

PREPARED BY : DATE	<h1>SHARP</h1> <p>TENRI LIQUID CRYSTAL DISPLAY GROUP SPECIFICATION</p>	SPEC No. LD-7808B
		FILE No.
ISSUE : SEP. 14, 1995		
PAGE : 15 pages		
APPROVED BY : DATE		APPLICABLE GROUP Tenri Liquid Crystal Display Group

DEVICE SPECIFICATION FOR
TFT-LCD Module
 MODEL No.
LQ10PS21

•1 CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY



H. FUKUOKA
 Department General Manager
 Engineering Department 2
 TFT LCD Development Center
 TENRI LIQUID CRYSTAL DISPLAY GROUP
 SHARP CORPORATION

1. Application

This specification applies to color **TFT-LCD** module, LQ10PS21.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon **TFT** (Thin Film Transistor). It is composed of a color **TFT-LCD** panel, driver **ICs**, control circuit and power supply circuit. Graphics and texts can be displayed on a 800X3X600 dots panel with 262,144 colors by supplying 18 bit data signals (**6bit/color**), four timing signals, **+5V** DC supply voltage for **TFT-LCD** panel driving.

The backlight system is not installed in this module and the **TFT-LCD** panel used for this model is a high-transmission and higher-color-saturation type. Therefore, this module is suitable for the projection-type multimedia applications.

Horizontal display reversal function is built in this module for the projection use.

[Features]

- ⊙ Low power consumption.
- ⊙ Light weight.
- ⊙ High **transmissivity**
- ⊙ Wide color reproduction range
- ⊙ Mechanical compatibility with the VGA models: LQ10P341.

3. Mechanical Specifications

Parameter	Specifications	unit
Display size	26 (10.4") Diagonal	cm
Active area	211.2(H) × 158.4 (V)	mm
Pixel format	800 (H) × 600 (V)	pixel
	(1 pixel = R + G + B dots)	
Pixel pitch	0.264(H) × 0.264 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions	265.0(W) × 195.0(H) × 8.0(D)	mm
Mass	420 ± 20	g
Surface treatment	Hard-coating 2H (clear)	

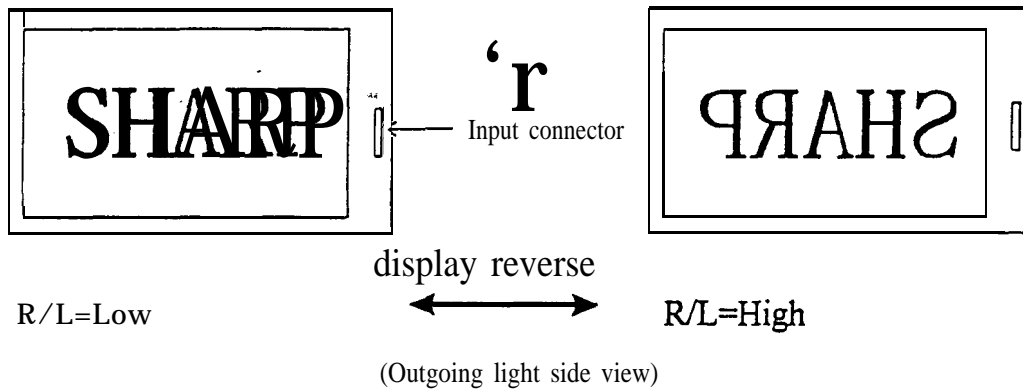
Outline dimensions is shown in Fig. 1

[Note1] The polarity of both synchronous signals are negative.

[Note2] The horizontal display start timing is **settled** in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in 7-2, Don't keep ENAB "High during operation.

[Note 3]

12 o' clock direction



5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V _i	T _a =25°C	-0.3 ~ V _{CC} + 0.3	v	[Note1]
+5V supply voltage	V _{CC}	T _a =25°C	0 ~ + 6.0	V	
Storage temperature	T _{stg}	-	-25 ~ +60	°C	[Note2]
Operating temperature (Ambient)	T _{opa}	-	0 ~ +50	°C	
Wave length of light source	λ _i	-	≧ 400	nm	
Illumination intensity of light source	Il	-	≧ 300,000	lx	[Note3]

[Note1] CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,R/L

[Note2] The temperature at any points of the module, especially on the TFT-LCD panel, should not exceed this specification value.

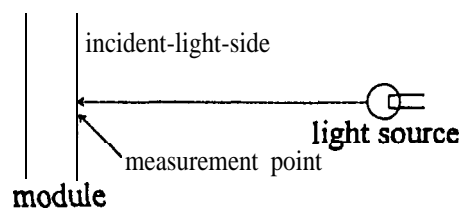
Humidity : 95%RH Max. at T_a ≤ 40°C.

Maximum wet-bulb temperature at 39°C or less at T_a > 40°C.

No condensation.

[Note3] The intensity at any points on the panel should not exceed this specification value. The light source should be placed at the incident-light side.

Measurement point: panel surface



6. Electrical Characteristics

Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	unit	Remark	
+ 5V	Supply voltage	Vcc	+4.5	+5.0	+5.5	V	【Note1】
	Current dissipation	Icc	-	270	425	MA	【Note2】
Permissive input ripple voltage	V _{RP}	“	—	100	mVp-p	Vcc=+5.0V	
Input voltage (Low)	V _{IL}	-	-	0.3VCC	V	【Note3】	
Input voltage (High)	V _{IH}	0.7Vcc	-	-	V		
Input current (low)	I _{OL1}	-	-	1.0	μ A	V _I =0V 【Note4】	
	I _{OL2}	-	-	60.0	μ A	V _I =0V 【Note5】	
Input current (High)	I _{OH1}	-	-	1.0	μ A	V _I =Vcc 【Note6】	
	I _{OH2}	-	-	60.0	μ A	V _I =Vcc 【Note7】	

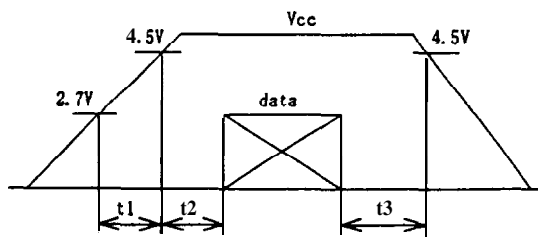
【Note1】

Vcc-turn-on conditions

0 < t1 ≤ 10ms

0 < t2 ≤ 50ms

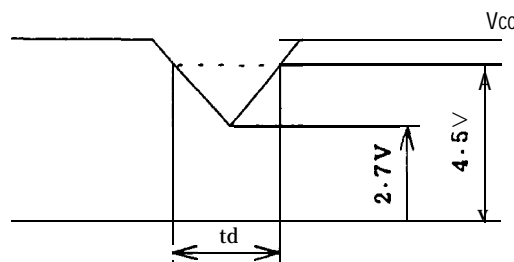
0 < t3 ≤ 1s



Vcc-dip conditions

1) 2.7V ≤ Vcc < 4.5V
td ≤ 10ms

2) Vcc < 2.7V



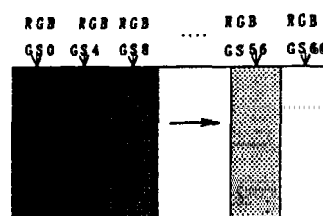
Vcc-dip conditions should also follow the Vcc-turn-on conditions

【Note2】 The typical value of Icc is measured in the following condition.

Vcc=+5.0V

16-gray-bar pattern.

All of the timing parameters are typical value,



【Note3】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,R/L

【Note4】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB

【Note5】 R/L

【Note6】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,R/L

【Note7】 ENAB

7. Timing **Characteristics** of input signals

Timing diagrams of input signal are shown in **Fig.2**.

7-1. Timing characteristics

Parameter		symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	-	40.0	42.0	MHz	
	High time	Tch	6	-	-	ns	
	Low time	Tcl	6	-	-	ns	
	Duty ratio	TH/T	40	50	60	%	
Data	Setup time	Tds	3	-	-	ns	
	Hold time	Tdh	10	-	-	ns	
Horizontal sync. signal	Cycle	TH	20.8	26.4	-	μs	
			832	1056	-	clock	
	Pulse width	THp	2	128	200	clock	
Vertical sync. signal	Cycle	Tv	628	666	798	line	
	Pulse width	TVP	2	4	6	line	
Horizontal display period		THd	800	800	800	clock	
Hsync-Clock phase difference		THc	10	-	Tc-10	ns	
Vertical data start position		TVs	23	23	23	line	
Hsync-Vsync phase difference		TVh	0	-	TH-THp	clock	

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

7-2. Horizontal display position and data enable signal

The horizontal display position is determined by ENAB signal and the input data corresponding to the **rising** edge of ENAB signal is displayed at the left end of the active area.

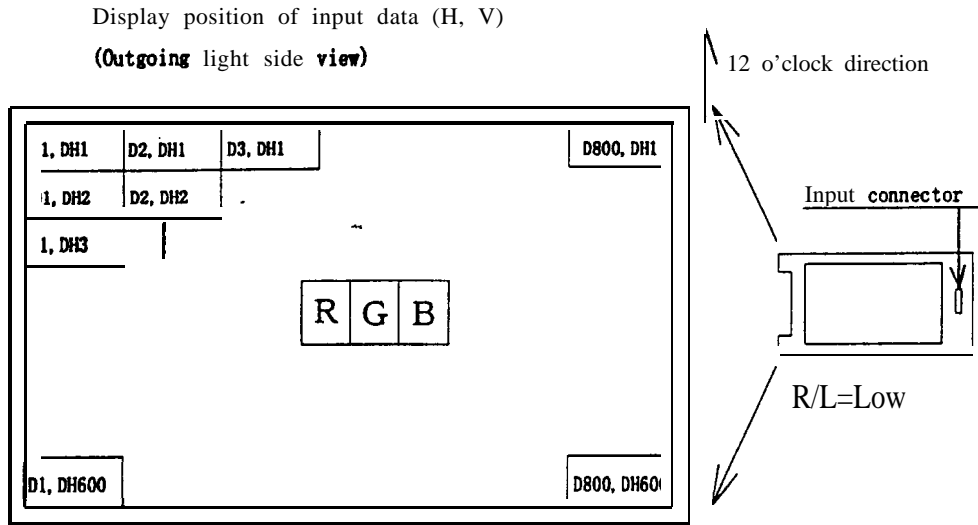
Parameter		Symbol	Min.	Typ.	Max.	unit	Remark
Enable signal	Setup time	Tes	5	-	Tc-10	ns	
	Pulse width	Tep	2	800	Th-10	clock	
Hsync-Enable signal phase difference		THE	58	88	170	clock	

Note) When ENAB is fixed "Low", the display starts from the data of **C88(clock)** as shown in **Fig.2**. Be careful that the module does **not** work when ENAB is fixed "High".

7-3. Vertical display position

The vertical display position, Tvs. is fixed "23" (line).

74. Input Data Signals and Display Position on the screen



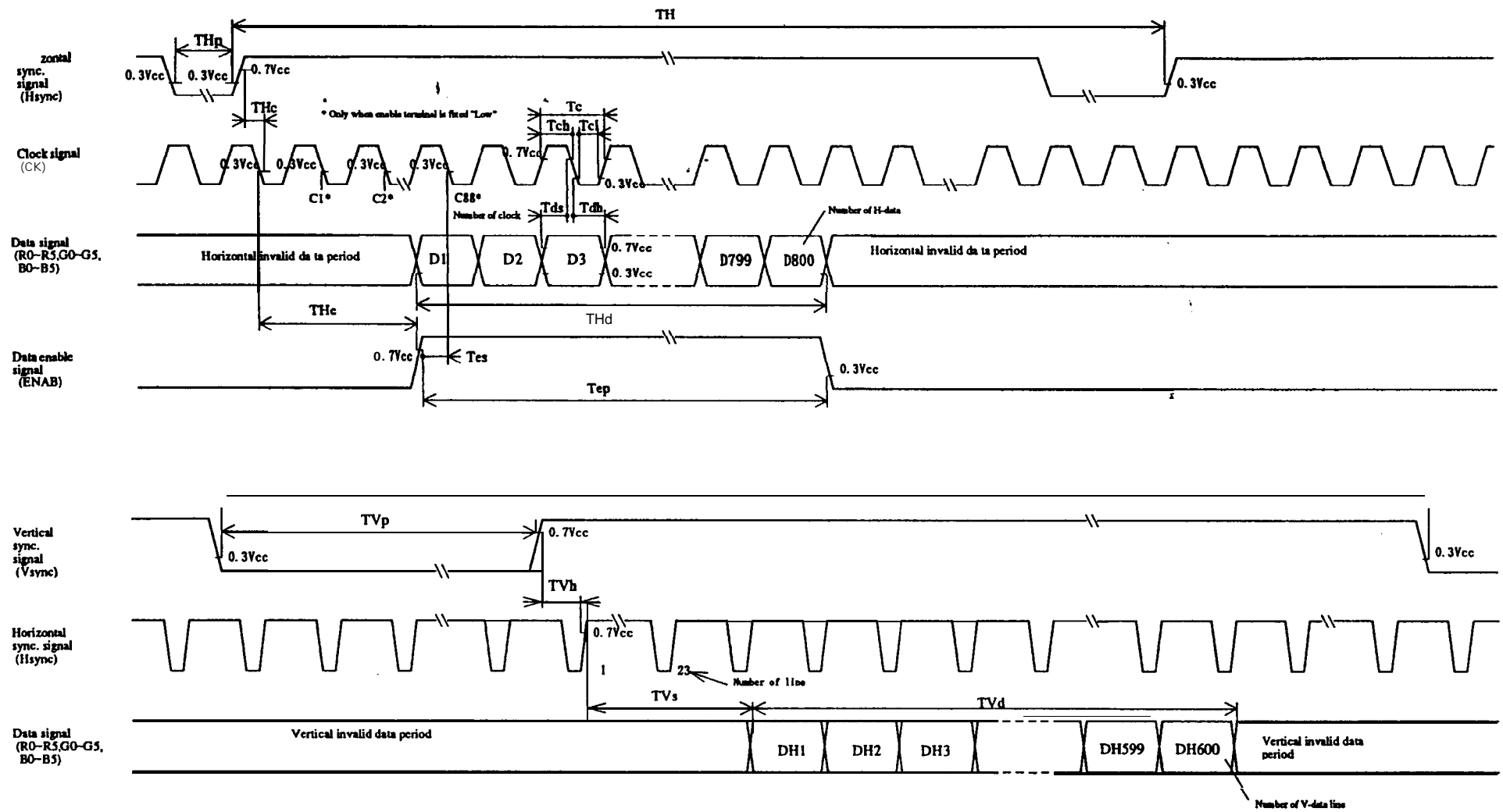


Fig.2 Input signal waveform

8. Input Signals, Basic Display Colors and Gray Scale of Each Color

Colors & Gray scale	Data signal																		
	GrayScale	R0	R1	R2	R3	R4	R5	GO	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Black		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	- 1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Green	-	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Cyan		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red	-	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Magenta	-	1		1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow	-	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
White	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ 0 ↓ Brighter	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓				↓					↓							↓		
	↓				↓					↓							↓		
	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ ↓ Brighter ↓	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↓				↓					↓							↓		
	↓				↓					↓							↓		
	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ ↓ Brighter ↓	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↓				↓					↓							↓		
	↓				↓					↓							↓		
	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0:Low level voltage, 1: High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

9. Optical Characteristics

Ta=25°C. Vcc=+5.0V

Parameter		symbol	Condition	Min.	Typ.	Max.	unit	Remark
Viewing angle range	Horizontal	621,922	CR>10	35	-	-	Deg.	【Note1,4】
	vertical	$\theta 11$		30	-	-	Deg.	
		e 12		10	-	-	Deg.	
Contrast ratio		CR	e =0°	100	-	-		【Note2,4】
Response time	Rise	τr		-	30	-	m s	【Note3,4】
	Decay	τd		-	50	-	m s	
Transmissivity		Tr		5.6	6.8	-	%	【Note4,5】
Shift of Chromaticity (white)	Δx			-0.035	-0.005	+0.025		【Note5,6】
	Δy			-0.010	+0.010	+0.050		

[Backlight for measurement]

Luminance: more than 3,500cd/m² ($\lambda_1 \geq 400\text{nm}$)

*The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

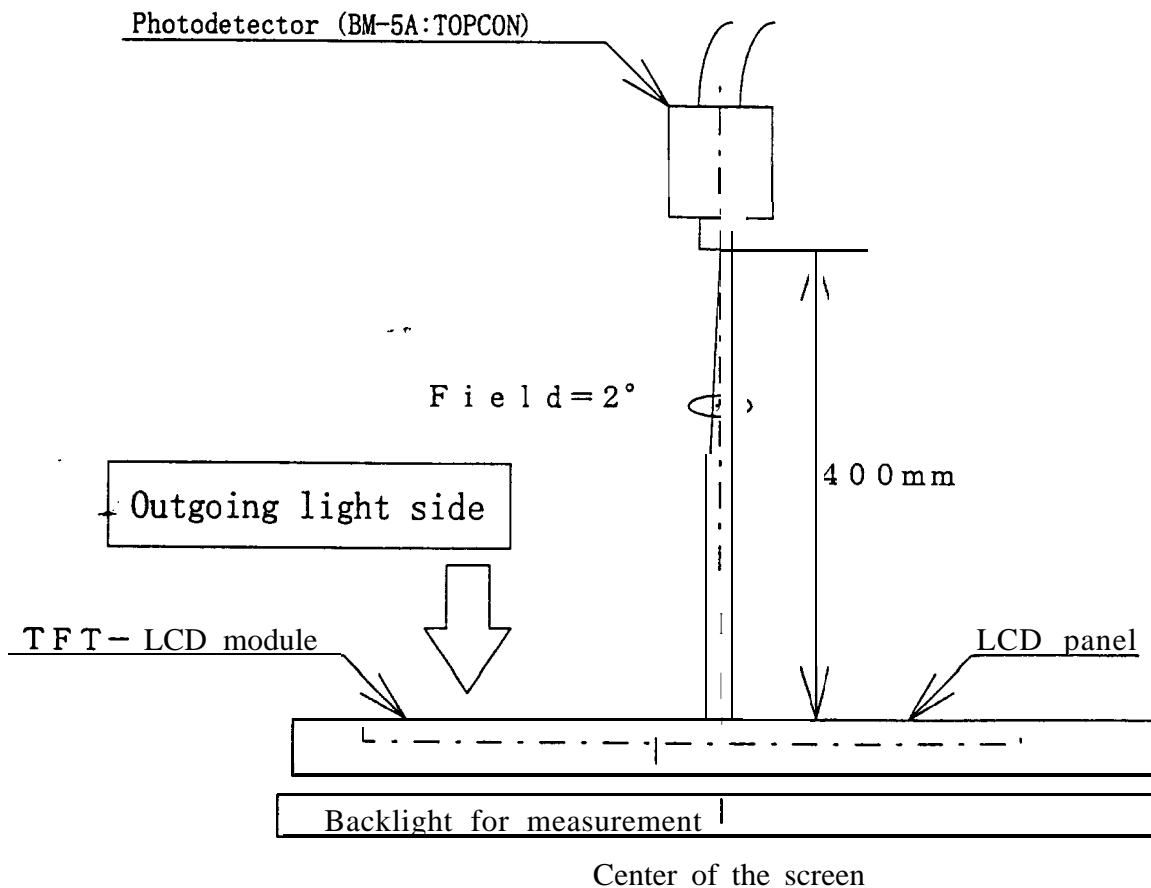
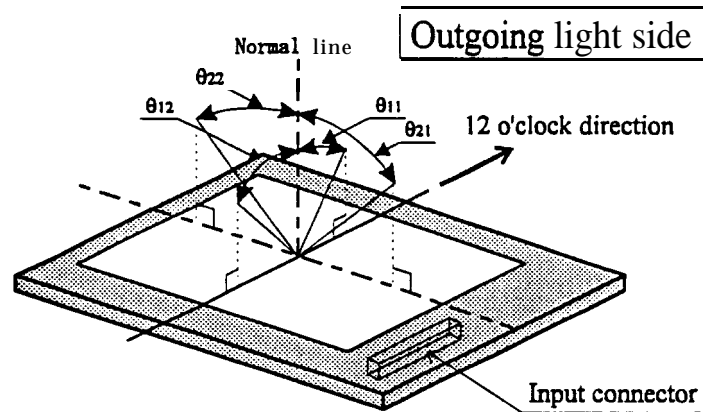


Fig. 3 Optical characteristics measurement

[Note1] Definitions of viewing **angle** range:



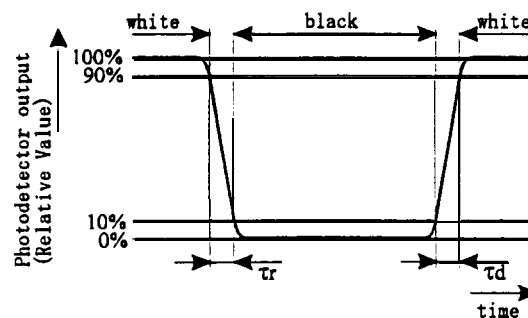
[Note2] Definition of **contrast ratio**:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note3] Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white” .



[Note4] This shall be measured at center of the screen.

[Note5] Definition of **transmissivity**:

Transmissivity is defined as follows.

$$T_r = \frac{\text{Luminance of transmitted light}}{\text{Luminance of incident light}} \times 100 (\%)$$

(Power source is not applied)

[Note6] **Chromaticity shift** is the difference of the chromaticity of the light source and that of the outgoing light through the module.

The values are measured with standard illuminant : C(x=0.310,y=0.316)

10. Display Quality

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

11. Handling Precautions

11-1) When insert or **pull** off the **connector** for the module, please turn off the power supply on the system side.

11-2) Precautions in mounting

A) When installing the module, be sure to fix **the** module on the same plane, not to warp or twist the module.

B) Since the **polarizer** is made of **soft** material, please take care not to scratch the surface.

C) On shipping, laminating film is attached on the panel surface to protect from scratches or dirt.

It is recommended to peel off the laminated film just before the use with strict attention to electrostatic charges.

11-3) Precautions when peeling off the laminated film:

A) Working environment

When the laminated film is peeled off, there may be cases that some particles like dust are stuck on the panel by electrostatic charges or the **TFT** panel is damaged by electrostatic discharge, so the following working environment is recommended.

(a) Anti-electrostatic treatment more than **1M Ω** on the floor.

(b) Work in the clean room.

(c) Humidity: 50% to 70%, **Temperature:** 15°C to 27°C

(d) Worker needs to wear the anti-electrostatic shoes, anti-electrostatic workwear, **anti-electrostatic** gloves and earth band.

B) How to work

(a) Sufficient ionized air blow is needed to avoid electrostatic charge caused by peeling the laminated film. Please keep the distance between the module and the heated ionized air blower within **20cm**.(Fig.①)

(b) Attach an adhesive tape on the laminated film at the corner near the blower to make peeling easier. (Fig.②)

(c) Pull the adhesive tape to your side with the film. Please peel it off slowly and carefully using more than 5 seconds.

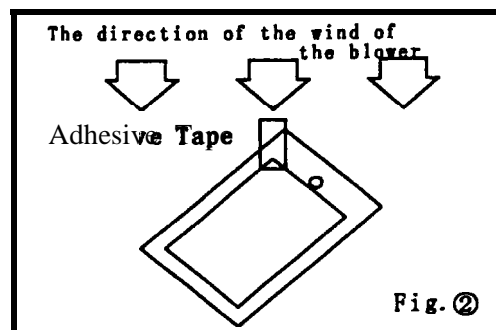
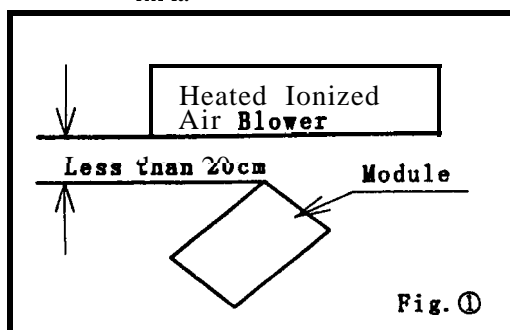
(d) The module after peeling the laminated film must be moved to next work immediately without getting dust.

(e) The way to remove 'dust' from the surface of the polarizer

• Blow it off by nitrogen blow that is taken measures against electrostatic charges.

Ionized air gun is recommended.

• When the polarizer is stained, wipe it gently using a soft cloth like a lens wiper breathing on it.



1 1-3) Others

- A) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- B) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- C) Since the panel is made of **glass**, it may break or crack if dropped or bumped on hard surface.
Handle with care.
- D) Since CMOS LSI is used in this module, take care of static electricity and ground your body when handling.
- E) Observe **all** other precautionary requirements in handling components.

12. Packing form (TBD) .

- 1) Piling number of cartons : MAX 7
- 2) Package quantity in one carton: 10 pcs
- 3) Carton size: 460 (W) X 300 (H) X 380 (D)mm
- 4) Total mass of one carton filled with full modules : 6150 g

Packing form is shown in **Fig.4**

13. Reliability test items

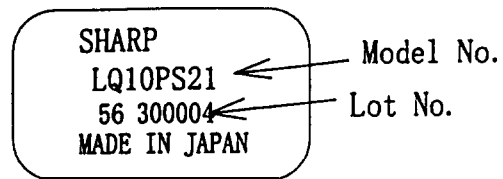
No.	Test item	Conditions
1	High temperature storage test	Ta=60°C 240h
2	Low temperature storage test	Ta=-25°C 240h
3	High temperature & high humidity operation test	Ta=40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50°C 240h (The panel temp. must be less than 60°C)
5	Low temperature operation test	Ta=0°C 240h
6	Vibration test (non- operating)	Frequency : 10~57Hz/Vibration width (one side) :0.075mm : 58~500Hz/Gravity:9.8m/s ² Sweep time: 11 minutes Test period: 3 hours (1 hour for each direction of X,Y,Z)
7	Shock test (non- operating)	Max. gravity: 490m/s ² Pulse width: 11 ms, half sine wave Direction: ±X, ±Y, ±Z once for each direction.

[Result Evaluation Criteria]

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

14. others

1) Lot No. Label: (TBD)



- 2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.
If adjusted value is changed, the. specification may not be satisfied.
- 3) Disassembling the module can cause permanent damage and should be strictly avoided.
- 4) Please be careful that image retention may occur when a fixed pattern is displayed for a long time.
- 5) If any problem occurs in relation to the description of this specification, it **shall** be resolved through discussion with spirit of cooperation.

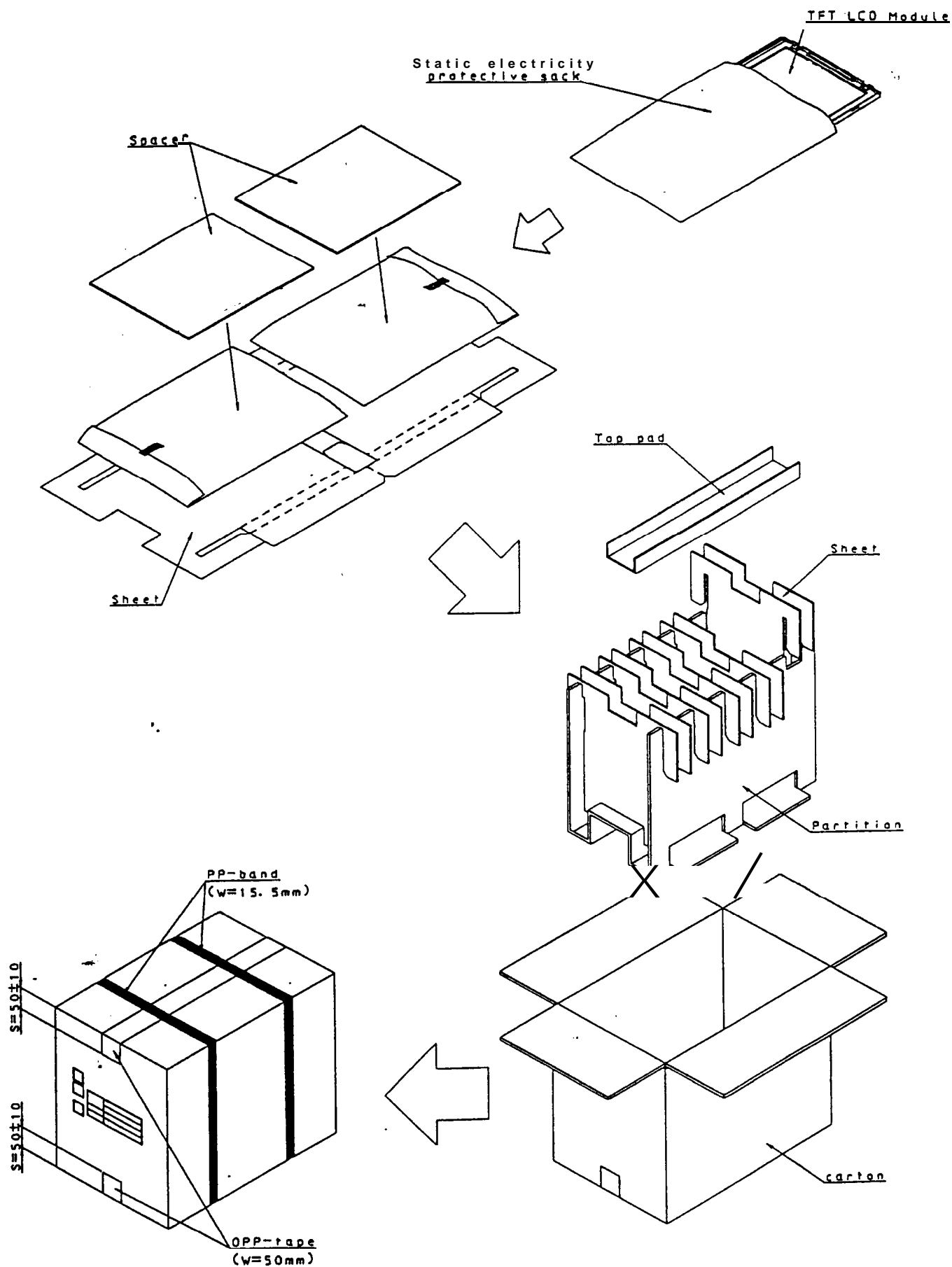


Fig.4 Packing form

