SHARP

LQ065T5AR01

Color TFT LCD Module

(Model Number: LQ065T5AR01)

Specifications

Spec No.: LCY-01096B

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DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ065T5AR01

CUSTOMER'S APPROVAL

DATE

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RECORDS OF REVISION

MODEL No : LQ065T5AR01

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LCY-01096	2001.11. 9.		-	-	1 st Issue
	2001.12.18	A	3	add a postscript(Fig.7)	
			8	change temperature of Absolute maximum	
				ratings.(Ta=25℃→-30～+85℃)	
			15,19	change protection film	
			16	correct a error word(Fig.7→Fig.8)	
			19	add a postscript(depth of mounting hole)	
	2002.01.24	B	-	change PWB for improve of coupling issue	
				(DUNTK2959TPZZ → DUNTK3028TPZZ)	

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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 has a 16:9 aspect ratio and accepts full color video signal conforming to the NTSC and PAL systems.
An outline of the module is shown in Table 1.

(2) Features

- 16:9 aspect ratio suitable for the wide-screen systems.
- a variety of display modes can be selected without any loss of wide-screen characteristics
- The 6.5 screen produces a high resolution image that is composed of 93,600 pixel elements in a stripe arrangement.
- Wide viewing angle technology is adopted.
  (The direction which has earlier inversion of gray scale image : 6 o'clock direction.)
- External clock synchronization allows an extremely clear image to be displayed.
- TFT-active matrix-LCD drive system with high contrast
- Dual mode type [NTSC (M) and PAL(B・G) standards]
- MBK-PAL which enables the 234-scanning lines panel to display a picture with virtually 274-scanning lines.
- Reduced reflection as a result of low reflectance black matrix and an antiglare (AG) and anti-reflection (AR) polarizer being adopted.
- A thin, lightweight and compact
  ①Effective area/Outline area= 82% ②Thickness= 16.0 mm③Mass= 240g(max)
- Through the use of TN-normally white mode, an image with highly natural color reproduction is realized.
- It is possible to reverse the display direction (right／left and up／down).
- Semi Self–heating Backlight that is excellent of brightness rising characteristics at low temperature in consideration of automotive application

(3) Construction and Outline

Outline dimension of TFT-LCD module : Fig. 1

The module consists of the TFT-LCD panel, driver ICs, control PWB mounted with electronic circuits, semi self-heating backlight, frame, inverter, DC/DC for single supply voltage, front and rear shielding cases.:Fig.7

(4)Module geometry(Mechanical specifications)

Table 1

Parameter	Specifications	Units	Remarks
Display format	93,600	pixels	
	1200(W)×234(H)	dots	
Active area	143.4（W）×79.326（H）	mm	
Screen size (Diagonal)	16.5 [6.5”]	cm	
Dot pitch	0.1195（W）×0.339（H）	mm	
Pixel configuration	R,G,B Stripe configuration		
Outline dimension	155(W)×89.2(H)×16.0(D)	mm	【Note4-1】
Mass	240	g	Max

【Note4-1】This measurement is typical,and see Fig .1 for the details.

(5)Input/Output terminal and their descriptions

5-1)TFT-LCD panel driving section

Table 2 (Hi and Lo means digital input voltage)

Pin No.	Symbol	i/o	Description	Remarks
1	TEST	i		
2	ＣＬＫＣ	i	Selection for input/output direction of HSY,VSY, CLK+,CLK－	【Note5-1】
3	ＨＳＹ	i／o	Input/Output horizontal sync. signal (low active)	【Note5-2】
4	ＶＳＹ	i／o	Input/Output vertical sync. signal (low active)	【Note5-3】
5	ＰＷＭＳ	o	Timing signal for PWM dimming of backlight	【Note5-4】
6	ＮＴＰ	i	Selection for NTSC or PAL	【Note5-5】
7	ＨＲＶ	i	Selection for horizontal scanning direction	【Note5-6】
8	ＶＲＶ	i	Selection for vertical scanning direction	【Note5-7】
9	ＭＯＤＳ	i	Selection for display mode	【Note5-8】
１０	ＭＯＤＷ	i	Selection for display mode	【Note5-8】
１１	ＭＯＤＮ	i	Selection for display mode	【Note5-8】
１２	ＶＩＮ	i	Positive power supply voltage	
１３	ＶＢＳ	i	Composite sync.signal (low active)	【Note5-9】
１４	ＢＲＴ	i	Brightness adjusting terminal	【Note5-10】
１５	ＶＲ１	i	Color video signal (Red) 1	Positive (On when VSW=Hi.)
１６	ＶＧ１	i	Color video signal (Green) 1	Ditto
１７	ＶＢ１	i	Color video signal (Blue) 1	Ditto
１８	ＧＮＤ１	i	Ground	
１９	ＶＲ２	i	Color video signal (Red) 2	Positive (On when VSW=Lo.)
２０	ＶＧ２	i	Color video signal (Green) 2	Ditto
２１	ＶＢ２	i	Color video signal (Blue) 2	Ditto
２２	ＧＮＤ１	i	Ground	
２３	ＣＬＫ－	i	Clock signal (LVDS－)	【Note5-11】
２４	ＣＬＫ＋	i	Clock signal (LVDS＋)	【Note5-11】
２５	ＶＳＷ	i	Selection signal of two sets of video signals	【Note5-12】
２６	ＰＷＭＩ	i	Input signal for backlight dimming	【Note5-13】
２７	ＶＢＬ	i	Power supply for BackLight	
２８	ＶＢＬ	i	Power supply for BackLight	
２９	ＧＮＤ２	i	Ground for BackLight	
３０	ＧＮＤ２	i	Ground for BackLight	

【Note5-1】 CLKC = "Hi": HSY and VSY terminals are the output mode.
CLKC = "Lo": CLK＋,CLK－, HSY and VSY terminals are the input mode.

【Note5-2】 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.

【Note5-3】 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.

【Note5-4】 PWM signal is used for the PWM dimming frequency and it is possible to control the 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.

【Note5-5】 NTP = "Hi": NTSC system
NTP = "Lo": PAL system

【Note5-6】 HRV = "Hi": Normal video
HRV = "Lo": Reversed video on horizontal direction

【Note5-7】 VRV = "Hi": Normal video
VRV = "Lo": Reversed video on vertical direction

【Note5-8】 Display mode settings are shown in Table 3.

【Note5-9】 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.

【Note5-10】 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.

【Note5-11】 When CLKC="Lo", this terminal will be external clock input terminal.
This signal should correspond to sampling timing of the horizontal direction image.
NTP, MODS, MODW, and MODN should be "Hi" when CLKC="Lo".

【Note5-12】 When VSW="Hi", CH1 (VR1, VG1, VB1) is selected.
When VSW="Low", CH2 (VR2, VG2, VB2) is selected.

【Note5-13】 The signal of PWMI is used for control of ON/OFF switch of backlight.
When PWMI="Hi", the backlight is lighted. When PWMI="Low", the backlight puts the light out.
And, PWMS signal is used for the PWMI dimming frequency and it is easy to get PWM signal dimming by combining both HSY and PWMS signal. But please use this PWMS signal just in case of inputting standard NTSC or PAL signal.

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.	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.	－	－

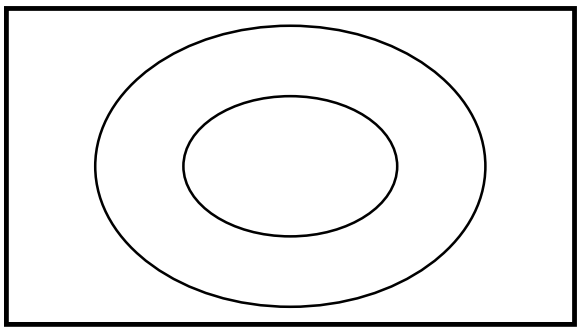


Fig.3)-1　Full mode

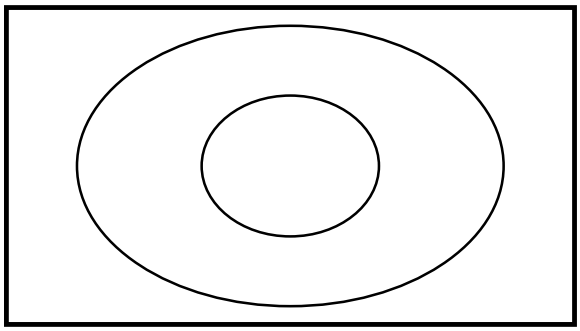


Fig.3)-2　Wide 1 mode

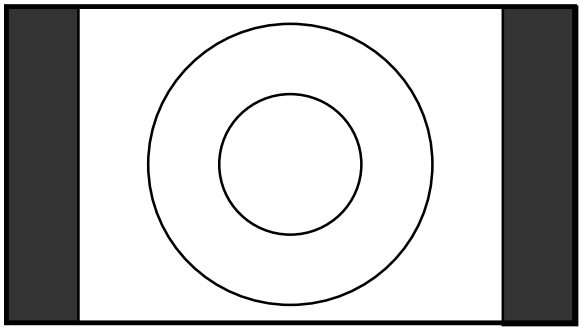


Fig.3)-3　Normal mode

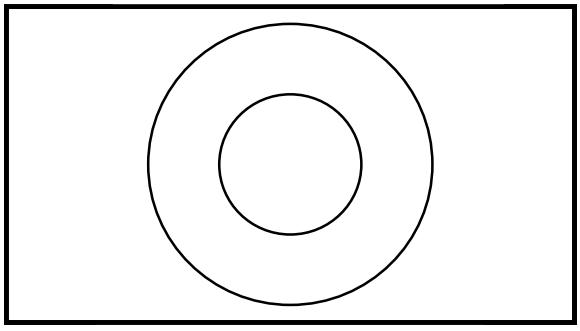


Fig.3)-4　Cinema mode

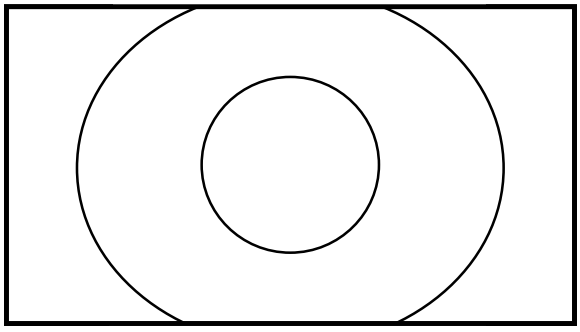


Fig.3)-5　Wide 2 mode

5-2)Functions, Modes and Terminals（Table４）

Mode terminals					Sync,signal I/O terminals				
CLKC	NTP	MODS	MODW	MODN	ＨＳＹ	ＶＳＹ	ＣＬＫ－,ＣＬＫ＋	ＶＢＳ	Remarks
H	H or L	L L L	H L L	L H L	H sync. output	V sync. output	-	Composite sync. input	test mode
H	H or L	H	L	H	H sync. output	V sync. output	-	Composite sync. input	NTSC or PAL mode (Normal mode)
H	H or L	other H or L settings			H sync. output	V sync. output	-	Composite sync. input	NTSC or PAL mode (Full,Wide,Cinema)
L	H	H	H	H	H sync. input	V sync. input	Pixel clock input	input Hi or Lo fixed value	External clock synchronous mode

(6) Absolute maximum ratings

Table 5　　ＧＮＤ＝０Ｖ、Ｔａ＝-30～+85℃

Parameter	Symbol	ＭＩＮ	ＭＡＸ	Unit	Note
Positive power supply voltage	ＶＩＮ	-0.3	9.0	V	
Positive power supply voltage	ＶＢＬ	-0.3	9.0	V	
Analog Input signals	ＶＩＡ	-	2.0	Vp-p	[terminal 6-1]
Digital Input signals	ＶＩＤ	-0.3	5.3	V	[terminal 6-2]
Digital Output signals	ＶＯＤ	-0.3	5.3	V	[terminal 6-3]
LVDS Input signals	LIS	-0.3	5.3	V	[terminal 6-4]
Brightness adjusting voltage	VBRT	0	5.0	V	
Storage temperature	Ｔstg	-40	85	℃	【Note 6-1,2】
Operating temperature (panel surface)	Ｔopr1	-30	85	℃	【Note 6-2,3,4】
Operating temperature (Ambient temperature)	Ｔopr2	-30	65	℃	【Note 6-4,5】

[terminal 6-1] ＶＢＳ, ＶＲ１, ＶＧ１, ＶＢ１, ＶＲ２, ＶＧ２, ＶＢ２ terminals(Video signal)
[terminal 6-2] ＨＳＹ, ＮＴＰ, ＶＳＹ, ＨＲＶ, ＶＲＶ, ＣＬＫＣ, ＶＭＳＷ, ＭＯＤＳ, ＣＬＫ, ＭＯＤＷ, ＭＯＤＮ, terminals
[terminal 6-3] ＨＳＹ, ＶＳＹ, ＰＷＭＳ terminals
[terminal 6-4] CLK－,CLK+ terminals

【Note 6-1】 This rating is applied to all parts of the module and should not be exceeded.

【Note 6-2】 Maximum wet-bulb temperature is less than 58℃. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 6-3】 Please measure in the effective display area only.

【Note 6-4】 The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, determine operating temperature using the formula Ta=＋25℃

【Note 6-5】 Ambient temperature when the backlight is lit (reference value).

(7) Electrical characteristics

7-1)Recommended operating conditions

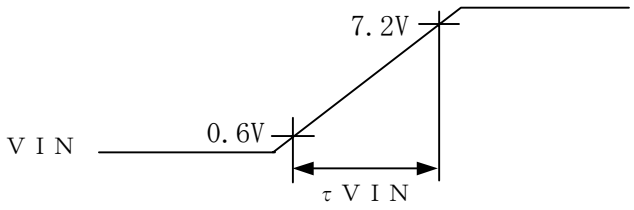
A)TFT-LCD panel driving section

Table 6　　GND＝0V, Topr1＝－30～85℃

Parameter			Symbol	MIN	TYP	MAX	Unit	Remarks
Power supply voltage			VBL	+7.2	+8.0	+8.5	V	
Power supply voltage			VIN	+7.2	+8.0	+8.8	V	
Power supply voltage rising time			τ VIN			60	ms	【Note 7-1】
Analog Input voltage	Amplitude		VBS	0.7	1.0	2.0	Vp-p	
			VI	-	0.7	-	Vp-p	【Note 7-2】
	DC component		VIDC	-1.0	0	+1.0	V	【Note 7-3】
Digital Input voltage	Hi		VIH	+3.5	-	+5.0	V	【Note 7-4】
	Lo		VIL	0	-	+0.5	V	
	Histeresis		VH	+0.2	-	-	V	
Digital output voltage	Hi		VOH	+4.0	-	+5.0	V	【Note 7-5】
	Lo		VOL	0	-	+1.0	V	
LVDS Input signal	Differential Input High Threshold		VTH			+100	mV	CLKC="Lo" 【Note 7-6】
	Differential Input Low Threshold		VTL	－100			mV	
	frequency		fCLI	7.2	8.0	8.8	MHz	
Input horizontal sync. signal	frequency	NTSC	fH(N)	15.13	15.73	16.33	kHz	CLKC='Hi' 【Note 7-7】
		PAL	fH(P)	15.03	15.63	16.23	kHz	
	pulse width	NTSC	τ HI(N)	4.2	4.7	5.2	μs	
		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. signal	frequency	NTSC	fV(N)	fH/284	fH/262.5	fH/258	Hz	CLKC='Hi' 【Note 7-8】
		PAL	fV(P)	fH/344	fH/312.5	fH/304	Hz	
	pulse width	NTSC	τ VI(N)	-	3H	-	μs	
		PAL	τ VI(P)	-	2.5H	-	μs	
	rising time		τ rVI	-	-	0.5	μs	CLKC='Hi' or 'Lo'
	falling time		τ fVI	-	-	0.5	μs	
Input horizontal sync. signal	frequency		fHI	fCLI/550	fCLI/508	fCLI/490	kHz	CLKC='Lo' 【Note 7-9】
	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' 【Note 7-10】
	pulse width		τ VI	1H	3H	5H	μs	
Data setup time			tSU1	24	-	-	ns	CLKC='Lo' 【Note 7-6,9,11】
Data hold time			tHO1	44	-	-	ns	
Data setup time			tSU2	1.0	-	-	μs	CLKC='Lo' 【Note 7-6,10,12】
Data hold time			tHO2	1.0	-	-	μs	

Caution: Signals must input after power has been turned on.

【Note 7-1】



【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，ＮＴＰ，ＶＳＹ，ＨＲＶ，ＶＲＶ，ＣＬＫＣ，ＶＳＷ，ＭＯＤＳ，ＭＯＤＷ，ＭＯＤＮ，ＰＷＭＩ terminals
【Note 7-5】 ＨＳＹ，ＶＳＹ，ＰＷＭＳ terminals
【Note 7-6】 CLK－,CLK+ (DS90C402：LVDS Receiver made by National Semiconductor)
(Adaptation LVDS Transmitter：DS90C401)
【Note 7-7】 ＶＢＳ(horizontal sync. component) terminal
【Note 7-8】 ＶＢＳ(vertical sync. component) terminal
【Note 7-9】 ＨＳＹ terminal
【Note 7-10】 ＶＳＹ terminal
【Note 7-11】During the clock input mode, CLK－,CLK+ and the HSY input signal are out of phase. In this mode, the HSY input signal is effected by the rise time of the CLK+ input signal.
【Note 7-12】 During the clock input mode, HSY and the VSY input signal are out of phase. In this mode, the VSY input signal is effected by the rise time of the HSY input signal.

7-2)Power consumption

Table 7 Ｔａ＝-30～+85℃

Parameter	Symbol	Conditions	ＭＩＮ	ＴＹＰ	ＭＡＸ	Unit	Remarks
Positive supply current	IIN	VIN=8.0V	-	160	210	mA	
Positive supply current	IBL	VBL=8.0V	-	750	950	mA	
Total			-	7.28	9.20	W	

7-3)Input/Output signal timing chart

Table 8 CLKC=Hi

VIN=+8.0,GND=0V NTSC:fH=15.73kHz,fv=60Hz, τ HI=4.7μs

PAL:fH=15.63kHz,fV=50Hz, τ HI=4.7μs

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Horizontal sync. Output	frequency	fHO	-	fH	-	kHz	
	pulse width	τ HO	2.0	4.6	8.0	μs	【Note 7-13】
	rising time	τ rHO	-	-	0.5	μs	CL=10pF
	falling time	τ fHO	-	-	0.5	μs	CL=10pF
Horizontal sync. phase difference	HSY falling time	τ pd1	0.5	1.6	3.0	μs	【Note 7-14】
	HSY rising time	τ pd2		1.6	3.4	μs	
Vertical sync. Output	frequency	fVO	-	Fv	-	Hz	
	pulse width	τ VO	-	4H	-	μs	1H=1/fH
	sync. output difference	τ VHO	-	11	29	μs	
	rising time	τ rVO	-	-	2.0	μs	CL=10pF
	falling time	τ fVO	-	-	2.0	μs	CL=10pF
Vertical sync. Phase Difference	odd field	τ DV1	-	1H	-	μs	
	even field	τ DV2	-	0.5H	-		
Clock and Video signal timing 【Reference value】		td	40	65	90	ns	【Note7-15】

【Note7-13】 This is changed by the value of τ pd1
【Note7-14】 Center position： τ pd1= 1.6±0.4 μs (NTSC mode)
【Note7-15】 Clock and Video signal timing：Fig.6

7-4) Display time range

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

(a1) Horizontal Direction (full,wide1,2,cinema)

13.1 ～ 63.2 μs from the falling edge of HSY.

(a2) Horizontal Direction (normal)

8.0 ～ 68.3 μs from the falling edge of HSY

(b1) Vertical Direction (full,wide1,normal)

20 ～ 253 H from the falling edge of VSY

(b2) Vertical Direction (Cinema)

49 ～ 224 H from the falling edge of VSY

(b3) Vertical Direction (Wide2)

42 ～ 228 H from the falling edge of VSY

(2)PAL(B･G) mode (NTP='Lo',CLKC='Hi')

(a1) Horizontal Direction (full,wide1,2,cinema)

13.3 ～ 63.2 μs from the falling edge of HSY

(a2) Horizontal Direction (normal)

8.1 ～ 68.4 μs from the falling edge of HSY. (Normal)

(b1) Vertical Direction (full,wide1,normal)

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.

(b2) Vertical Direction (cinema)

49 ～ 282 H from the falling edge of VSY

(b3) Vertical Direction (wide2)

35 ～ 291 H from the falling edge of VSY

However, the video signals of (22n+14)H,(22n+21)H/Even field.
(22n+25)H,(22n+32)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) Horizontal Direction ： 86 ～ 485 clk from the falling edge of HSY.
(clk means input external clock.)

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

7-5)Backlight driving section

Usable area for Backlight lighting

PWM Dimming Duty=100%～5%

(Please use this PWMS signal just in case of inputting standard NTSC or PAL signal)

DC/AC inverter driving frequency = 65kHz (reference value)

(8)Optical characteristics

Table 9 VIN=+8.0V, VBL=+8.0V Ta=25℃

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		△θ11	CR≧5	60	65	-	° (degree)	【Note8-1,2,3】
		△θ12		35	40	-	° (degree)	
		△θ2		60	65	-	° (degree)	
Contrast ratio		CRmax	Optimal viewing angle	60	-	-		【Note8-1,3】
Response time	Rise	τr	θ＝0°	-	30	60	ms	【Note8-1,4】
	Fall	τd		-	50	100	ms	
Luminance		Y	θ＝0°	315	420	-	cd/m²	【Note8-1,5】
White chromaticity		x	θ＝0°	0.263	0.313	0.363		【Note8-1,5】
		y		0.279	0.329	0.379		
Lamp life time	+25℃	-	Continuation	10,000	-	-	hour	【Note8-1,6】
	-30℃	-	Intermission	2,000	-	-	time	【Note8-1,7】

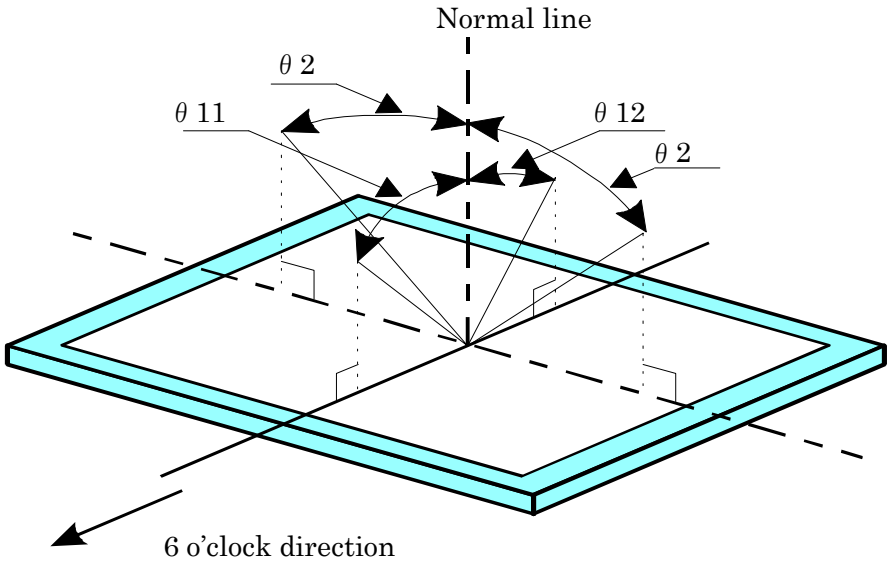
Applied voltage condition for the measurement :

i) Bright adjustment voltage (BRT) to be opened

ii) Video signal of standard black level and 100% white level

【Note 8-1】Measuring method : Fig.5

【Note 8-2】Viewing angle range is defined as follows.

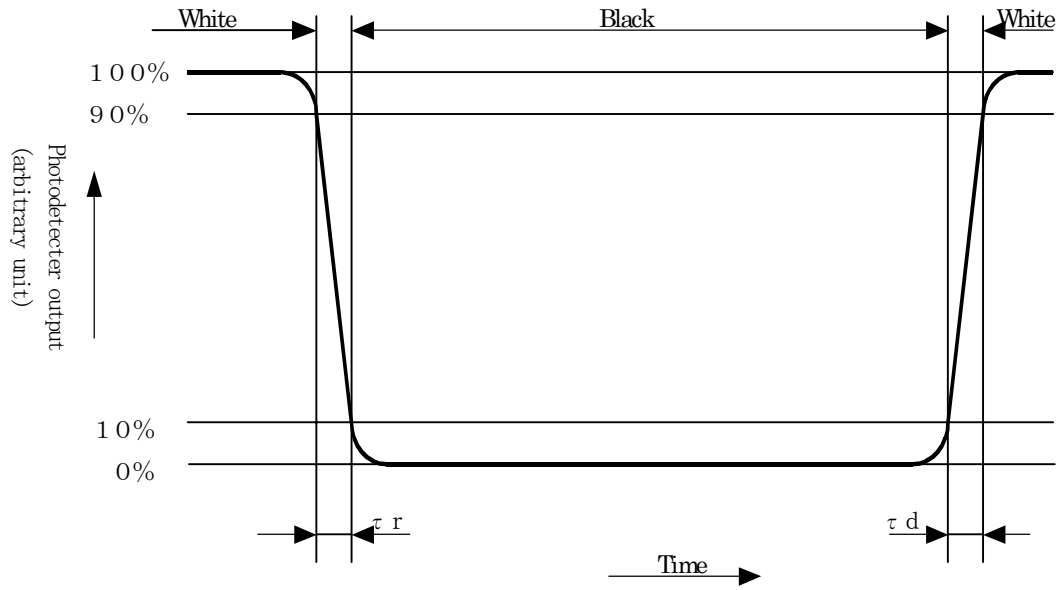


definition for viewing angle

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

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

【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".

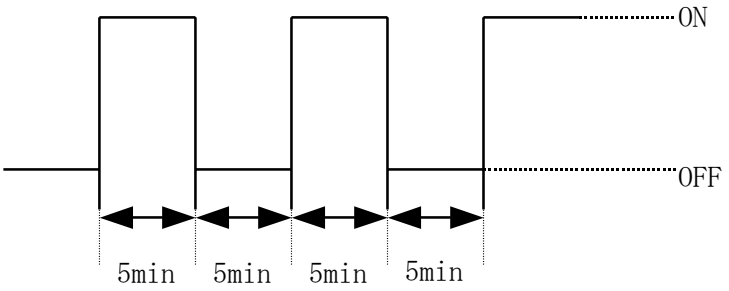


【Note 8-5】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter BM-7.(After 30 minutes operation)

【Note 8-6】 Lamp life time is defined as the time when brightness not to become under 50% of the original value in the continuous operation under the condition of PWM dimming duty 100%～5% (Ta=25℃).

【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.

Ambient temperature:-30℃



(9)Mechanical characteristics

9-1) External appearance

Extreme defects should not exist. (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.

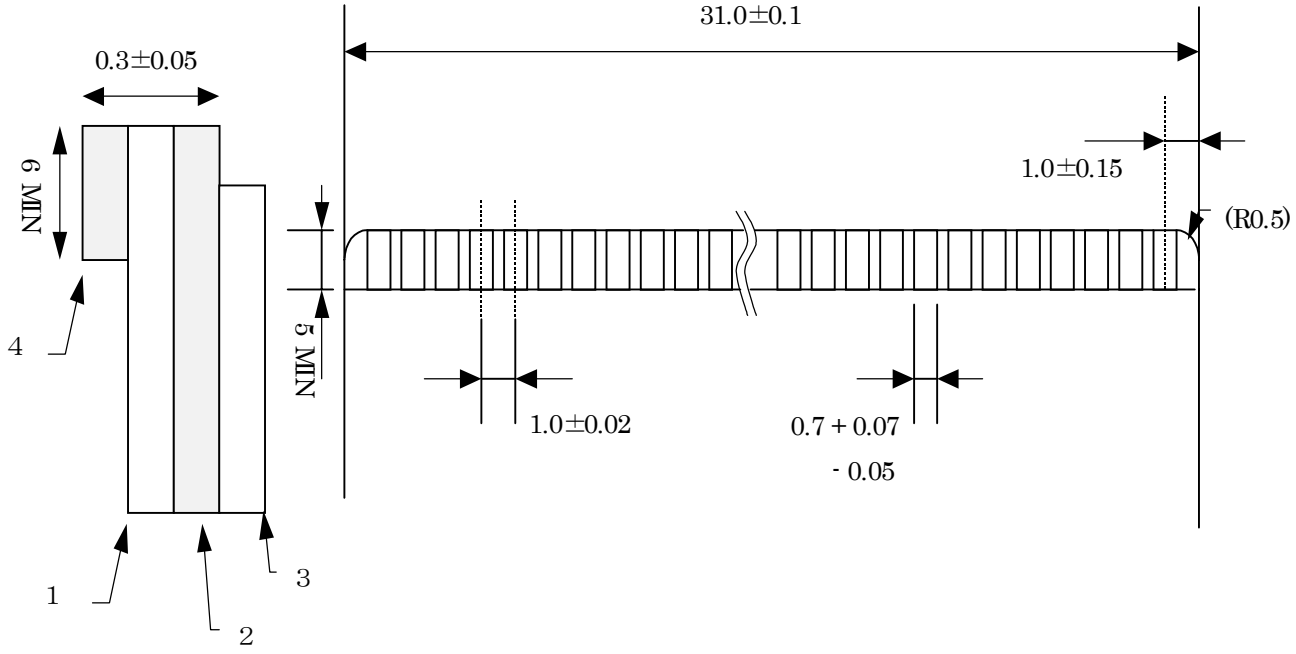
Caution: In spite of very soft toughness, if, in the long-term, add pressure on the active area, it is possible to occur the functional damage.

9-3) Input/output connector performance

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

(30 pin【KYOCERA ELCO CORPORATION】:6200307032800)

1) Applicable FPC： Refer the below figure
2) Terminal holding force： More than 0.9N/pin.
   (Each terminal is pulled out at a rate of 25 ±3mm/min.)
3) Insertion/pulling :contact resistance is not twice larger than the durability initial value after applicable FPC is inserted and pulled out 20 times



No.	Name	Materials
1	Base material	Polyimide or equivalent material(25 μ m thick)
2	Copper foil	Copper foil(35 μ m thick) Solder plated over 2 μ m
3	Cover lay	Polyimide or equivalent material
4	Reinforcing plate	Polyester polyimide or equivalent material(188 μ m thick)

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

(10) Display quality

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

(11) Mechanical Noise

No abnormal mechanical noise which can be easily recognized when the module is shaken by hand.

(12) Handling instructions

12-1) 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.

Don't reach the pressure of touch-switches of the set side to a module directly, because images may be disturbed.

Please power off the module when you connect the input/output connector.

12-2) Precautions in mounting

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.

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 form 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.

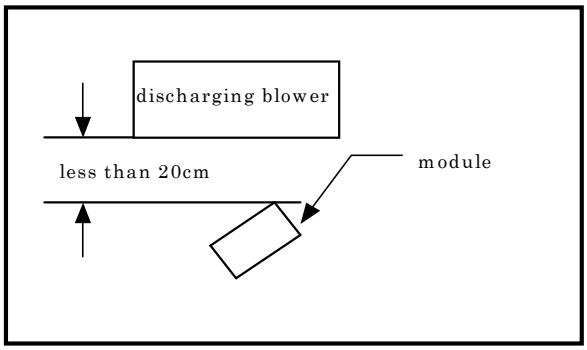
B) Working procedures

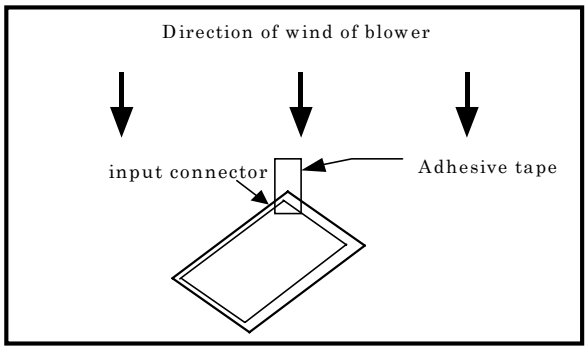
a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.

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

c) Peel off laminator, pulling adhesive tape slowly to your side.

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. 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 softly remove them from the panel.

When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirt, wipe the part, breathing on it.
Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.
Since TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface, handle with care.
Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

12-3) 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.

12-4) 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.

12-5)Mounting direction

Mounting direction of the TFT-LCD module to the application needs to be carefully fixed by evaluating display performance.

12-6)Others

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

(13) Shipping requirements

13-1) Packing form is shown in Fig.8.

13-2) Carton storage condition

① Number of layers of cartons in pile : 10 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.

(14)Reliability test conditions

Reliability test conditions for the TFT-LCD module are shown in Table 10.

(15)Others

15-1)Indication of lot number

The lot number is shown on a label. Attached location is shown in Fig.1(Outline Dimensions).
Indicated contents of the label

LQ065T5AR01 ○○○○○○○○○○
model No. lot No.

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~8th figure ‥ serial No. 00001～
the 9th figure ‥ revision marks blank or A,B,C …
the 10th figure ‥ production factory code blank or A,B,C …

Reliability test conditions for TFT-LCD module

Table 10

Remark)

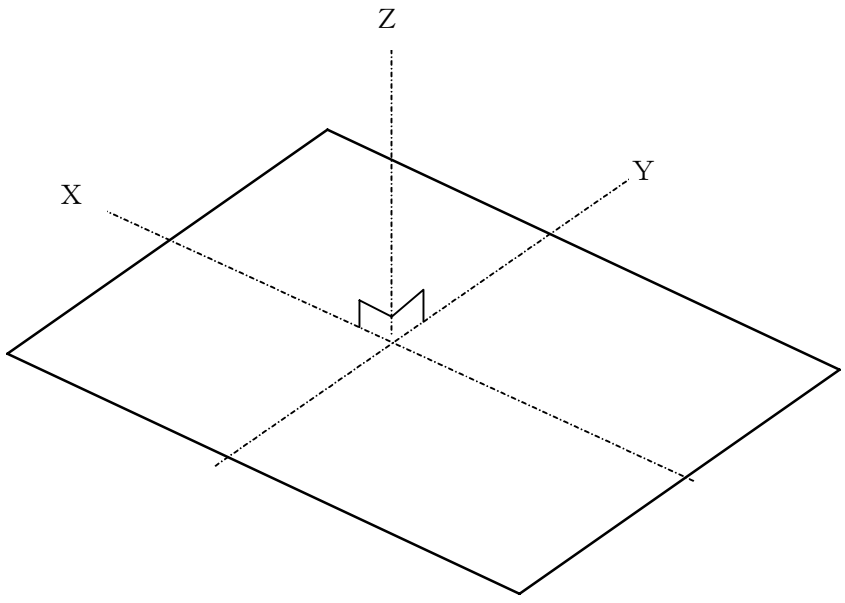
Temperature condition is based on operating temperature conditions on (6)-Table 5

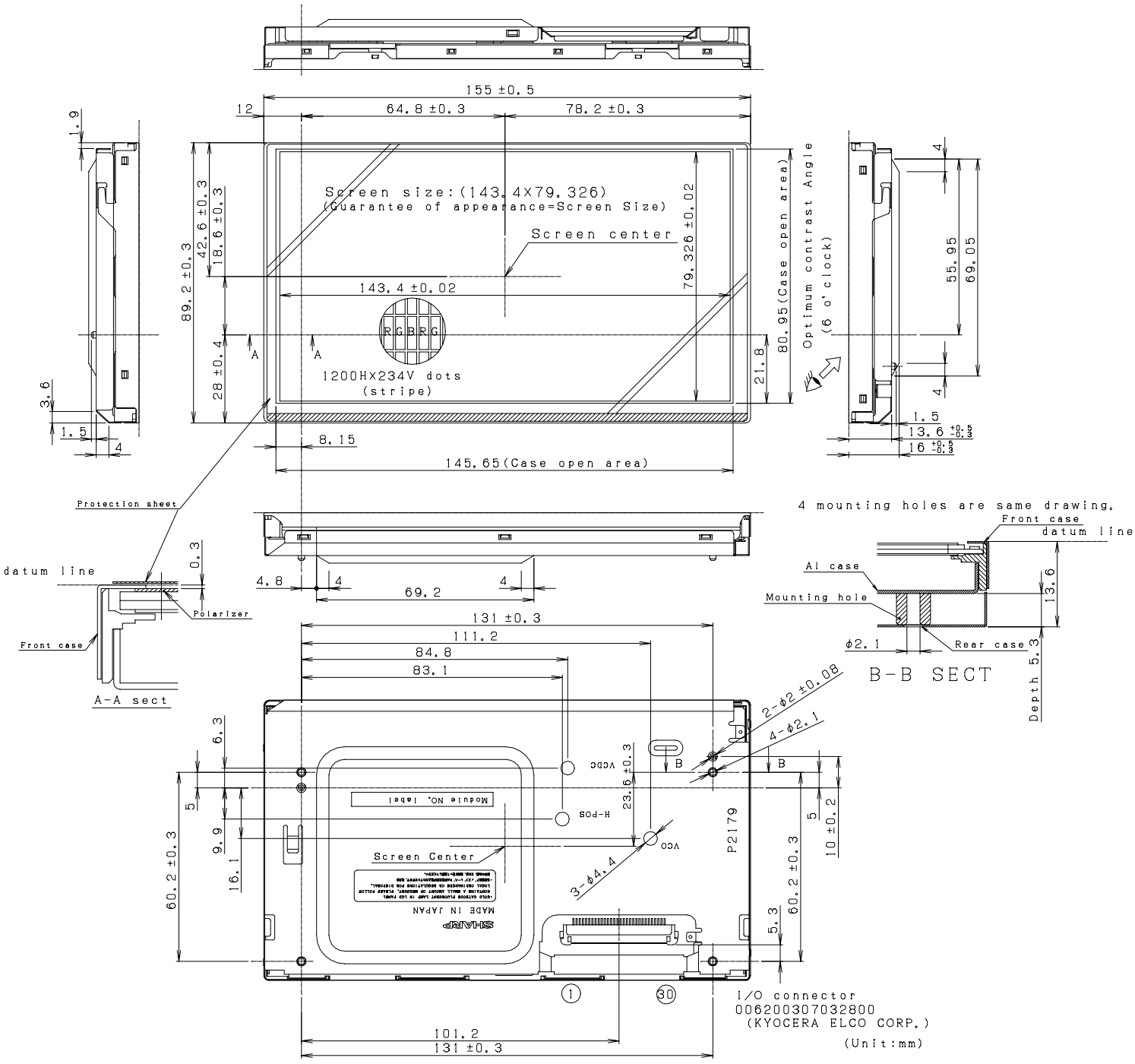
No.	Test items	Test conditions
1	High temperature storage test	Ta=+85℃ 240h
2	Low temperature storage test	Ta=-40℃ 240h
3	High temperature And high humidity operating test	Ta=+60℃, 90%RH 240h
4	High temperature operating test	Tp=+85℃ (Ta=+65℃) 240h
5	Low temperature operating test	Ta=-30℃ 240h
6	Electro static discharge test	±200V, 200pF(0Ω) 1 times for each terminals
7	Shock test	980m/s^2・6ms, ±X, ±Y, ±Z 3times 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 : 28.4 m/s^2 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 storage test	Ta=-30～+85℃ / 200cycles (0.5h) (0.5h)

【Note】Ta=Ambient temperature, Tp=Panel temperature

【Check items】In the standard condition, there shall be no practical problems that may affect the display function.

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





note1) General tolerance is ±0.5
note2) Unit is mm
note3) Take care in set design to hide the scratches and bubbles appeared on the polarizer or other frame area which is located outside of active area.

Since this module is under development, all the specified value is tentative. The technical literature is subject to change without notice.

DEVELOPMENT ENGINEERING DEPT.7
TFT DIVISION 1
TFT LIQUID CRYSTAL DISPLAY GROUP
SHARP CO.LTD.

DRAWING No LCM-01021D | DATE 2001.12.11

Fig.1 Outline dimensions of TFT-LCD module

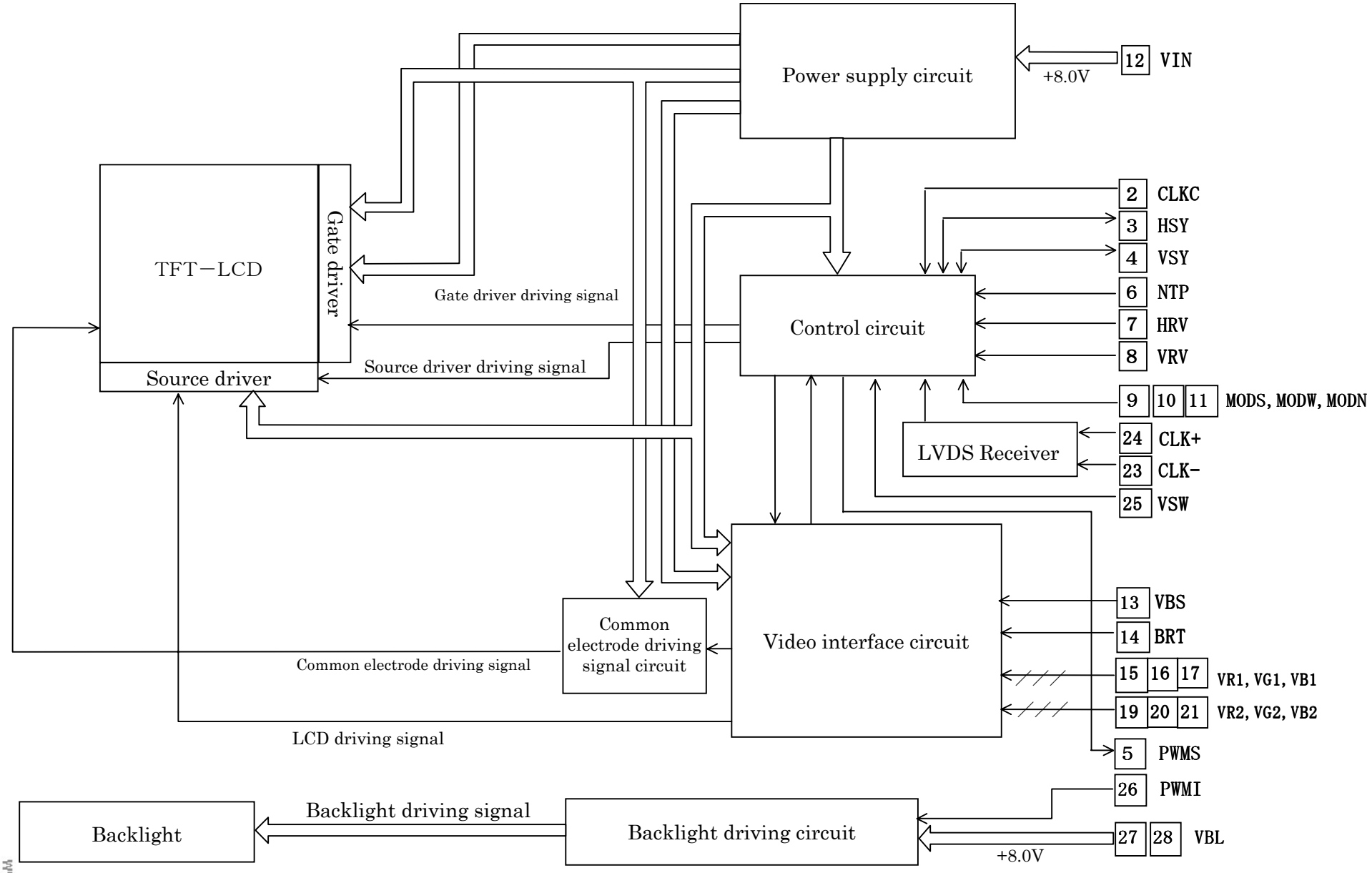


Fig.2 Circuit block diagram of the module

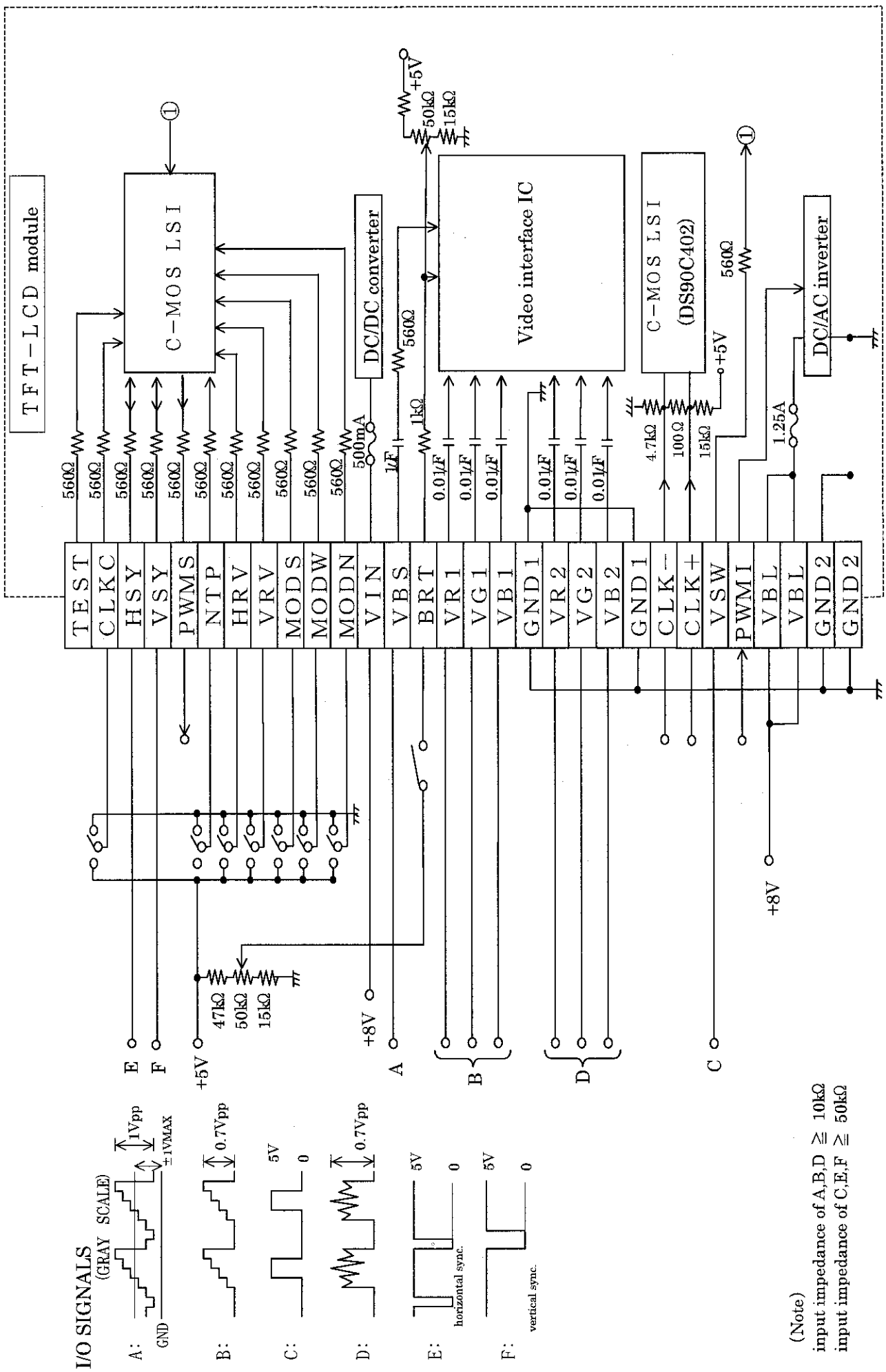


Fig.3 Recommended circuit of TFT-LCD module

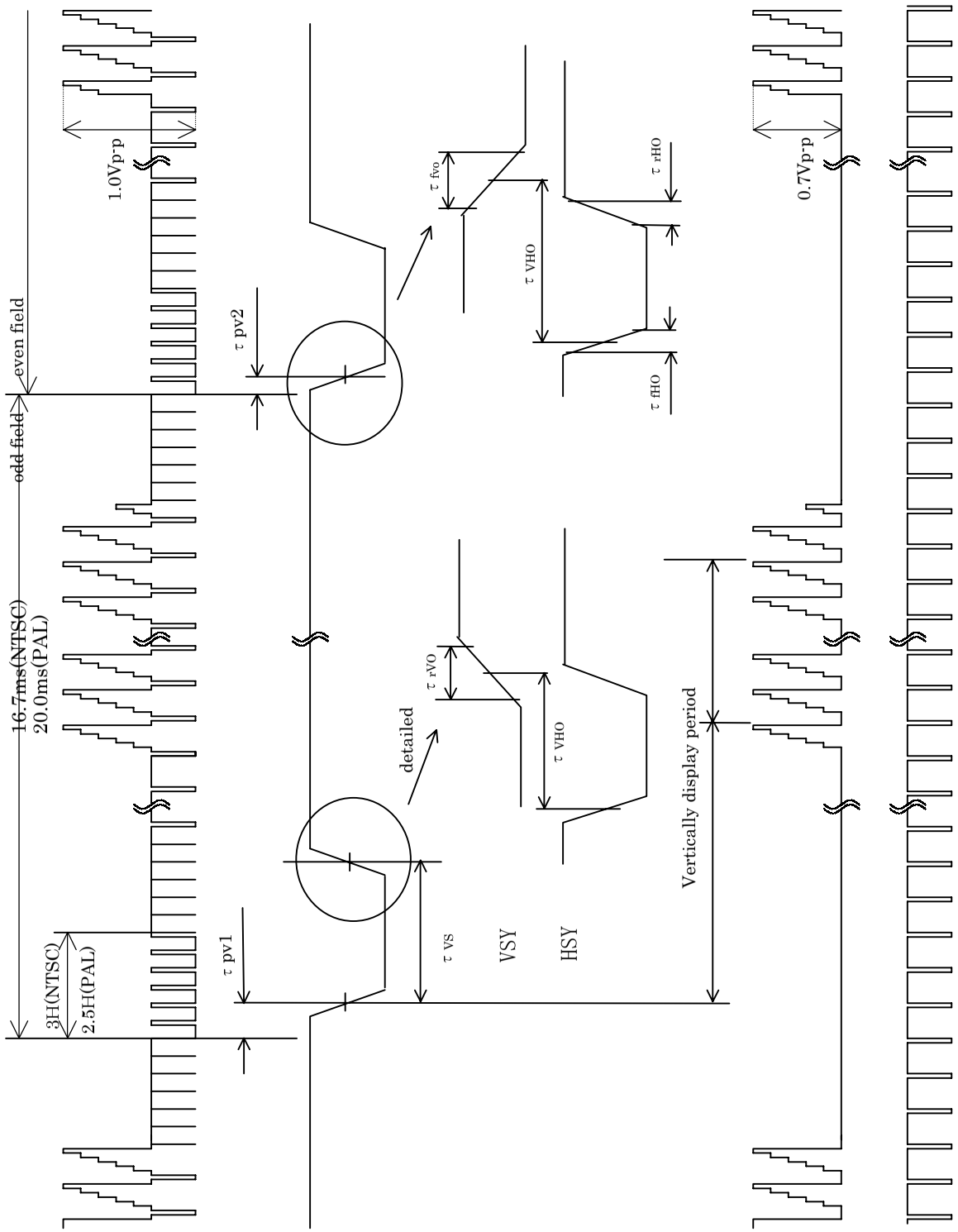


Fig. 4−A Input / Output signal waveforms (CLKC=" Hi ")

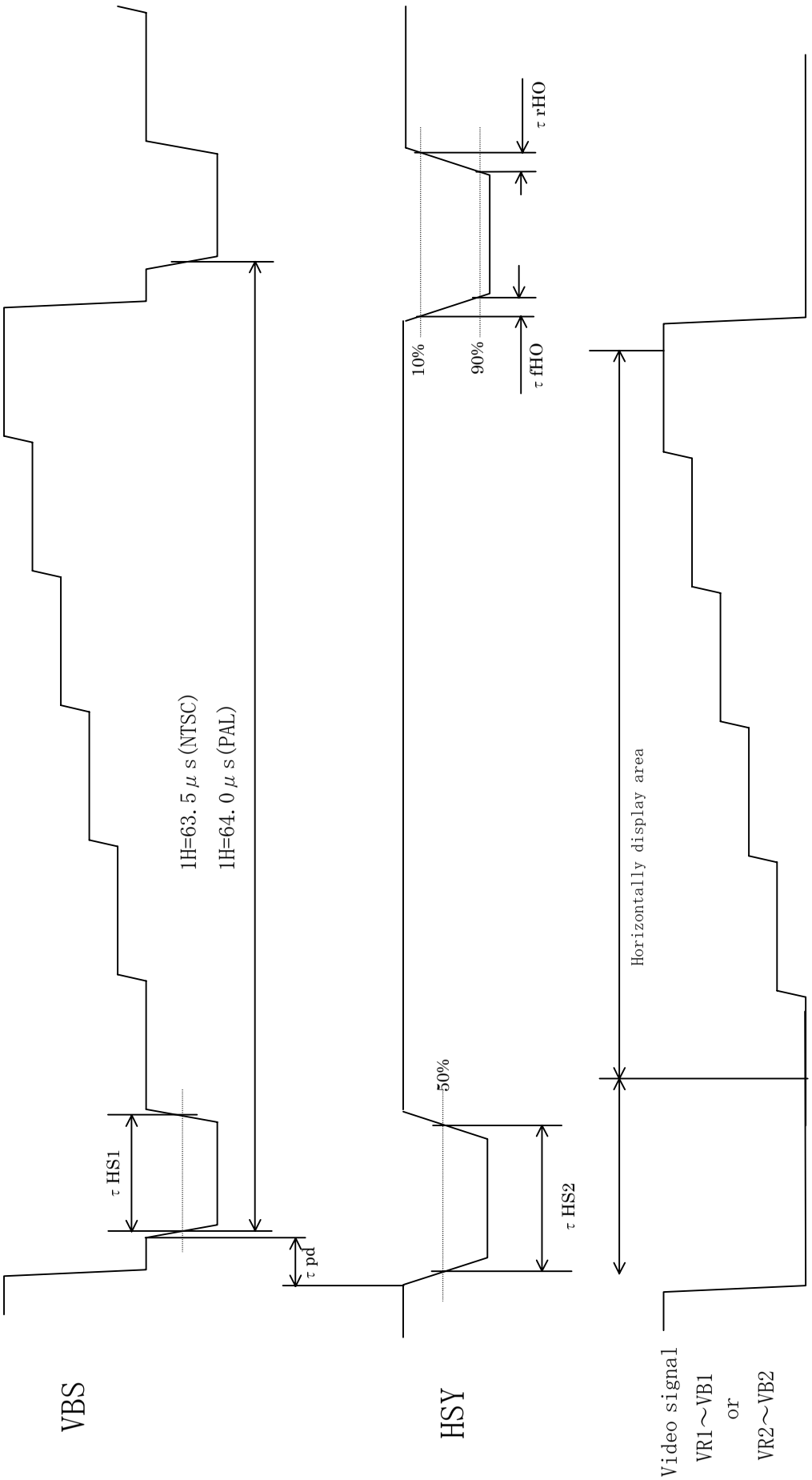


Fig. 4－B Input/Output signal waveforms (CLKC=" Hi")

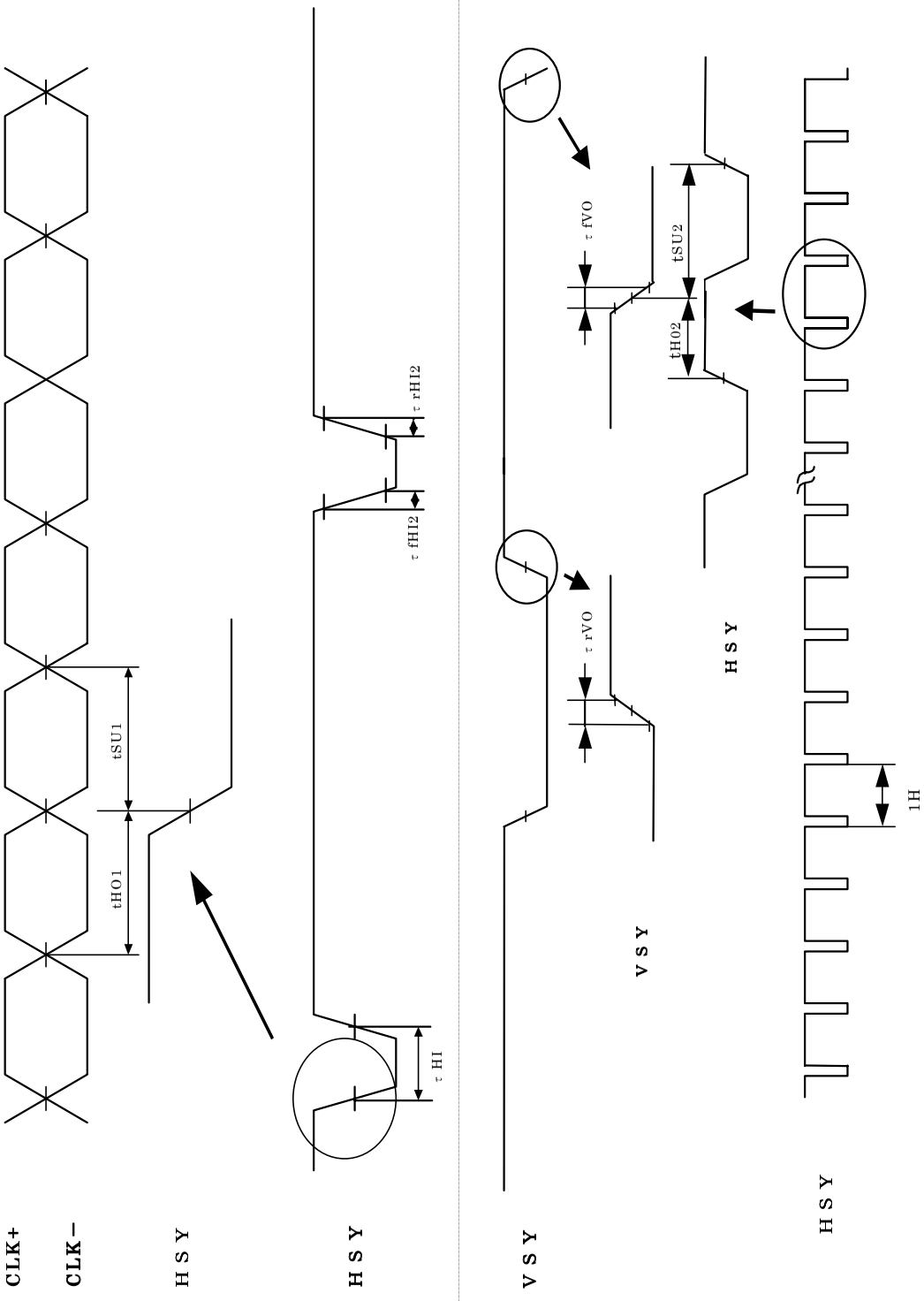


Fig. 4−C Input/Output signal waveforms (external clock mode NTP="Hi", CLKC="Lo")

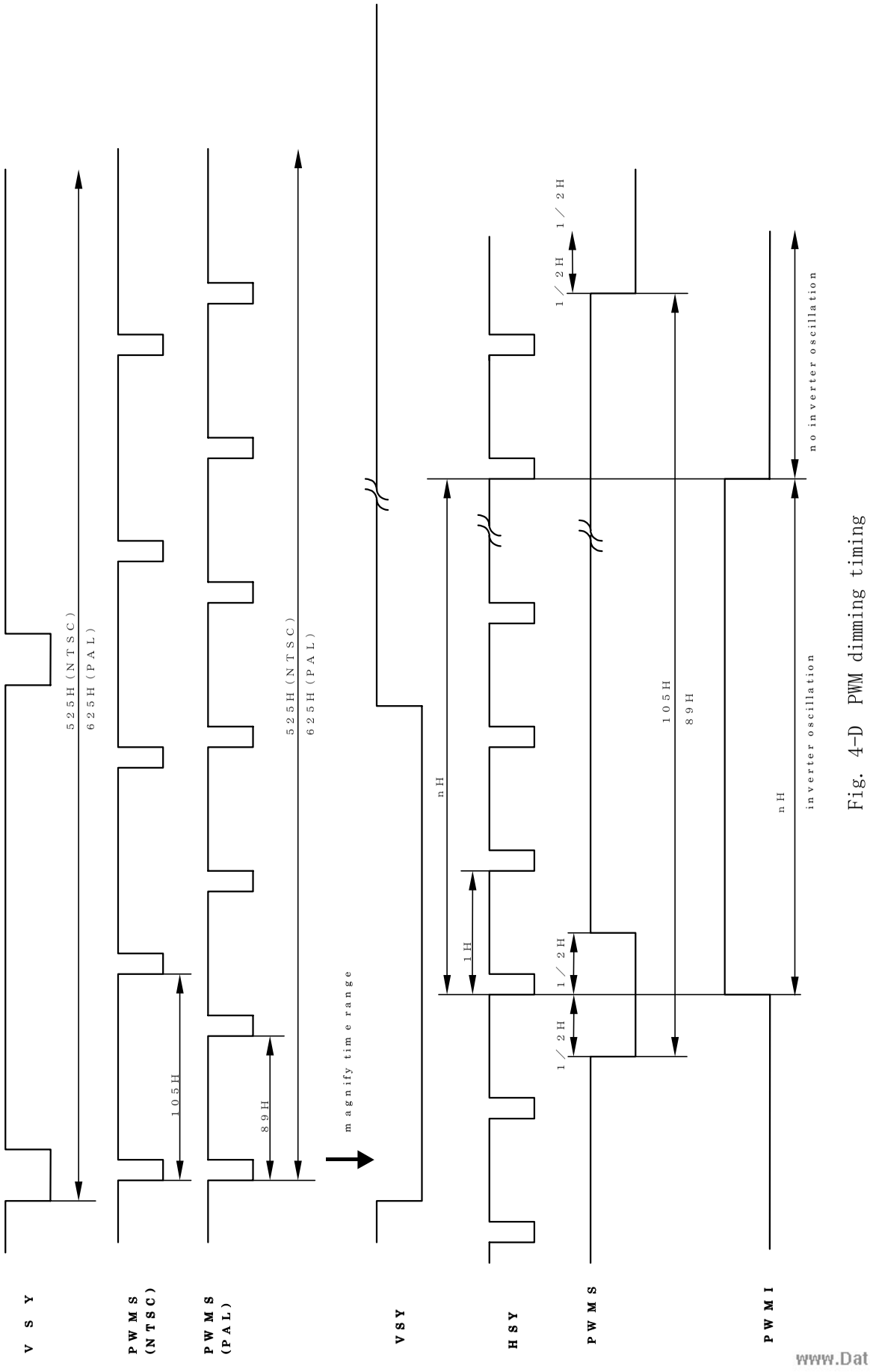


Fig. 4-D PWM dimming timing

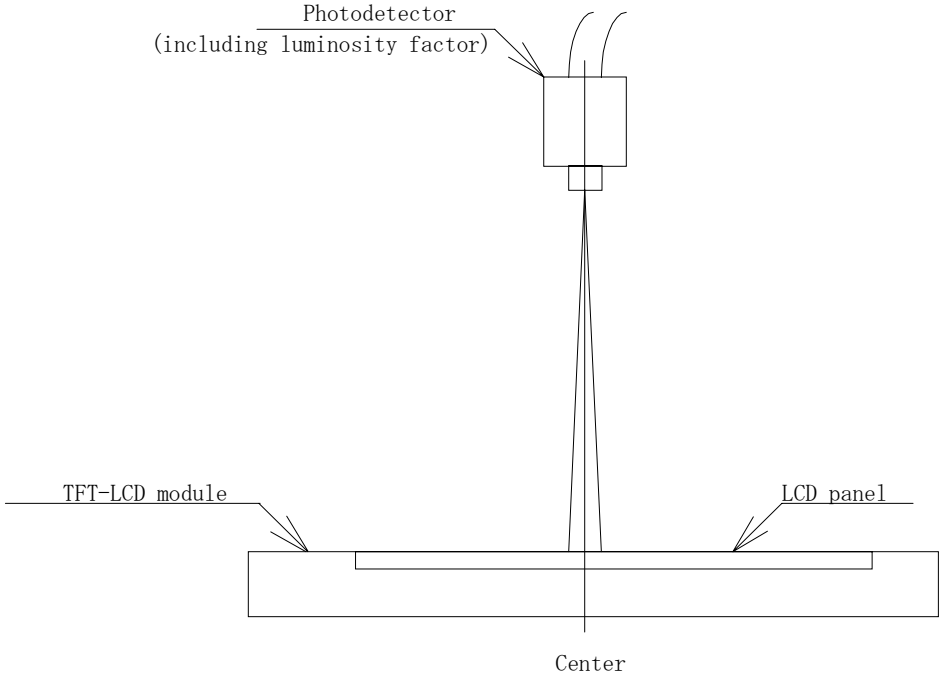


Fig. 5　Measuring method of optical characteristics

【Reference】
Clock and Video signal timing

[Input Condition]

DotClock frequency	f CLK = 8.0MHz
Hsyn. frequency	fH＝15.748kHz
Vsyn. Frequency	fV＝60.107Hz
Video Signal	Cross-Hatching (To show white lines every 24 dots with the background display of Balck) Amplitude = 0.7Vpp TVr＝TVf＝17ns TVH＝125ns

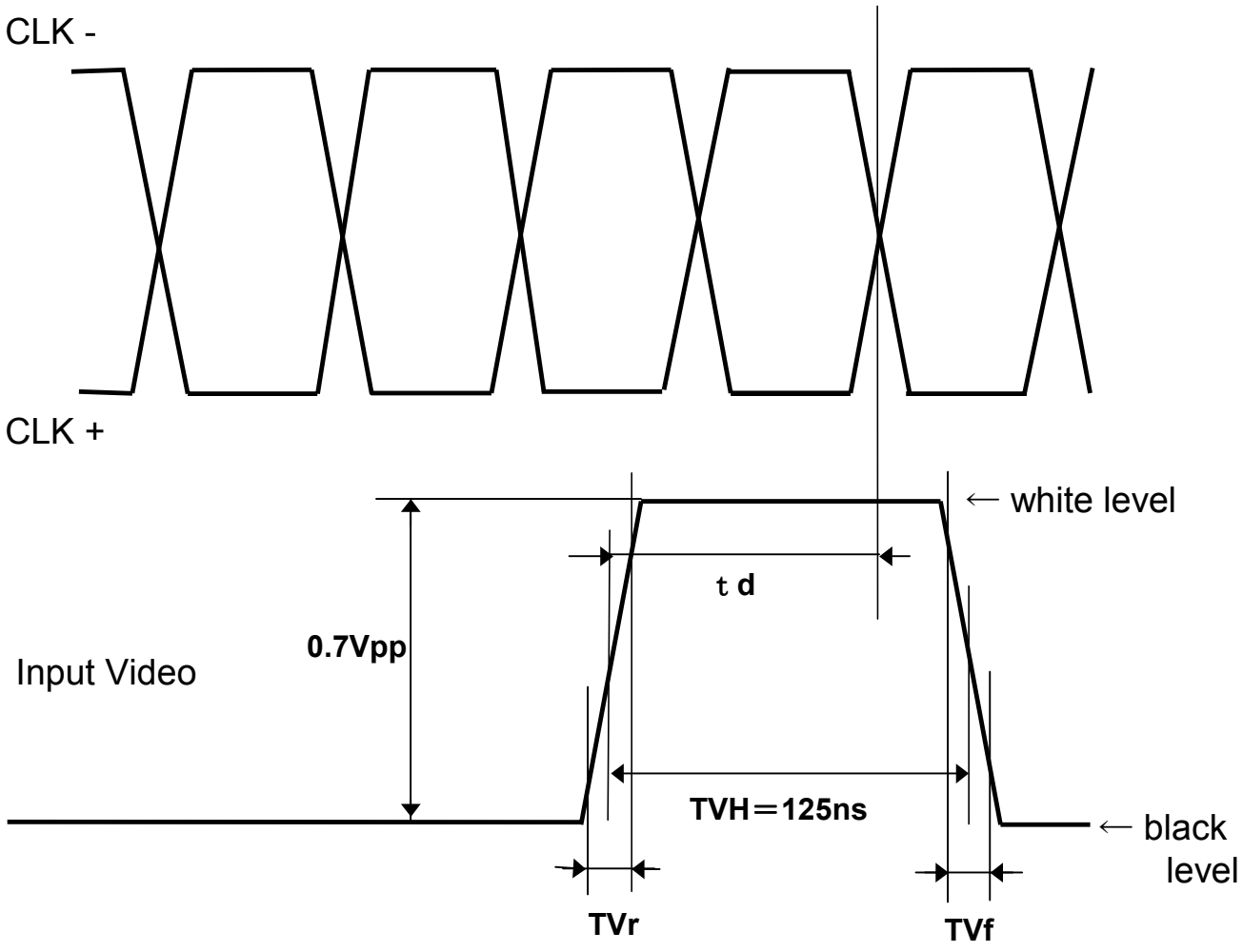


Fig.6 Clock and Video signal timing

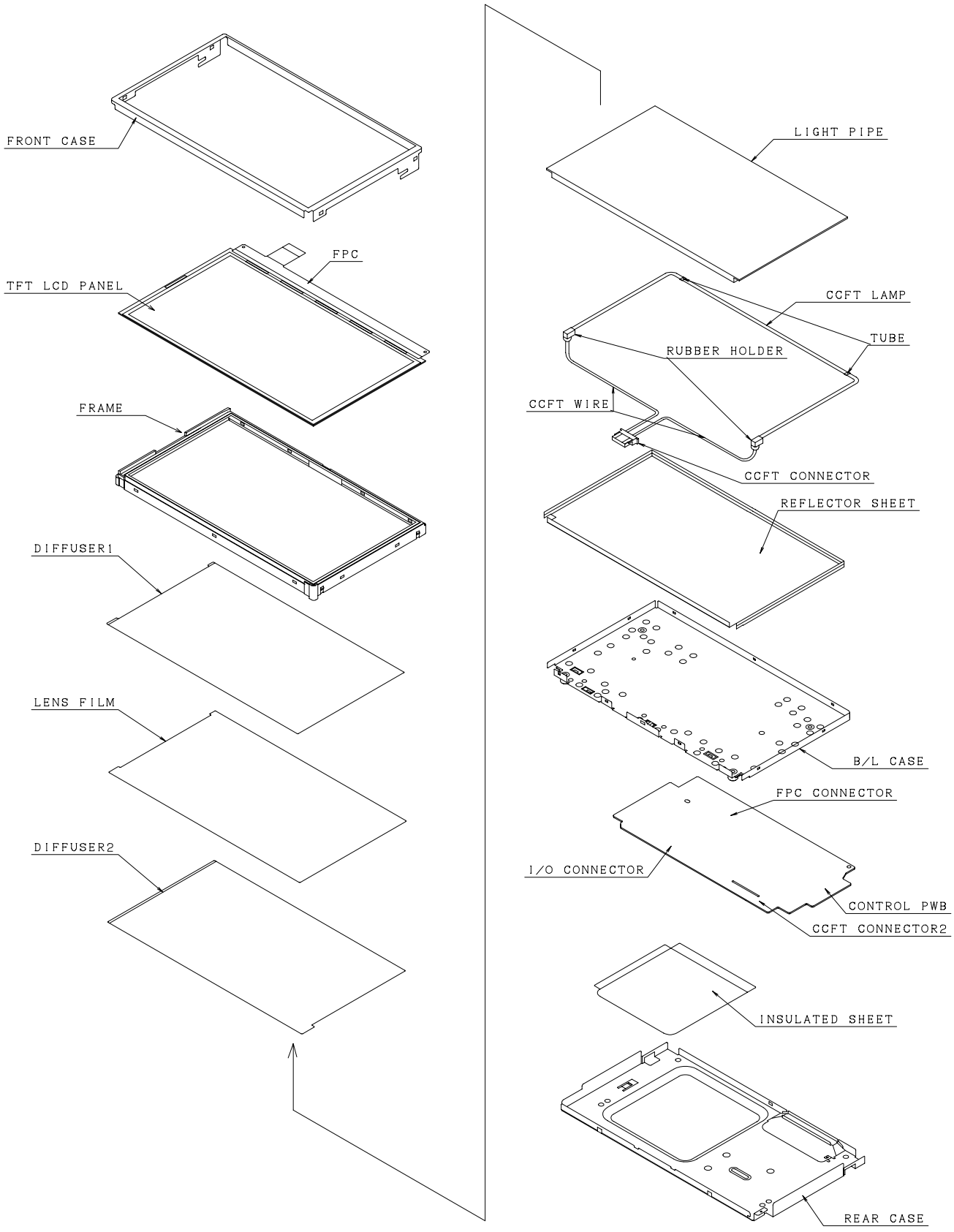


Fig.7 Construction of TFT-LCD module

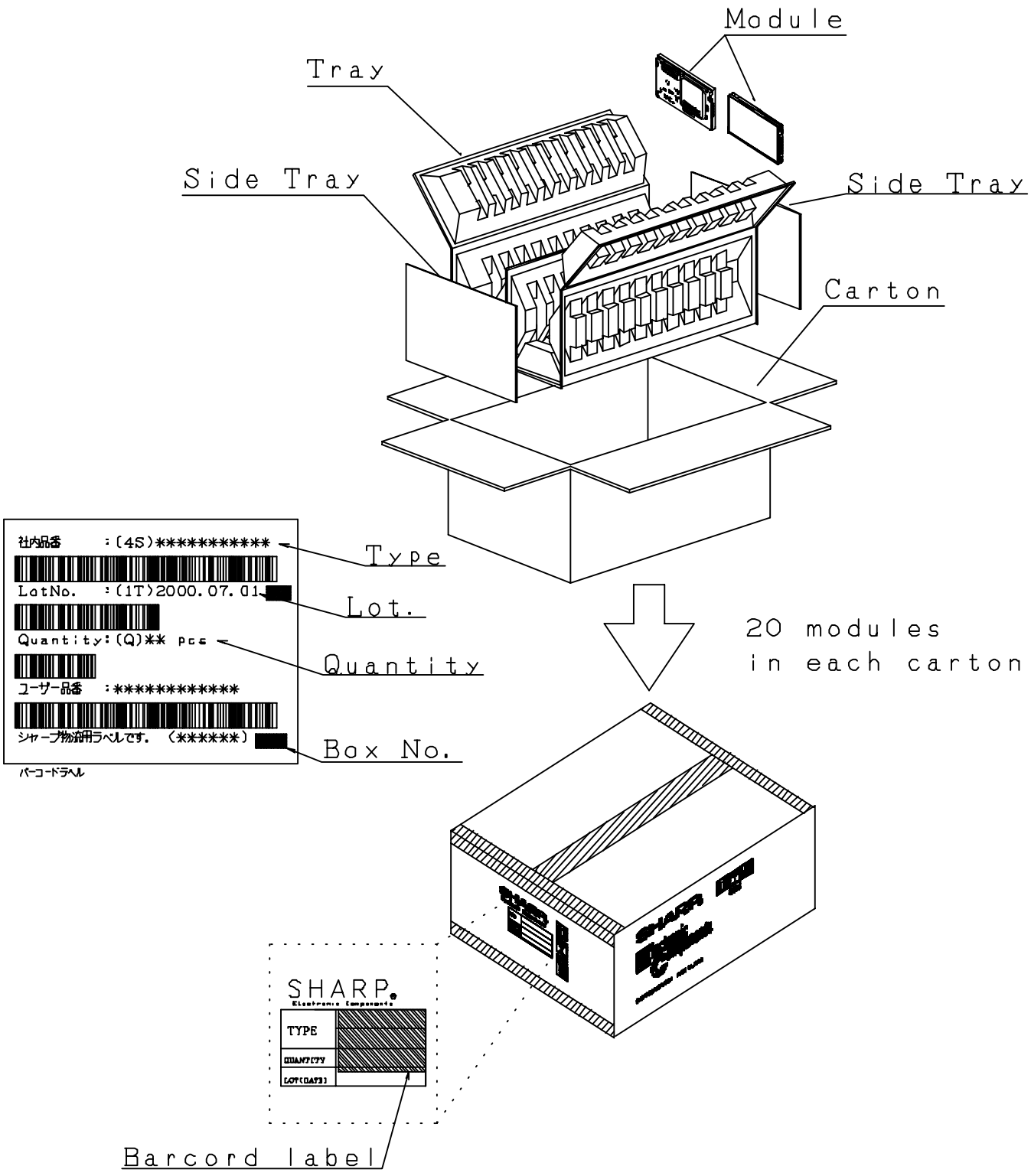


Fig.8 Packing form

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