	V	【Note 7-3】
Digital input voltage	High level		V_{IH}	+3.7	-	+5.1	V	Input resister is over 10kΩ.
	Low level		V_{IL}	0	-	+1.0	V	【Note 7-4】
	Histeresis		V_H	0.4	-	-	V	
Digital output voltage	High level		V_{OH}	+4.0	-	+5.5	V	Load resister is over 60kΩ.
	Low level		V_{OL}	0	-	+1.0	V	【Note 7-5】
Output clock	Duty cycle		Duty	45/55	50/50	55/45	−	CLKC="Hi"【Note 7-6】
	Drive capability		I_{OH}	-	-	0.25	mA	V_{OH}=2.6V 【Note 7-7】
			I_{OL}	-0.28	-	-	mA	V_{OL}=2.3V
Input horizontal sync. component	freq.	NTSC	$f_{H(N)}$	15.13	15.73	16.33	kHz	CLKC="Hi"
		PAL	$f_{H(P)}$	15.03	15.63	16.23	kHz	【Note 7-8】
	pulse width	NTSC	$\tau_{HI(N)}$	4.2	4.7	5.2	μs	for VBS terminal
		PAL	$\tau_{HI(P)}$	4.2	4.7	5.2	μs	
	rise time		τ_{rHI1}	-	-	0.5	μs	
	fall time		τ_{fHI1}	-	-	0.5	μs	
Input vertical sync. component	freq.	NTSC	$f_{V(N)}$	f_H/284	f_H/262	f_H/258	Hz	CLKC="Hi", H=1/f_H
		PAL	$f_{V(P)}$	f_H/344	f_H/312	f_H/304	Hz	【Note 7-9】
	pulse width	NTSC	$\tau_{VI(N)}$	-	3H	-	μs	for VBS terminal
		PAL	$\tau_{VI(P)}$	-	2.5H	-	μs	
	rise time		τ_{rVI1}	-	-	0.5	μs	
	fall time		τ_{fVI1}	-	-	0.5	μs	
Input clock	frequency		f_{CLI}	18.2	18.9	19.6	MHz	SAM="Hi" CLKC="Lo"
			f_{CLI}	6.0	6.8	7.6	MHz	SAM="Lo" 【Note 7-10】
	'Hi' width		τ_{WH}	20.0	-	-	ns	for CLK terminal
	'Lo' width		τ_{WL}	20.0	-	-	ns	
	rise time		τ_{rCLI}	-	-	5.0	ns	
	fall time		τ_{fCLI}	-	-	5.0	ns	
Input HSY (Horizontal sync.)	frequency		f_{HI}	f_{CLI}/1230	f_{CLI}/1200	f_{CLI}/1170	Hz	SAM="Hi" CLKC="Lo"
			f_{HI}	f_{CLI}/465	f_{CLI}/435	f_{CLI}/405	Hz	SAM="Lo" 【Note 7-11】
	pulse width		τ_{HI}	1.0	4.7	8.4	μs	for HSY terminal
	rise time		τ_{rHI1}	-	-	0.05	μs	
	fall time		τ_{fHI1}	-	-	0.05	μs	
Input VSY (Vertical sync.)	frequency		f_{VI}	50	f_{HI}/262	f_{HI}/258	Hz	【Note 7-12】 CLKC="Lo"
	pulse width		$\tau_{VI(P)}$	1H	3H	5H	μs	for VSY terminal
	rise time		τ_{rVI2}	-	-	0.5	μs	
	fall time		τ_{fVI2}	-	-	0.5	μs	
Data set up time			t_{SU1}	25	-	-	ns	【Note 7-13】 CLKC="Lo"
Data hold time			t_{HO1}	25	-	-	ns	
Data set up time			t_{SU2}	1.0	-	-	μs	【Note 7-14】
Data hold time			t_{HO2}	1.0	-	-	μs	

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
DC bias voltage for common electrode driving signal	V_{CDC}	+0.0	+2.0	+3.0	V	DC component【Note 7-15】
Terminal voltage applicable to brightness	V_{BRT}	+2.0	+2.3	+2.4	V	

【Note 7-1】 Power supply voltage should not be changed after adjusting V_{CDC}.
【Note 7-2】 VR1, VG1, VB1, VR2, VG2, VB2 terminals (Video signal)
【Note 7-3】 VBS, VR1, VG1, VB1, VR2, VG2, VB2 terminals
【Note 7-4】 HSY, VSY, NTP, VSW, HRV, VRV, SAM CLKC, CLK terminals
【Note 7-5】 HSY, VSY, CLK terminals (output mode)
【Note 7-6】 CLK terminals (output mode)
【Note 7-7】 Duty cycle is defined as follows.



Duty=T_{OL}/T_{OH}

【Note 7-8】 VBS (horizontal sync. component)
【Note 7-9】 VBS (vertical sync. component)
【Note 7-10】 CLK (input mode)
【Note 7-11】 HSY (input mode)
【Note 7-12】 VSY (input mode)
【Note 7-13】 In case of CLKC='Lo', it shows the phase difference from HSY to CLK. In that case, HSY will be taken at the rise timing of CLK.
【Note 7-14】 In case of CLKC='Lo', it shows the phase difference from VSY to HSY. In that case, VSY will be taken at the rise timing of HSY.
【Note 7-15】 Adjusting the optimal voltage on every module at the typical value of power supply voltage to get the maximum value of contrast. However, in the case that the power supply voltage is changed, for example, the level of power supply voltage is reduced, please adjust it externally to get the best contrast with a resistor you add to this terminal, or semifixed resistor, VCDC, in module. A recommended circuit is shown in Fig. 5.

B)Backlight driving section

Table 7

Parameter	symbol	MIN	TYP	MAX	Unit	Remarks
lamp Voltage	VL_7	540	610	680	Vrms	I_L=6.0mArms
lamp current	I_L	5.5	6.0	6.5	mArms	normal operation
lamp frequency	f_L	30	-	60	KHz	
Kick-off voltage	V_S	-	-	1650	Vrms	Ta=+25℃
		-	-	1700	Vrms	Ta=-30℃

7-2) Power consumption

Table 8

Top1= -30 ～ +85℃

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
Positive supply current	I_{SH}	V_{SH}=+8.0V	−	140	170	mA	
Negative supply current	I_{SL}	V_{SL}=−5.0V	−	55	70	mA	
Total	W_S		−	1.4	1.7	W	【Note 7-14】
lamp power consumption	W_L	normal driving		4.0	−	W	【Note 7-15】

【Note 7-14】excluding backlight section

【Note 7-15】reference data by calculation(I_LxV_Lx1:number of lump)

7-3) Circuit diagram

The circuit block diagram of TFT-LCD module is shown in Fig. 4.

BRT, V_{CDC}, external adjusting recommended circuit is shown in Fig. 5.

Caution: Turn on or off the power supply (V_{SH} and V_{SL}) at the same time.
Be careful to supply all power voltage before inputting signals.

7-4) Input/output signal waveforms.

They are shown in Fig. 6.

Caution: For the VBS signal, input standard composite video (or sync.) signal applicable to the operating mode which have NTSC(M) or PAL(B･G) and is selected by the NTP signal.
A long time input of non-standard sync. signal may cause flicker or degradation of display quality.

7-5) Dimming backlight by PWM timing chart

In case of using PWM mode,please refer the timing chart shown in Fig. 7.

7-6) Input/Output signal timing chart

It is shown in fig. 6

Table 9 (CLKC="Hi"、NTSC:f_H=15.7kHz、f_V=60Hz／PAL:f_H=15.6kHz、f_V=50Hz)

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Horizontal sync. output pulse [HSY]	pulse width	τ_{HS2}	3.2	3.9	4.6	μs	f=f_H 【Note 7-20】
	phase difference	τpd	0.6	1.1	1.6	μs	【Note 7-21】
	rise time	τ_{rHO}	−	−	0.5	μs	C_L=10pF
	fall time	τ_{fHO}	−	−	0.5	μs	
Vertical sync. output pulse [VSY]	pulse width	τvs	−	4H	−	μs	1H=1/f_H
	phase difference	τ_{VHO}	−	11.0	28.0	μs	【Note 7-22】
	rise time	τ_{rVO}	−	−	2.0	μs	C_L=10pF
	fall time	τ_{fVO}	−	−	2.0	μs	
Vertical phase difference	odd field	τ_{PV1}	−	1H	−	μs	1H=1/f_H
	even field	τ_{PV2}	−	0.5H	−	μs	【Note 7-23】
Clock output frequency [CLK]	NTSC MODE	f_{CLO}	−	$fH\times\frac{1201}{2}$	−	MHz	SAMC="Hi"
	PAL MODE	f_{CLO}	−	$fH\times\frac{1209}{2}$	−	MHz	【Note 7-24】
	NTSC MODE	f_{CLO}	−	$fH\times\frac{1201}{6}$	−	MHz	SAMC="Lo"
	PAL MODE	f_{CLO}	−	$fH\times\frac{1209}{6}$	−	MHz	【Note 7-25】

(Supply voltage condition:V_{SH}=+8.0V, V_{SL}=-5.0V)

【Note 7-20】 Adjusted by variable resister (H-POS) in a module.

【Note 7-21】 Variable by variable resister (H-POS) in a module.

adjustment : τpd = 1.1 ± 0.5 μs

【Note 7-22】 Synchronized with HSY, based on falling timing of HSY.

【Note 7-23】 VSY signal delays.

【Note 7-24】 independent sampling mode

【Note 7-25】 simultaneous sampling mode

7-7) Display time range

① NTSC(M) mode (NTP='Hi', CLKC='Hi')

Displaying the following range within video signals.

(a) Horizontally : 12.2 ~ 63 μs from the falling edge of HSY. (SAM='Hi')

: 12.3 ~ 62.9 μs from the falling edge of HSY. (SAM='Lo')

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

② PAL(B·G) mode (NTP='Lo', CLKC='Hi')

Displaying the following range within video signals.

(a) Horizontally : 13.0 ~ 63.8 μs from the falling edge of HSY. (SAM='Hi')

: 13.1 ~ 63.7 μs from the falling edge of HSY. (SAM='Lo')

(b) Vertically : 26 ~ 298 H from the falling edge of VSY.

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.

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

Displaying the following range within video signals.

(a) Horizontally : 205 ~ 1164 clk from the falling edge of HSY. (SAM='Hi')

: 84 ~ 403 clk from the falling edge of HSY. (SAM='Lo')

(clk means input external clock.)

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

(8)Optical characteristics

Table 10 Ta=25℃

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angel range		$\Delta\theta 11$	CR≧5	60	65	-	°(degree)	
		$\Delta\theta 12$		35	40	-	°(degree)	
		$\Delta\theta 2$		60	65	-	°(degree)	【Note 8-1,2】
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	+25℃	Y_{25}	I_L=6.0mArms	240	320	-	cd/m²	【Note 8- 5】
	-10℃	Y_{-10}	I_L=9.0mArms	50	70	-	%	【Note 8- 8】
White chromaticity		x	I_L=6.0mArms	0.263	0.313	0.363		【Note 8- 5】
		y	I_L=6.0mArms	0.279	0.329	0.379		【Note 8- 5】
lamp life time	+25℃	-	continuation	10,000	-	-	hour	【Note 8- 6】
	-30℃	-	intermission	2,000	-	-	time	【Note 8- 7】

DC/AC inverter for external connection shown in following.

Harison Co.: HIU-288

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

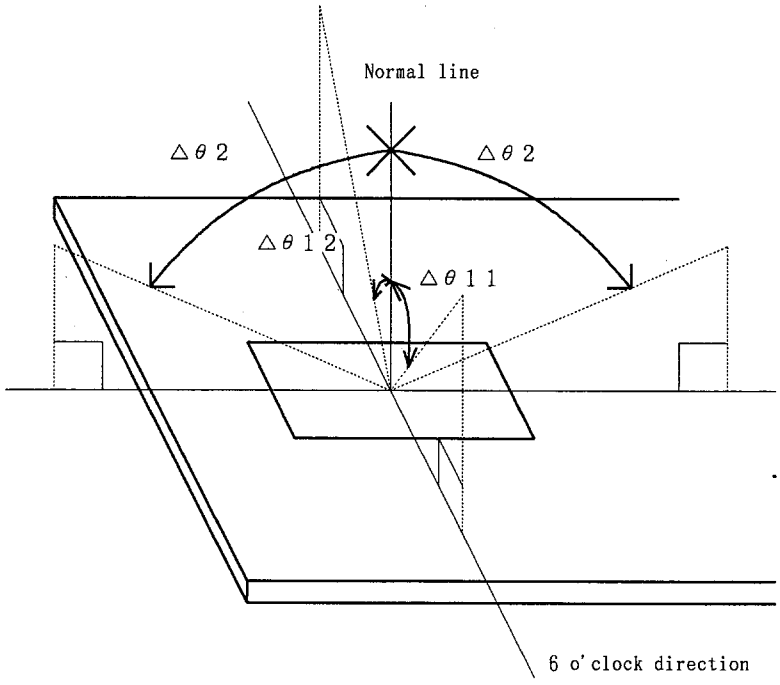


Fig.(i) Definition of viewing angle

【Note 8-2】 Applied voltage condition:

i) V_{CDC} is adjusted so as to attain maximum contrast ratio.

ii) Brightness adjusting voltage (BRT) is open.

iii) 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" from "white", and "white" from "black".

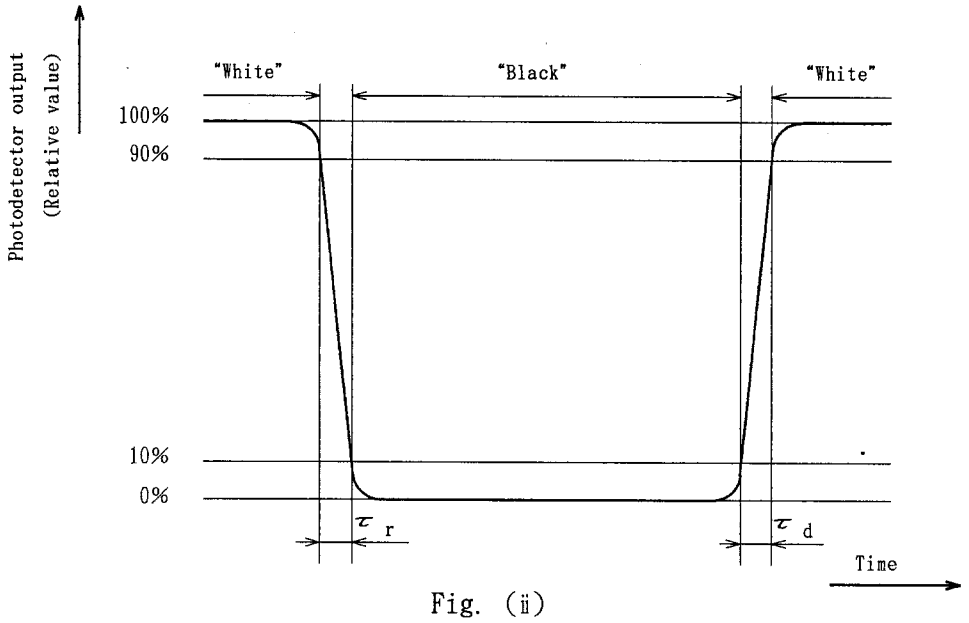


Fig. (ii)

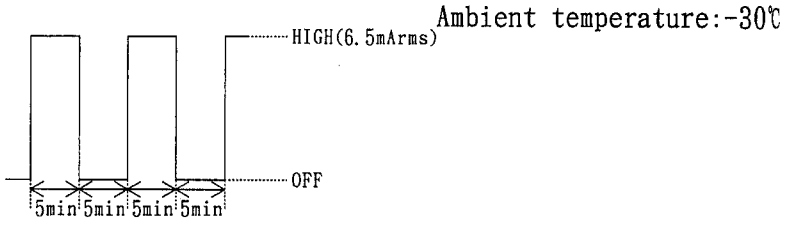
【Note 8-5】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter BM-7. (After 30 minutes operation)
DC/AC inverter driving frequency: 49kHz

【Note 8-6】 Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of lamp current IL=5.5~6.5mArms and PWM dimming 100%~5%. (Ta=25℃)

①Brightness becomes 50% of the original value.

②Kick off voltage at Ta=-30℃ exceeds maximum value, 1700Vrms.

【Note 8-7】The intermittent cycles is defined as a time when brightness becomes 50% of the original value under the condition of following cycle.



【Note 8-8】Ambient temperature -10℃. Measured luminance on the panel after 2minutes operation. (luminance Y_{25} at "Ta=25℃, I_L=6.0mArms 30minutes operation after" =100%)

(9)Mechanical characteristics

9-1) External appearance

Extreme defects should not exist. (See Fig. 3)

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, adding pressure on the active area, it is possible to occur the functional damage.

9-3) Input/output connector performance

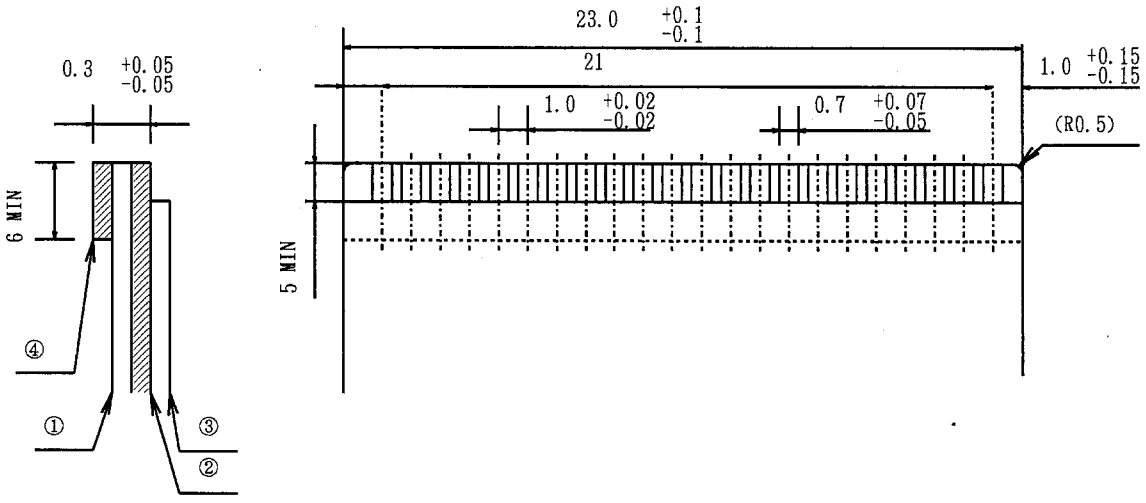
A)Input/output connectors for the operation of LCD module (FPC connector 22 pin)

i)Applicable FPC Shown in Fig.(ⅲ).

ii)Terminal holding force : More than 0.9N/pin

(Each terminal is pulled out at a rate of 25 ±3mm/min.)

iii)Insertion/pulling :contact resistance is not twice larger than the initial durability value even after applicable FPC is inserted and pulled out 20 times



No.	N a m e	Materials
①	Base material	Polyimide or equivalent material(25μm thick)
②	Copper foil	Copper foil(35μm thick) Solder plated in 2 to 12μm
③	Cover lay	Polyimide or equivalent material
④	Reinforcing plate	Polyester polyimide or equivalent material(188μm thick)

Fig. (ⅲ) FPC applied to input/output connector (1.0mm pitch)

B)I/O connector of backlight driving circuit

Symbol	Used Connector	Corresponding connector	Manufacturer
CN1	BHR-02(8.0)VS-1N	SM02(8.0)B-BHS-TB(wire to board)	JST
		SM02(8.0)B-BHS-1N(wire to board)	JST
		BHMR-03V(wire to wire)	JST

(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 M2.6 tapping screw (fastening torque is 0.3 through 0.5N·m) is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.

To pusing module, (ex. touching switch etc.)causes disordered images. 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-ⅰ).)

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

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

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

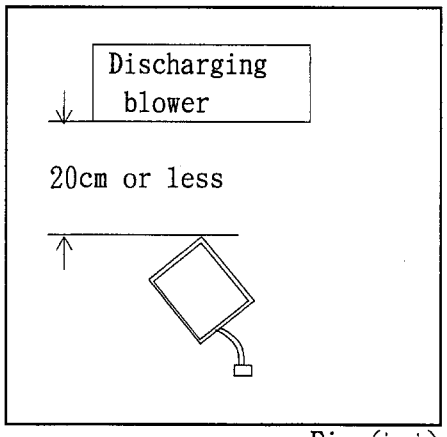


Fig. (ⅳ-ⅰ)

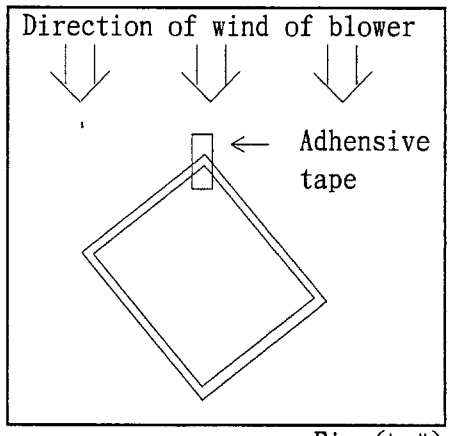


Fig. (ⅳ-ⅱ)

Fig. (ⅳ)

e) Method of removing dust from polarizer

- Blow off dust with N_2 blower for which static electricity preventive measure has been taken. Ionized air gun (Hugle Electronics Co.) is recommended.
- Since polarizer is vulnerable, wiping should be avoided. But when the panel has stain or grease, we recommend to use adhesive tape to remove them softly from the panel.

③ When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirts, wipe the part, breathing on it.

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

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

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

11-3) Precautions in adjusting module

Variable resistor on the rear face of the module have been adjusted 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

① The LCD module shall be protected against water salt-water by the waterproof cover.

② 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; LCD Module 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 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. 8.

12-2) Carton storage condition

① Number of layers of cartons in pile : 10 layers max.

② Environmental condition :

•Temperature	0 ℃ to 40 ℃
•Humidity	60 %RH 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 2 years
•Opening of package	To prevent TFT-LCD module from being damaged by static electricity, adjust the room humidity to 50 %RH or higher and provide an appropriate measure for electrostatic earthing before opening the package.

(13) Reliability test items

Reliability test items for the TFT-LCD module are shown in Table 11.

(14) Others

14-1) Indication of lot number

Attached location of label : See Fig. 3.

Indicated contents of the label

LQ×××××××××× ○○○○○○○○○

Model number　　Lot number

1 place : Produced year (ex. 1998 ⇨ 8)

2 place : Produced month (1, 2, 3, ……, 9, X, Y, Z)

3~8 place : Serial number (000001～)

9 place : Revisional sign (A, B, C, ……)

Reliability test Items for TFT-LCD Module

Table 11

No	Test items	Test conditions
1	High temperature storage test	Tp=+85℃ 240h
2	Low temperature storage test	Tp=−30℃ 240h
3	High temperature and high humidity operating test	Tp=+60℃・90~95%RH 240h
4	High temperature operating test	Tp=+85℃ 240h
5	Low temperature operating test	Tp=−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 : 33.3Hz~400Hz Acceleration : 28.4m/s² Frequency : 15min 2 hours for each direction of X, Z 【Note 13-1】 4 hours for direction of Y (8 hours in total) (JIS D1601)
9	Heat shock test	−30℃～+85℃／200cycles (0.5h) (0.5h)

【Note】 Tp=Panel temperature

【Evaluation Result Criteria】

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

【Note 13-1】 Direction of X, Y, Z is defined as follows.

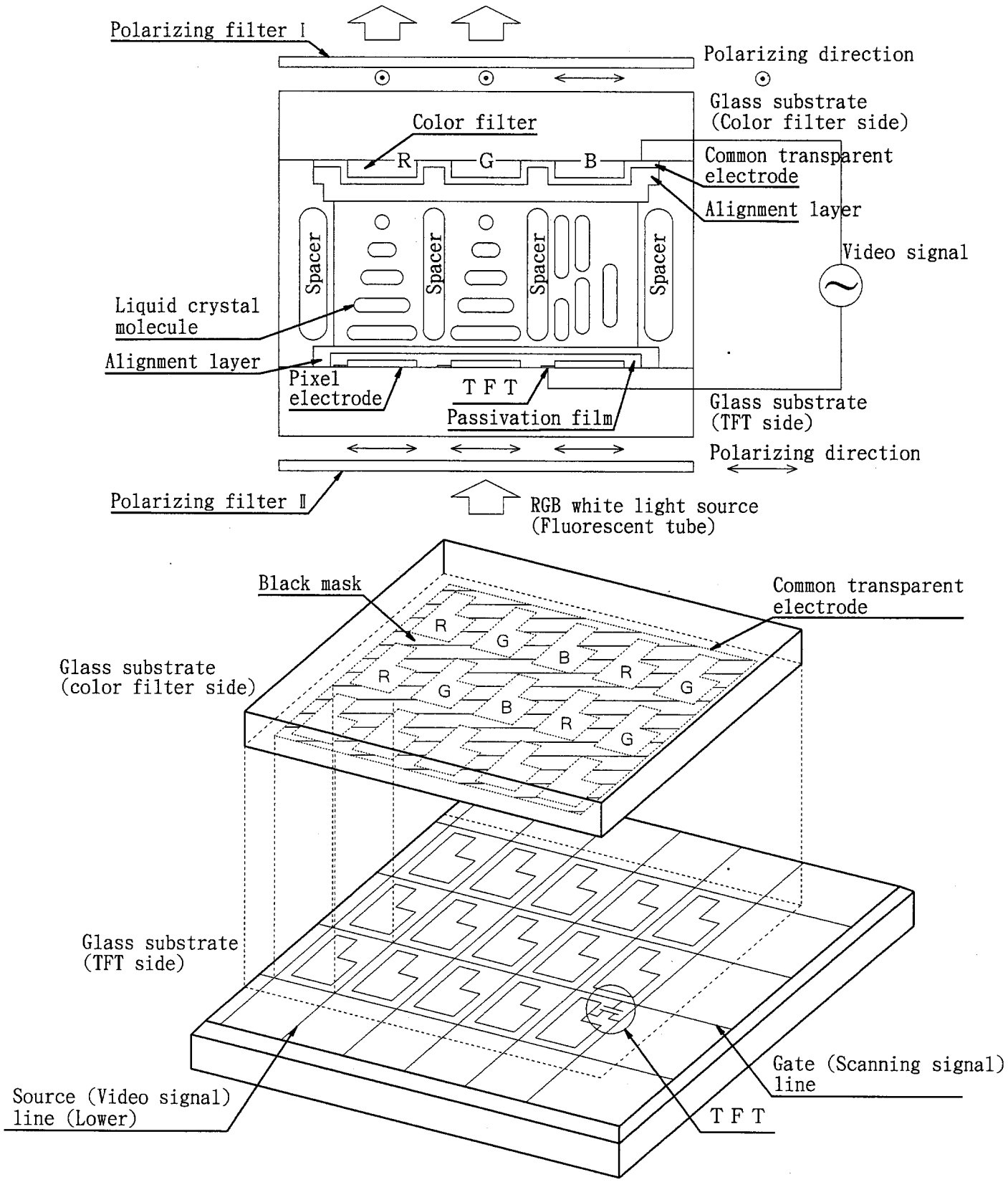


Fig 1. Illustration of TFT-LCD panel

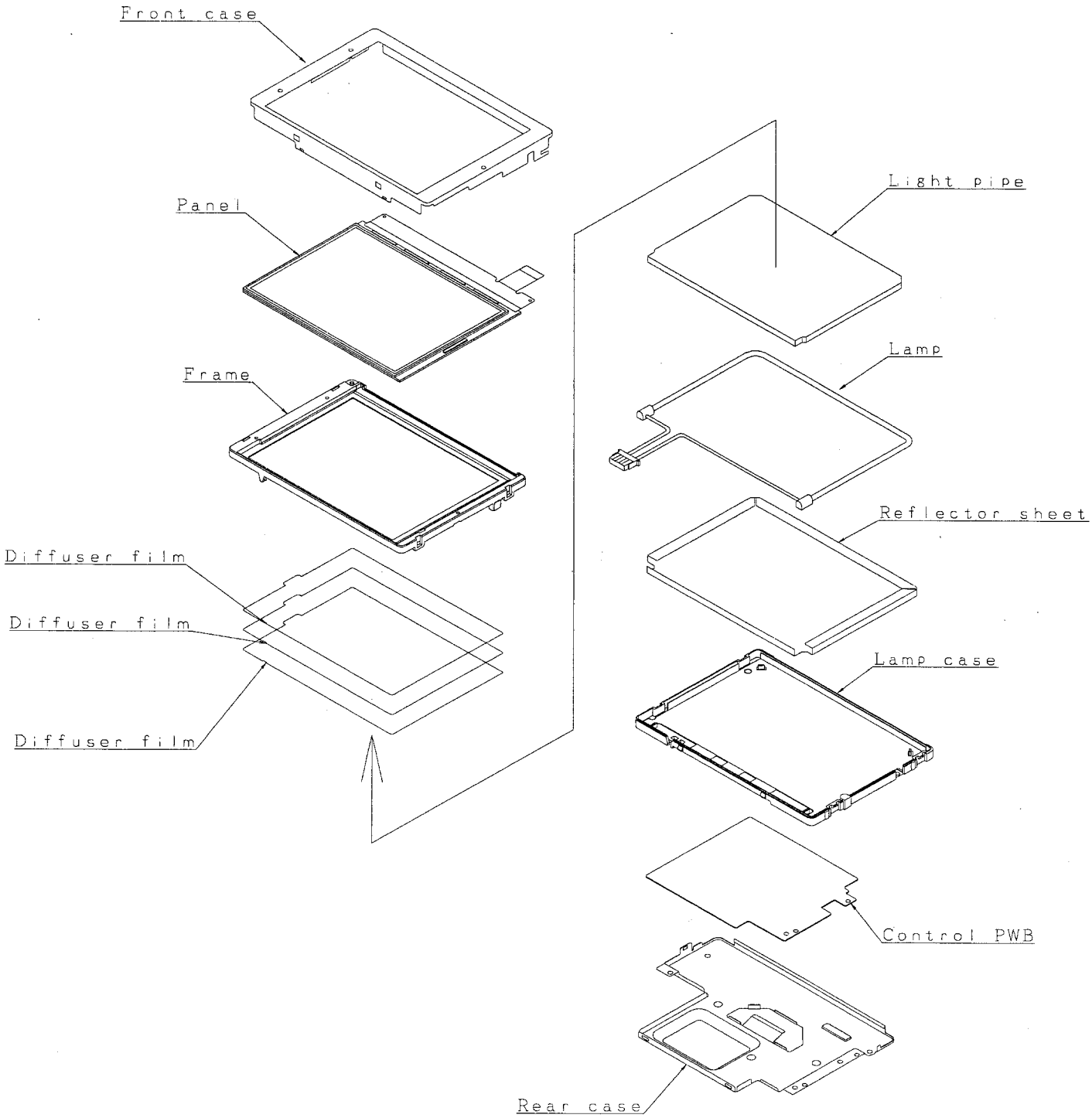


Fig. 2. Construction of TFT-LCD module

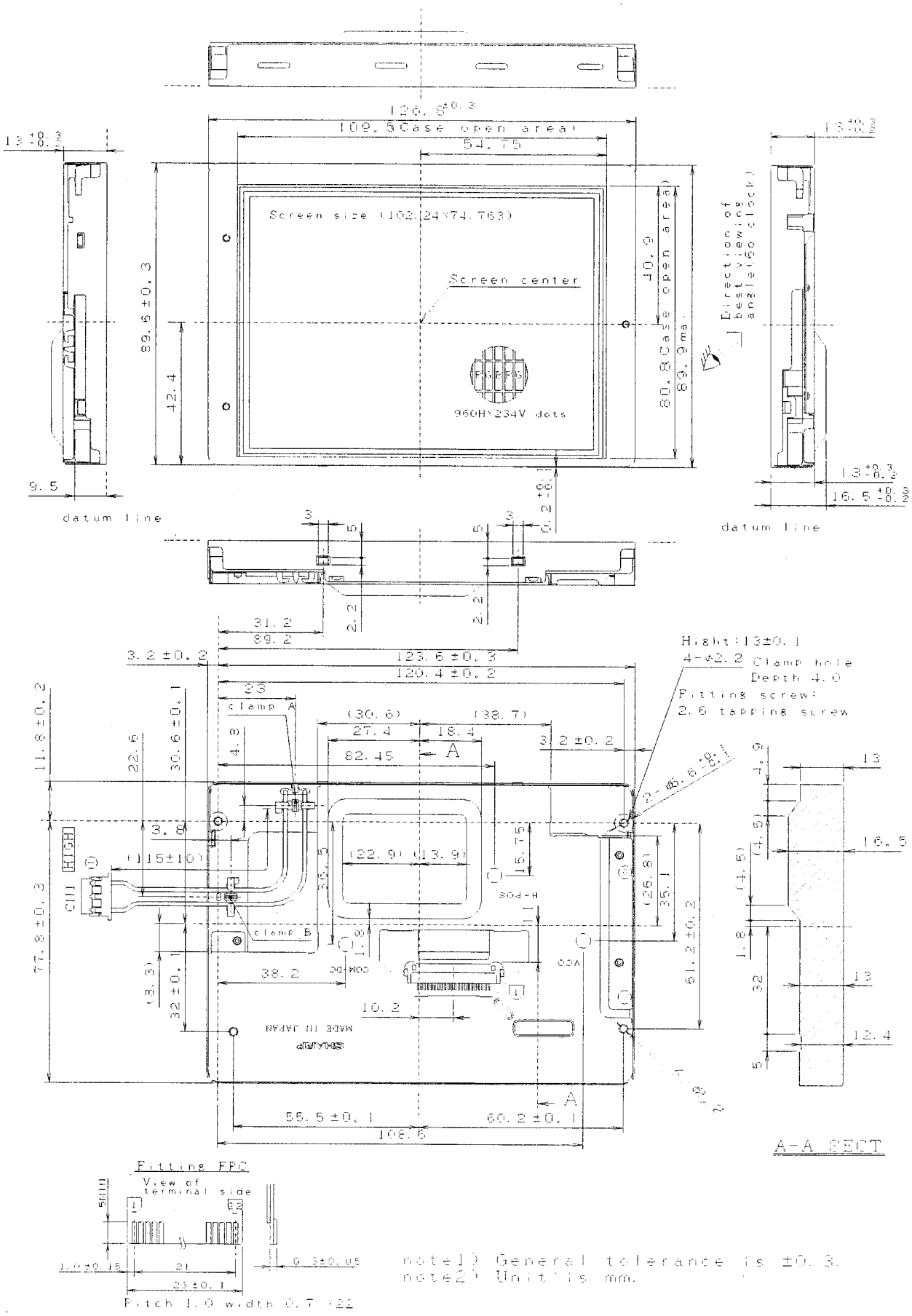


Fig. 3. Outline dimensions of TFT-LCD module

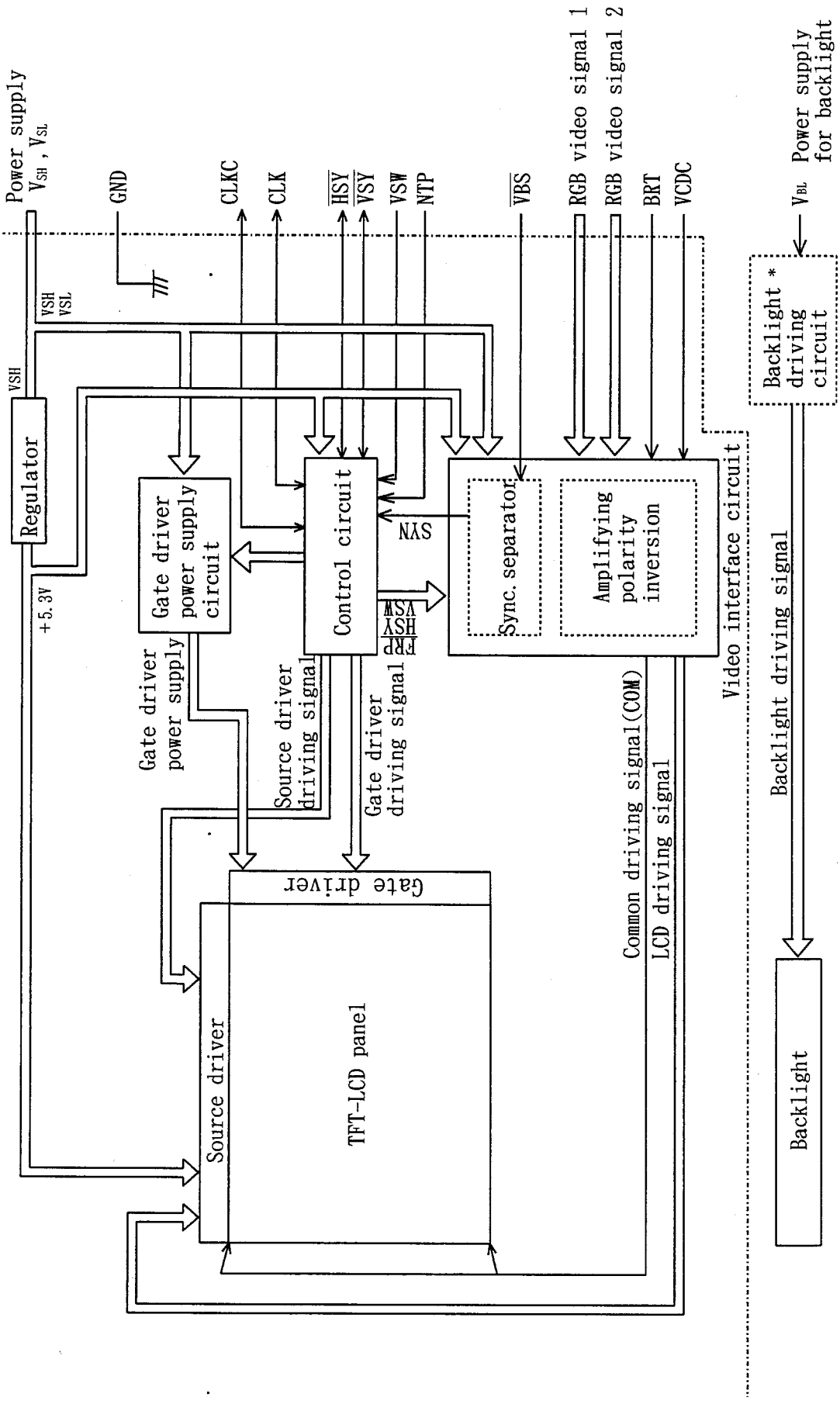
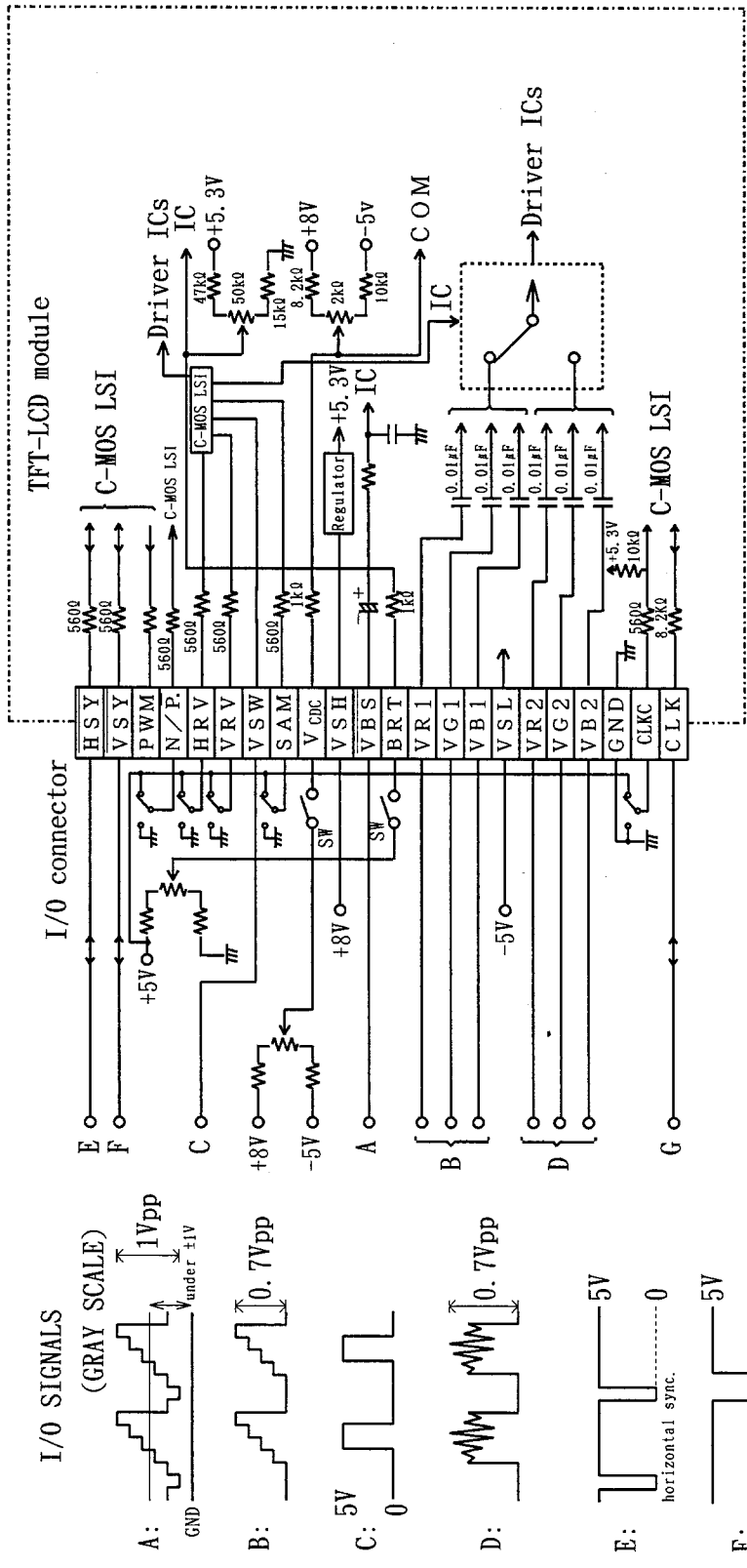
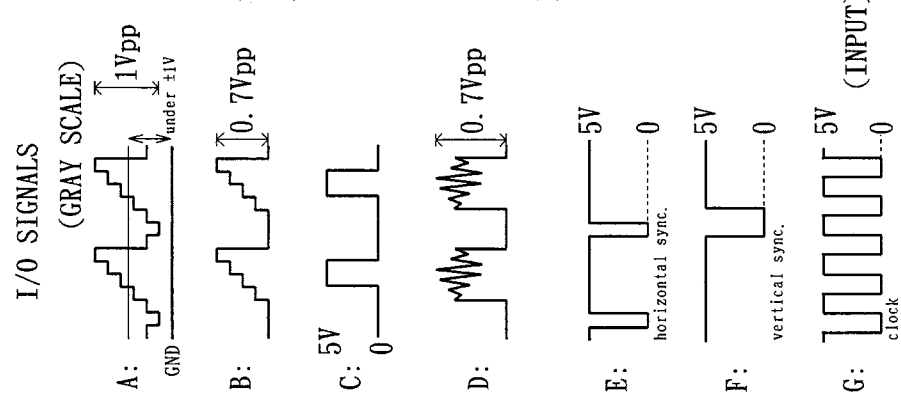


Fig. 4. Circuit block diagram of TFT-LCD module





(Note)
input impedance of A, B, D: >10kΩ
input impedance of C: >50kΩ

Fig. 5 Recommended circuit to be referred

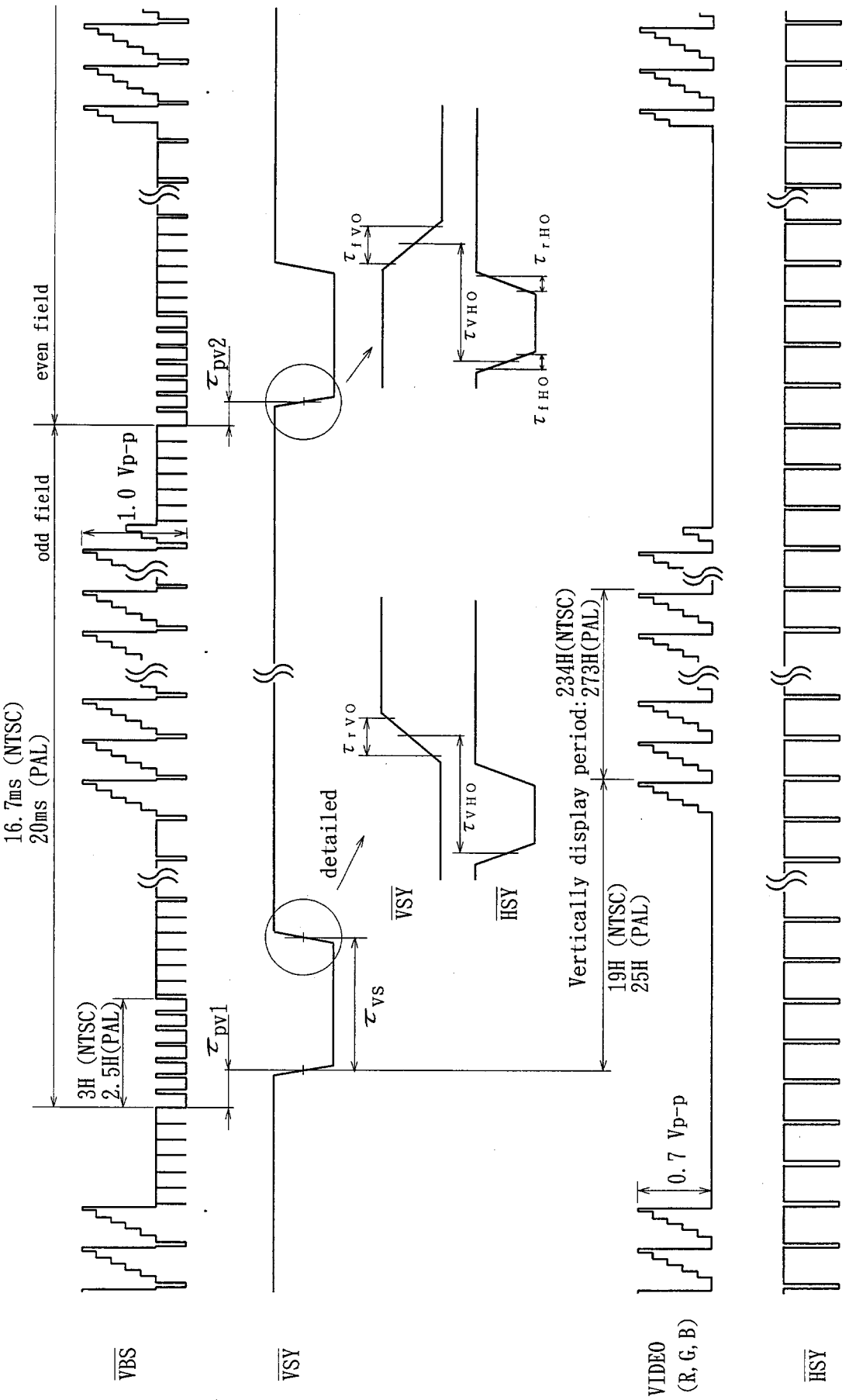


Fig. 6-A Input/Output signal waveforms(CLKC='Hi')

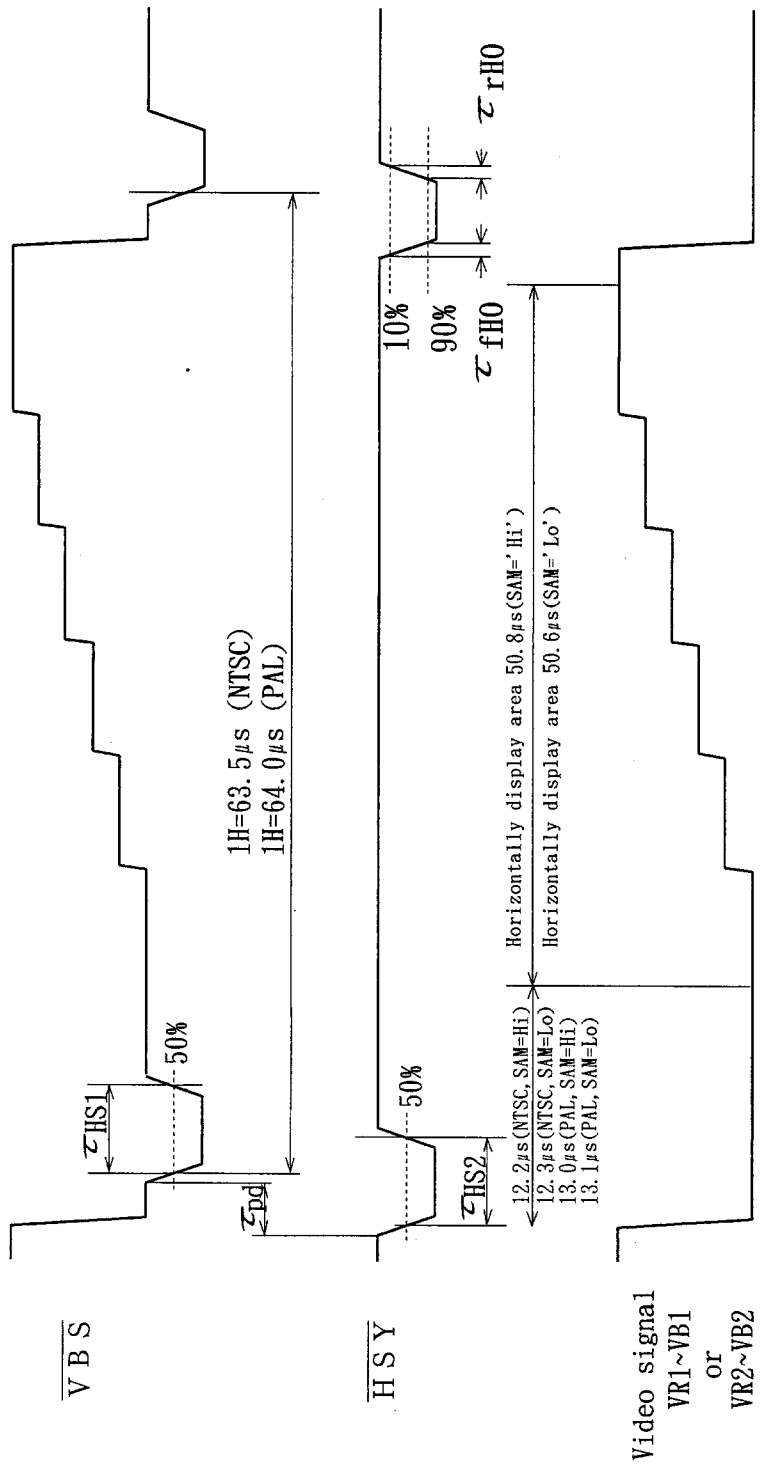


Fig.6-B Input/Output signal waveforms (CLKC='Hi')

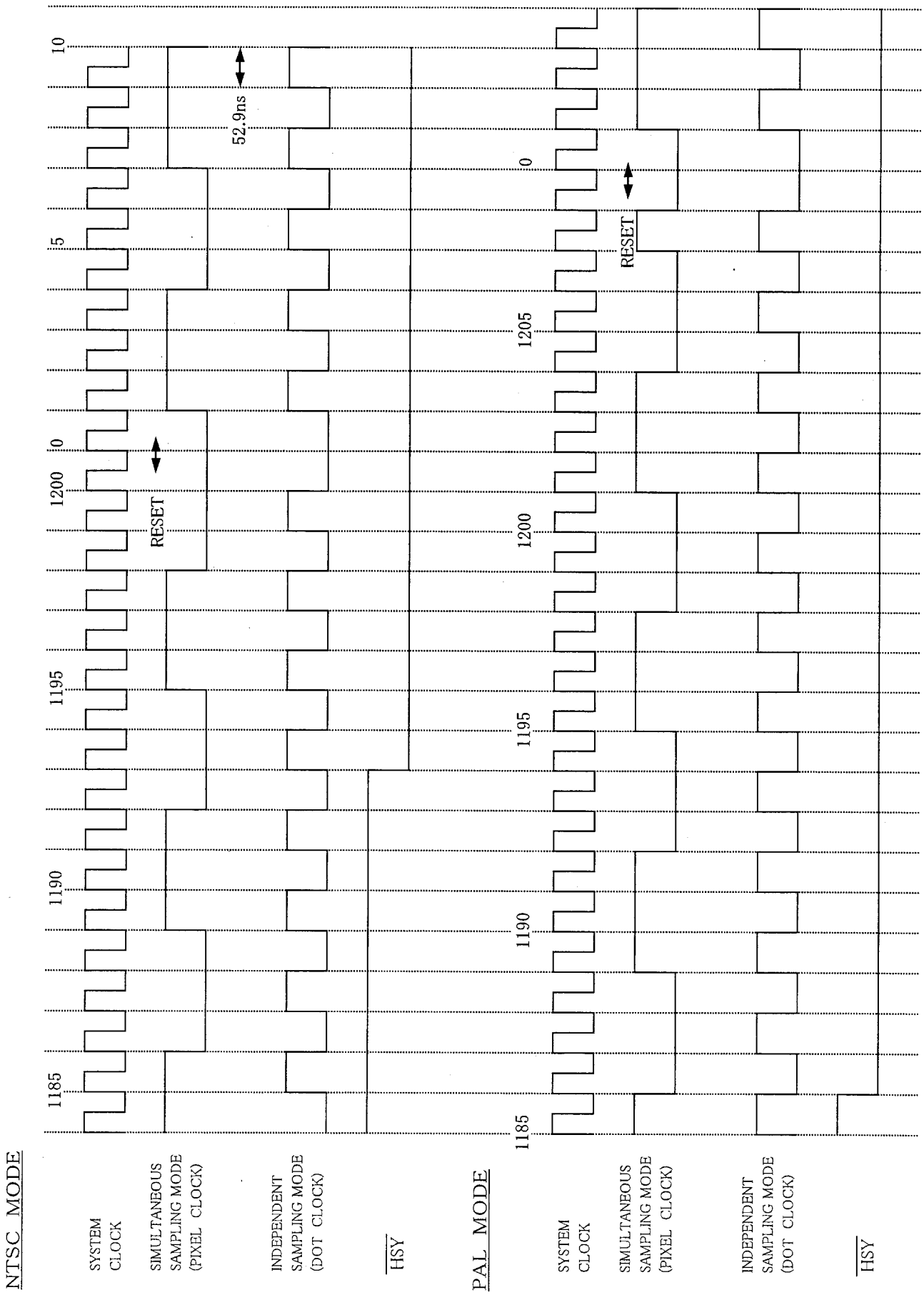


Fig.6-C. Input/Output signal waveforms (CLKC="Hi")

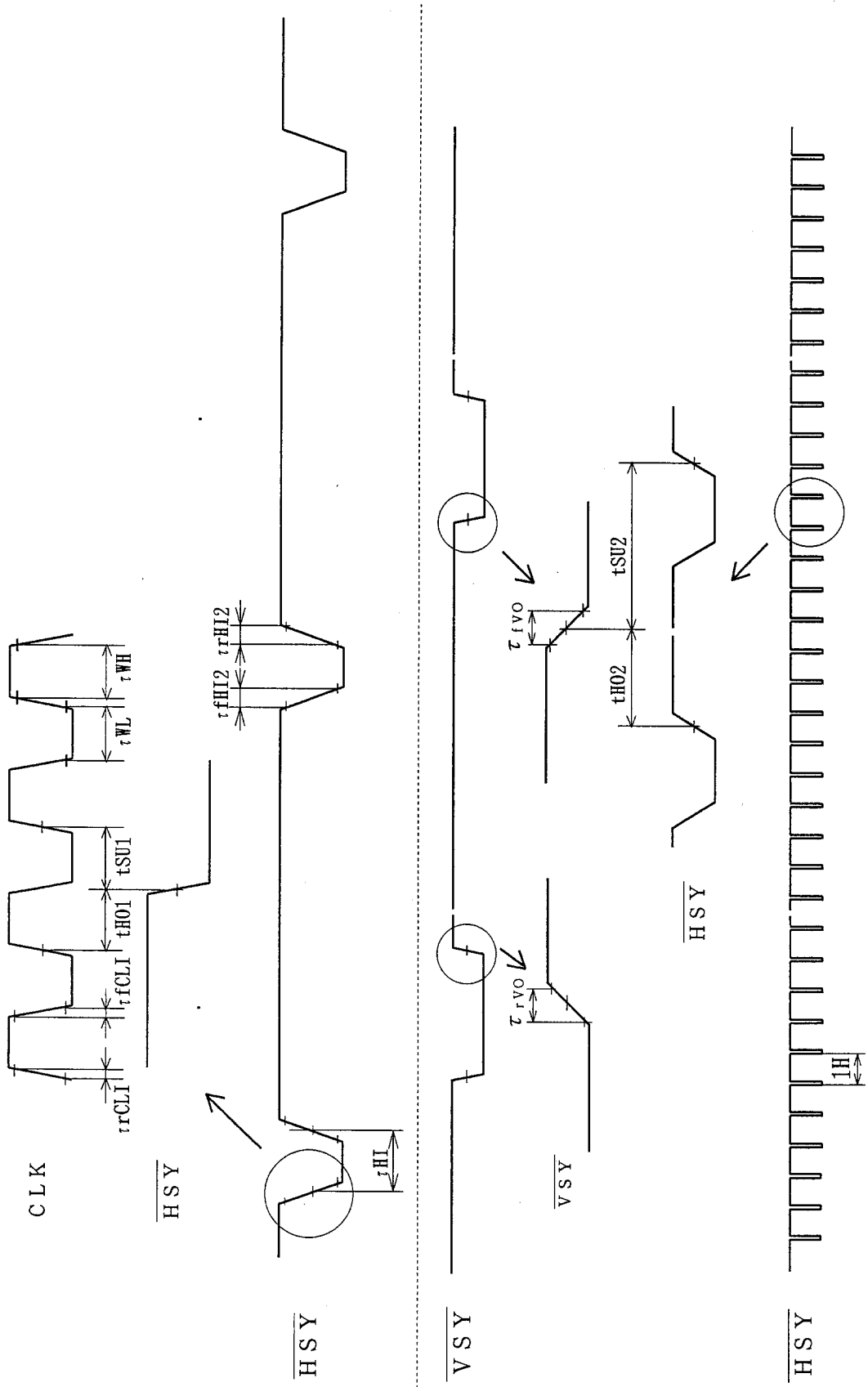


Fig. 6-D Input/Output signal waveforms(external clock mode NTP='Hi', CLKC='Lo')

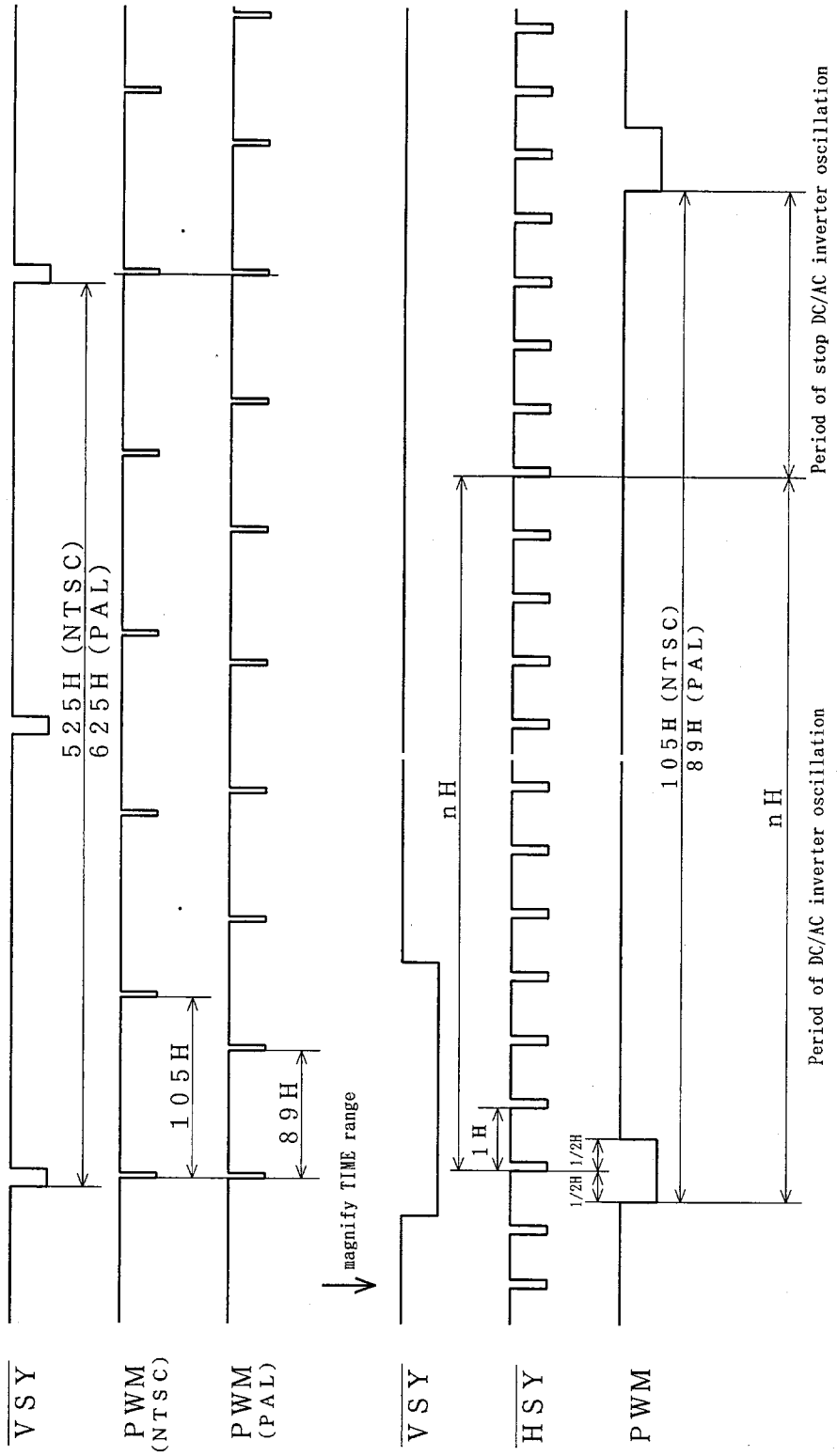


Fig. 7 PWM signal waveform for dimming backlight

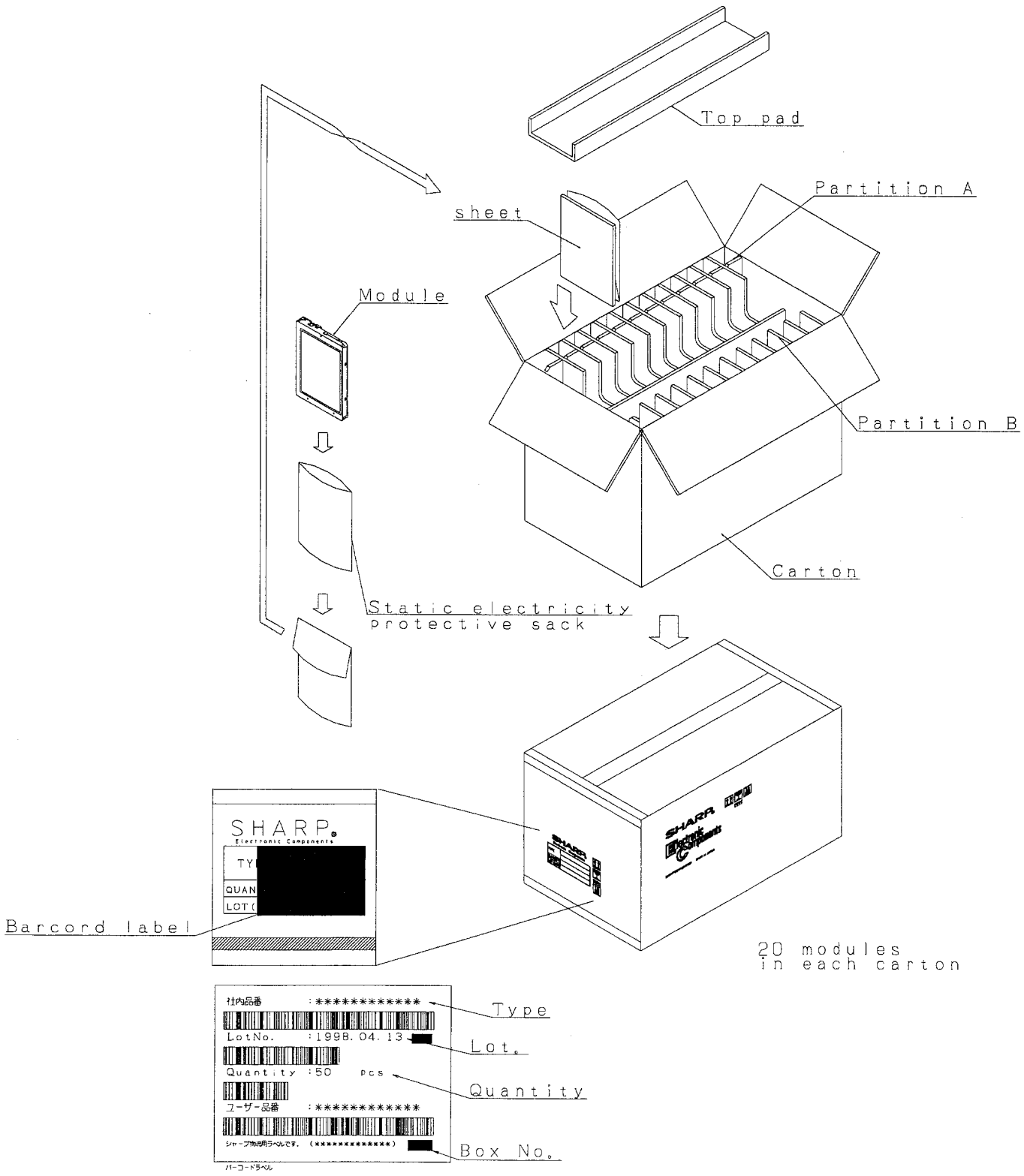
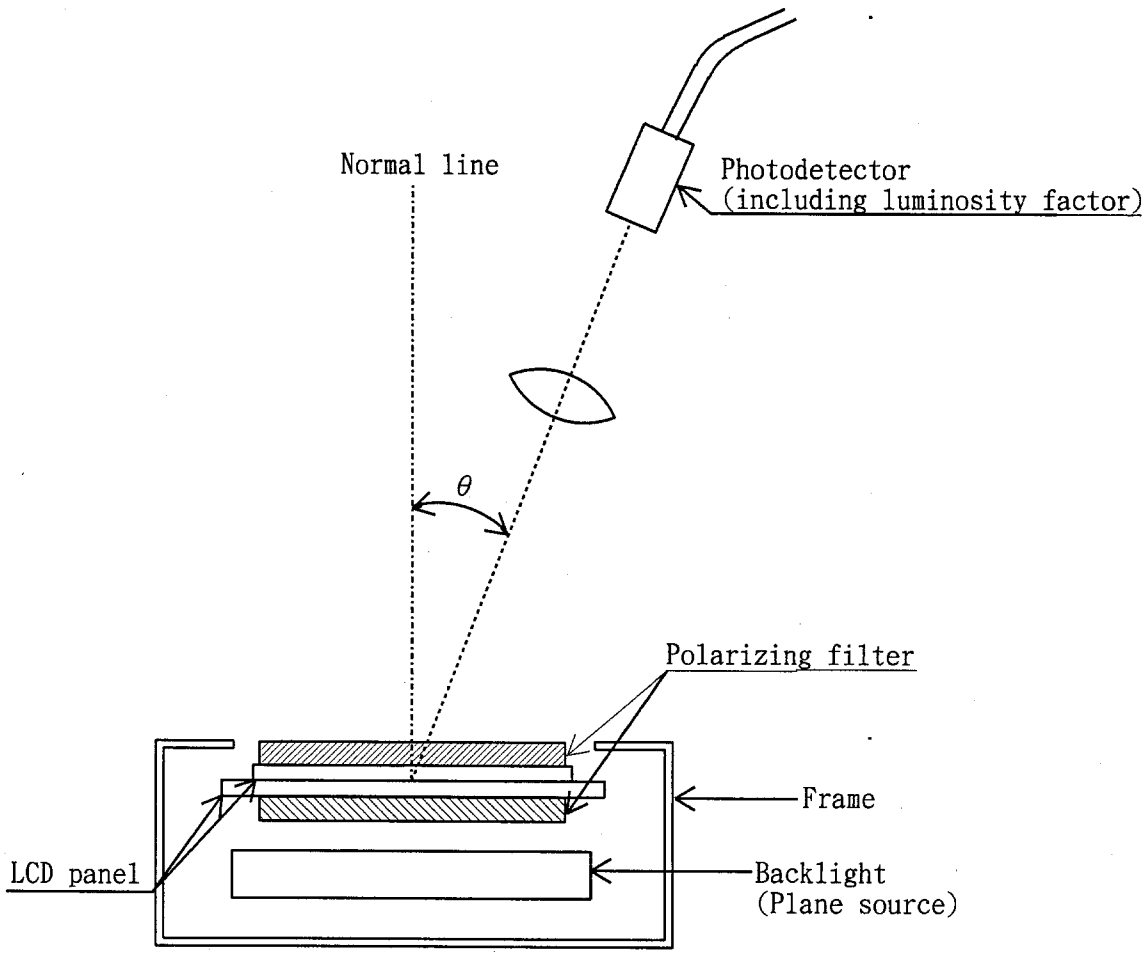


Fig. 8. Packing form



Brightness : Less than 5000cd/m^2

Wave length: To be cut less than 400nm

Fig. 9. Optical characteristics

(Appendix-1) Adjusting method of optimum common electrode DC bias voltage

To obtain optimum DC bias voltage of common electrode driving signal(V_{CDC}), 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 gain optimum common electrode DC bias voltage, there is the following method which use photo-electric device.

《Measurement of flicker》

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

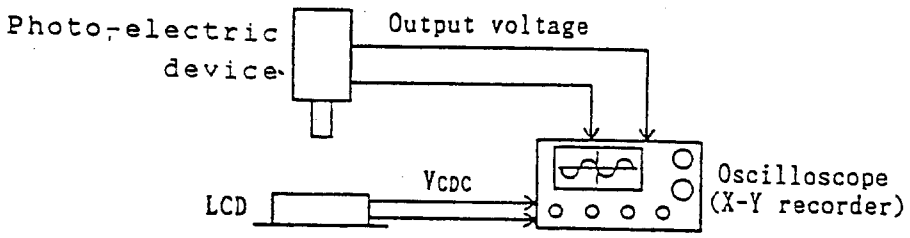


Fig.A Measurement system

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 NTSC:60Hz(30Hz) PAL:50Hz(25Hz) flicker by changing DC bias voltage slowly. (Fig,B)

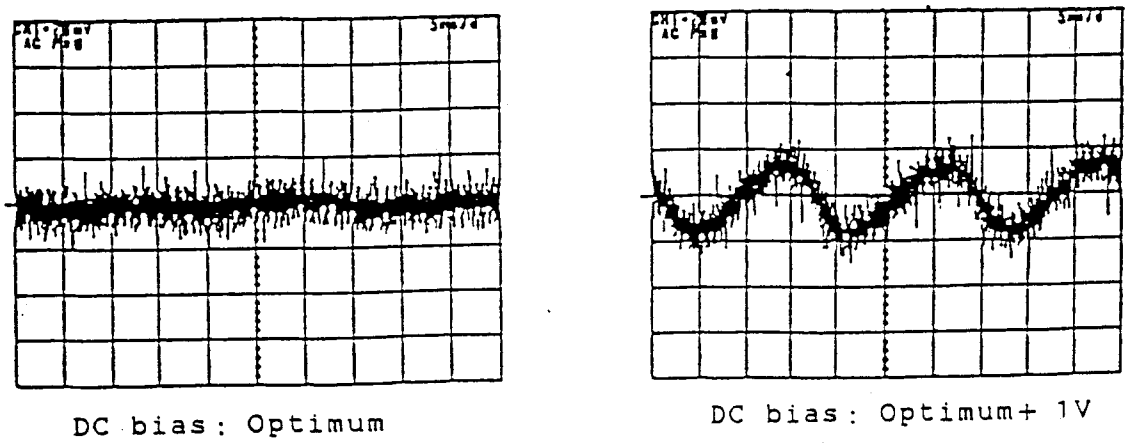
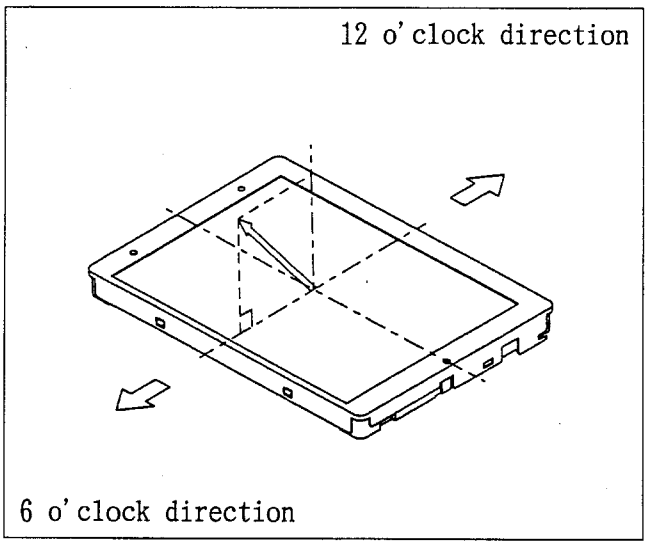


Fig.B Waveforms of flicker

(Appendix-2) Electrical display rotating function

This module LQxxxxxxxxx has a following optical characteristics.

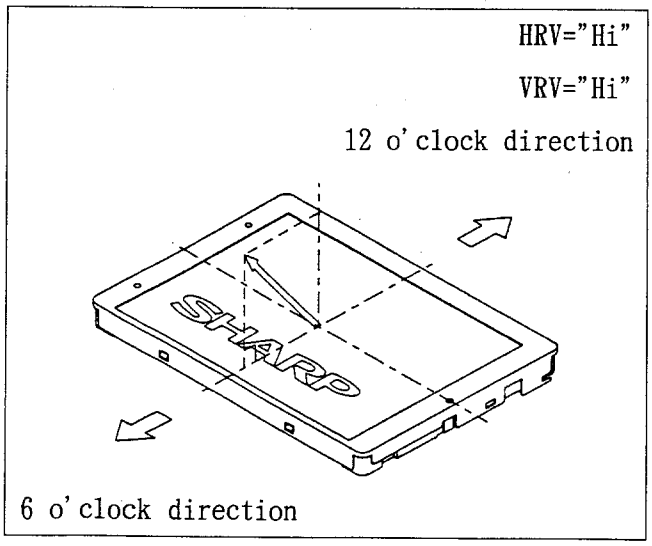
And the optimum viewing angle is 6 o'clock direction.



Direction of arrow : optimum viewing angle

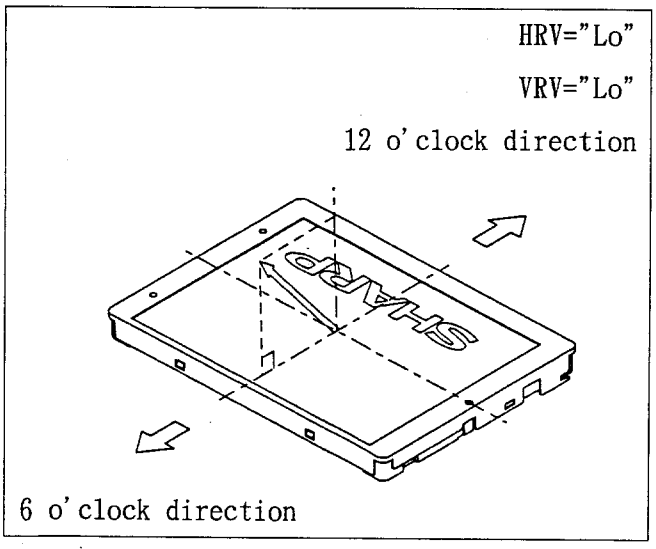
Fig. C. 6 o'clock viewing angle panel

Basically this TFT-LCD module LQxxxxxxxxx has the 6 o'clock viewing angle panel as above. However, it is also possible to use as 12 o'clock viewing angle type by using "Electrical display rotating function" as follows; (in this case, it is necessary to rotate the module 180° mechanically.)



Direction of arrow : optimum viewing angle

Fig. D. 6 o'clock direction type



Direction of arrow : optimum viewing angle

Fig. E. 12 o'clock direction type

TO: Bosch	SHARP	No.
		FILE No. LDI-05NE2
		ISSUE June.16.2000
		PAGE 5 Pages
	TFT LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION INCOMING INSPECTION STANDARDS	APPLICABLE DIVISION TFT DIVISION 1 TFT LCD GROUP

Incoming Inspection Standards For TFT-LCD
Model No.

LQ050A5AG03

☐ CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED
BY K. Hoshi

K.Hoshi
General Manager
Product Quality Assurance Dept.
TFT Division 1
TFT Liquid Crystal Display Group
SHARP CORPORATION

SHARP

INCOMING INSPECTION STANDARDS FOR TFT-LCD MODULES

1. Scope

These incoming inspection standards shall apply to TFT-LCD modules (hereinafter called "MODULE") supplied by Sharp Corporation (hereinafter called the "Seller") to Bosch (hereinafter called the "Buyer").

2. Incoming inspection

*The Buyer shall have the right to conduct at its own cost and expense, an incoming inspection of the MODULE's at the destination specified in the relevant bills of lading in accordance with the MODULE's specifications separately agreed upon and the inspection standard set forth in this Article.

*The Buyer shall notify the Seller writing of a result of such inspection judgement (acceptance or rejection) in accordance with the said inspection standard within 40 days after the date of the bills of lading.

*Should the Buyer fail to so notify the seller within the said 40 days period, the Buyer's right to reject the MODULE's shall then lapse,and the said MODULE's shall be deemed to have been accepted by the Buyer.

3. Method of incoming inspection

Unless otherwise agreed in writing, the method of incoming inspection shall be in accordance with a sampling inspection based on ISO 2859-1.

4. Classification of defects

Defects are classified as major defect and a minor defect according to the degree of defect defined herein.

a) Major defect
A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose.

b) Minor defect
A minor defect either is a defect that is not likely to reduce materially the usability of the product for its intended purpose, or is a departure from an established having little bearing on the effective use or operation of the product.

*Specific criteria of judgement on major and/or minor defects or otherwise shall be in accordance with the attached "Classification of Defect."

5. Acceptable quality level ("AQL")

The AQL for major and minor defects shall be respectively set forth below.

a) Major defects : AQL : 0.4
b) Minor defects : AQL : 1.0 Based on overall evaluation

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6. Method of sampling inspection

a) Lot size : Quantity per shipment lot per model
b) Sampling type : Normal inspection, Single sampling
c) Inspection level : II
d) Sampling table : Table in ISO 2859-1
e) Inspection conditions : The inspection conditions shall be as in the LCD specifications. The environmental conditions and the visual inspection shall be as follows :

(i) The environmental conditions
Room temperature : 20 - 25 °C
Humidity : 65 ± 5% RH
(ii) The external visual inspection : The inspection shall be conducted by using a single 20W fluorescent lamp for illumination and the distance between the MODULE and the eyes of the inspector shall be 35cm or more.

7. Determination of acceptability and subsequent disposal

*If the number of defects found in the sample MODULE's from the lot is equal to or less than the applicable acceptance level, the lot shall be accepted.
*If the number of defects is greater than the applicable acceptance level, the lot shall be rejected. The Buyer shall inform the Seller of a detailed result of such inspection within the time period stipulated in Article 2. The disposal is as follows :

a) Accepted lot
An acceptance under the above incoming inspection shall constitute an acceptance by the Buyer of such lot of the MODULE's in terms of the landed quality thereof.
b) Rejected lot
If a lot of PRODUCTS is rejected under the above incoming inspection due to any defects for which the Seller is responsible and such a fact is clearly confirmed by the Seller, the Seller shall exercise one of the following three options. This must be determined with mutual consent and shall be confirmed by the Seller. The best choice of the options shall be left to the Seller's discretion and the Seller shall advise the Buyer of its choice not later than two weeks of receipt of the Buyer's advice :

1. The Buyer shall return the defective lot to the place to be designated by the Seller and the Seller shall screen all of the PRODUCTS in the lot and repair defective PRODUCTS.

2. The Seller shall screen all of the PRODUCTS in the lot and repair defective products within a reasonable time period at the Buyer's facility.

3. The Buyer shall screen the entire lot for the good modules at the expense of the Seller to be separately agreed upon. The rejected PRODUCTS shall be returned to the place to be designated buy the Seller.

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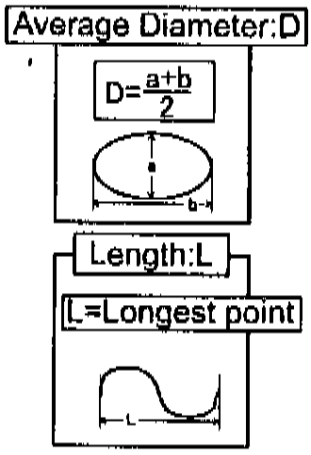
8. External Inspection

Average diameter : D(mm) Length : L(mm)

Items to be inspected		Inspection standards (Acceptable level)
Extraneous substances	Black spots	Module operating (White picture position) $0.1 \leqq D \leqq 0.5$, $N \leqq 2$
	Lint	Module operating (Black picture position) $L \leqq 3$, $N \leqq 2$
Scratches on the polarizer		Non operating (*1) $L \leqq 10$, $N \leqq 3$
Dent on the polarizer		Non operating (*1) $0.1 \leqq D \leqq 0.5$, $N \leqq 3$



*1 The external visual inspection: The inspection shall be conducted by using a single 20W fluorescent lamp for illumination and the distance between the MODULE and the eyes of the inspector shall be 35cm or more.

*The area for external inspection is active area plus 1.0mm width.(Upper, Lower, Left and Right)

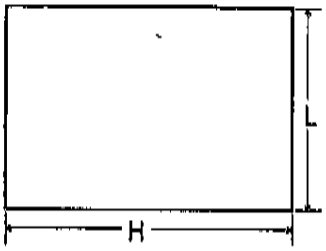
9. Dot defect

9-1 Inspection Conditions [Visual inspection]

Viewing distance : 35cm
Ambient illumination : 100 to 150Lux
Ambient temperature : 20-25 °C
Light source condition : Based on the specification

Note: Viewing angle : The surface of the MODULE and the eyes of the inspector shall be 90 degrees.

9-2 Zone



※ Please reference effective display area (active area) of specification about H,L

9-3 Difinition

a. Bright dot
·Green/Red/Blue dots : When the MODULE lights, dots appear bright in display at Black picture position.
Count : Visible through 5% transparency of filter
No count : Not visible through 5% transparency of filter

b. Black dots
·When the MODULE lights, dots appear black in display at white picture position.

c. Scratches on the color filter
Count : Visible over the half of a dot
No count : Visible under the half of a dot

d Scratches on the Cr mask
Count : Visible over 50 μm φ
No count : Visible under 50 μm φ

9-4 Number of dot defect (Acceptable)

a. R,G Bright dot

Green and Red dots	ZONE TOTAL
Green	1 MAX
Red	1 MAX

b. Total number of dot defect

	ZONE TOTAL
Bright dots & Black dots	8 MAX

9-5 Defect distance

·Bright dots ··· 5 mm or more
·Black dots ··· 5 mm or more

9-6 Joined dot defect

Bright dot join (more than 2dots)····· Nothing
Black dot join (2 dots join) ····· 1 dot defect count
Black dot join (3 dots or more) ····· Nothing

10. Display non-uniformity

There should be no distinct non-uniformity visible through 2% transparency of filter.

11. An afterimage (Acceptable level)

After displaying same pattern for 5seconds, afterimage disappears within 10 seconds.

12. Others

If some problems arise about mentioned items in this document and other items, the user of the TFT-LCD module and Sharp will cooperate and make efforts to solve the problems with mutual respect and good will.

13. Classification of defect

13-1 Major defect

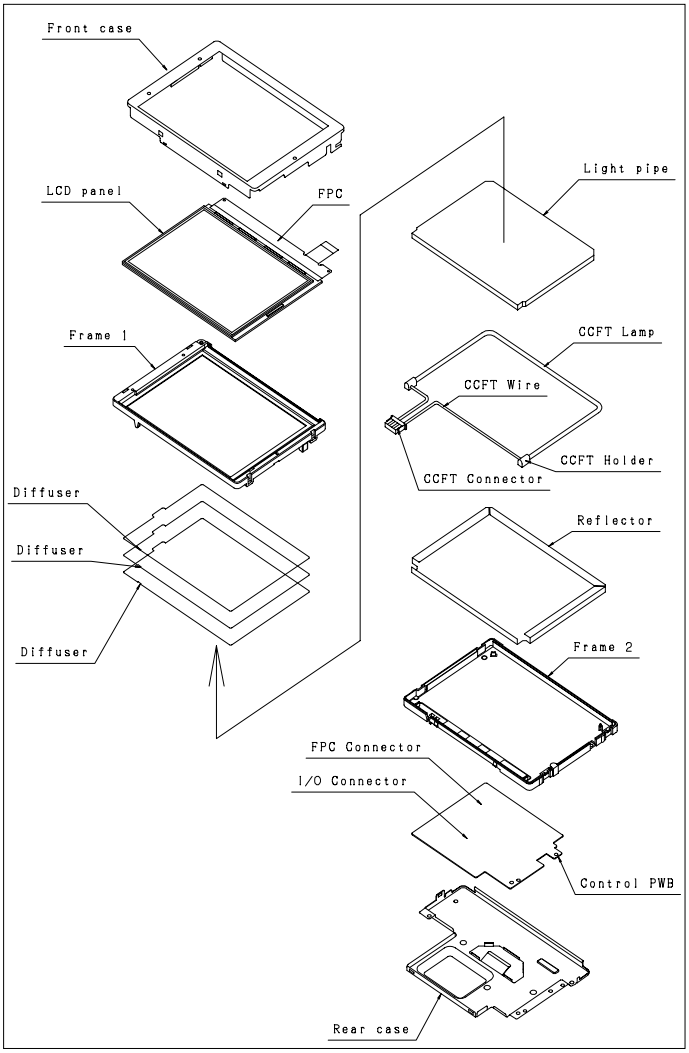
1. Function defect
   Abnormal operation including distinct R,G,B line defects and /or white line defect.

13-2 Minor defect

1. Dot Defect
2. Display non-uniformity
3. An afterimage
4. Extraneous substances
5. Scratches
6. Dents
7. Contrast ratio
8. Current dissipation

COMPONENT		GENERIC NAME	CAT. No. (GRADE)	UL FILE No.	FLAME CLASS	MANUFACTURER	component code
FRONT CASE	Alminum Metal Cupper Plate	S A 1	-	-	-	-	P2164
TFT-LCD PANEL		GLASS 5inch 0.7mm glass	-	-	-	SHARP CORP.	CC05
Front Polarizer	AG/wide viewing/dye	-	-	-	-	SANRITZ CORP.	Z2912
Rear Polarizer	Clear/wide viewing/dye	-	-	-	-	SANRITZ CORP.	Z2913
COG source driver	Analog 240 out x 4pcs	-	-	-	-	Sharp Corporation	LH1669
COG column driver	240 output x 1pc	-	-	-	-	Sharp Corporation	LH1624
FPC	SB18-25-18ME	FLEXIBLE SINGLE LAYER PRINTED WIRING BOARDS	F2	E69892	94V 0	NITTO DENKO CORP	H2126
REAR CASE	Alminum Metal Cupper Plate	S A 1	-	-	-		P2165
backlight	Frame1	PC SUS	-3001 -	41179(S -	94V 0 -	MITSUBISHI ENGINEERING PLASTICS CORP. -	B0089
	Frame2	PC AL	2801-87001 -	E45587 -	94V-0 -	GE PLASTICS JAPAN LTD	B0089
	Diffuser	PET	D121	-	-	TSUZIDEN & CO,.LTD	B0089
	Light Pipe	PMMA	DELPET 80N	E48285	94HB	ASAHI CHEMICAL IND.CO.,LTD	B0089
	CCFT Lamp	GLASS	-	-	-	HARISON TOSHIBA LIGHTING Corp.	B0089
	CCFT wire	FLUOROCARBON RESIN XLPE	UL10353-W-SN AWG2	E46702	VW-1	KURABE S A C0 LTD	B0089
	CCFL connector	66NYLON	BH	E60389	94V 0	JAPAN SOLDERLESS TEERMINAL MFG CO LTD (BHR-20(8.0)VS-1N (made by JST))	B0089
	CCFT Holder	SILICONE RUBBER	SH502U	E55519	94V 0	TORAY DOW CORNING SILICONE CO LTD	B0089
	Reflector Sheet	t=0.188	E60L	-	-	TORAY INDUSTRIES INC	B0089
CONTROL PWB	PWB	MULTILAYER PRINTED WIRING BOARDS	2A	E84369	94V 0	SHIKIBO ELECTRONICS CO LTD (FR4, T=0.6, glass epoxy)	K2608
	Video IF IC (IR3Y26A)		-	-	-	Sharp Corporation	K2608
	Control IC (LZ9GF29)		-	-	-	Sharp Corporation	K2608
	I/O CONNECTOR	-	6200	E67646	-	KYOCERA ELCO CORP (00 6200 522 330 000)	K2608
	(INSULATOR SLIDER)	POLYPHENYLENE	FZ-1140	E53829	94V 0	DAINIPPON INK & CHEMICAL INC	
	FPC CONNECTOR	CONNECTORS	FH12-26S-0.5SH	-	-	HIROSE ELECTRIC CO LTD	K2608
		POLYAMIDE	CH230N	E52579	94V 0	MITSUI CHEMICALS INC	
		POLYPHENYLENE	FZ-1140	E53829	94V 0	DAINIPPON INK & CHEMICAL INC	

ABOVE UL RELATED DATA IS FOUNDED ON UL YELLOW BOOK EDITED IN 2000



CN2 FH12-24S-0.5SH

CN1 00-6200-522-330-800

IC1301 LZ9GF29

IC1801 IR3Y26A

IC1401 NJM2107F

IC1001 LP2951CM

Q1901 OPEN

Q1902 DTC114EUA

Q1201 DSC4116(GR)

Q1202 DSC4116(GR)

Q1203 FMY3A

Q1204 FMY4A

Q1101 DSC4116(GR)

Q1102 2SC4116(GR)

Q1103 2SA1586(GR)

Q1301 2SC2411K(Q)

D1101 MA8051L

D1102 1SS226

D1103 1SS226

D1104 MA8051L

D1105 MA8091M

D1106 MA8120M

D1107 OPEN

D1108 OPEN

D1109 OPEN

D1301 MA3X

D1302 MA8051L

D1401 OPEN

D1601 MA716

D1602 OPEN

CN2 pins: CLD, GND, HW, SMW, B, R, SK, CTR, SWCH, OPEN, VSS, OPEN, VCC, VGL, CSW, SCS, SPIO, MODE1, MODE2, VSH, VGH

CN1 pins: CLK, GND, VDD, VSS, HRV, VRV, VSW, VSK, VCLK, VSR, VBR, VBT, VBL, VSL, VBA, VBB, VBD, GND, VSYC, HSY

IC1301 pins: VIN, CVOP, CVIN, DVOP, FRPT, GPS, GND, EXCL, SYNI, HSY, VSY, SPIO; PDP, RESH, FRPV, LOWI, TEST, GND, VDD, SAMO, OSCI, OSCO, CLD, SPOI; SYNO, PRCO, PRCI, SAMP, PRPC, CLC2, CLC1, HR, VCLK, CLC3, FST2, FST1, SERV; GND, CVDC, VRA, VBA, HBA, VBA, VSWI, VSWO, VR, SPS, CTS, LOWO, CLTR

IC1801 pins: NC, SYN_SEP, COM_A, COM_O, CONT, B_IN1, GND, G_IN1, R_IN1, VCC1, NC, NC; NC, B_OUT, VCC2, G_DC, G_OUT, GND, R_DC, R_OUT, GND, GAM_2, GAM_0, NC; SYNO, SYNT, FRP, COM1, NC, SC_R, SC_B, BRT, RGB_A, SB_R, SB_B, B_DC; B_IN2, G_IN2, R_IN2, REG, HF_I, SW, HF_O, NC, NC, NC, NC, NC

IC1401 pins: IN, OUT, VCC, GND

IC1001 pins: VIN, VOUT, GND, ON/OFF, NC, ERROR

TP-CLD, TP-COMMON, TP-CLOCK, TP-R, TP-G, TP-B, TP-H, TP-V, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11

シールドケース接続パッド

フレーム接続パッド

Title: DUNTK2608TPZZ

Size: A4 | Number: LQ050A5AG03 C-PWB | Revision

Orcad D | Date: 27-Nov-2001 | Sheet of

File: F:\AP\XP\C-..\2607.Sch.Sch | Drawn By: