No. LCY-95025B

SHARP CORPORATION

TENTATIVE

TECHNICAL LITERATURE

FOR

TFT-LCD module

MODEL No. LQ64SP1

DATE Mar. 11. 1996

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LIQUID CRYSTAL DISPLAY GROUP

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RECORDS OF REVISION

SPEC NO.	DATE	REVISED NO.	PAGE	SUMMARY	NOTE
LCY-96025A	Mar 7 1996	-	-		1st Issue
LCY-96025B	Mar 11 1996	B	2	Used polarizer: NPF-EG1425DU or equivalent →NPF-EG1425DUHC	Changed "
		"	4	【Note2】 shown display reverse figure" →【Note3】	•
		"	6	【Note2】All of the timing parameters are →All of the timing parameters are typical value	"
		"	7	Note)...may be occured →...may occur.	"
			16	Fig.1:addition of pin number	"

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1. Application

This technical literature applies to a color TFT-LCD module, LQ64SP1.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFTs (Thin Film Transistors). It is composed of a type color TFT-LCD panel, driver ICS, control circuit and power supply circuit. Graphics and texts can be displayed on a 800x3x600dots panel with 262,144 colors by supplying 18 bit data signals(6bit/color), four timing signals and +5.0V DC supply voltage for TFT-LCD panel driving.

A backlight unit is not built in this module and the horizontal and vertical display reverse function is available. Therefore, this module can be used for the projection-type instruments.

[Features]

◎ Low power consumption.
◎ Small footprint and thin shape.
◎ Light weight.
◎ High transmittance panel.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	16 (6.4") Diagonal	cm
Active area	129.6(H) × 97.2(V)	mm
Pixel format	800(H) × 600(V)	pixels
	(1 pixel =R+G+B dots)	
Pixel pitch	O.162(H) × O.162(V)	mm
Pixel arrangement	R, G, B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	175.0(W)x126.5(H)x5.8(D)	mm
Mass	(TBD)	g
Used polarizer (Outgoing light side)	NPF-EG1425DUHC(NITTO DENKO Co., Ltd.)	

*1 Note: excluding the electrical components.

The outline dimensions is shown in Fig.1

4. Input Terminals

4-1. TFT-LCD panel driving

The module-side connector: IL-FRP-40S-HF(JAE)

CN1 The user-side FPC:Shown in Fig. 2

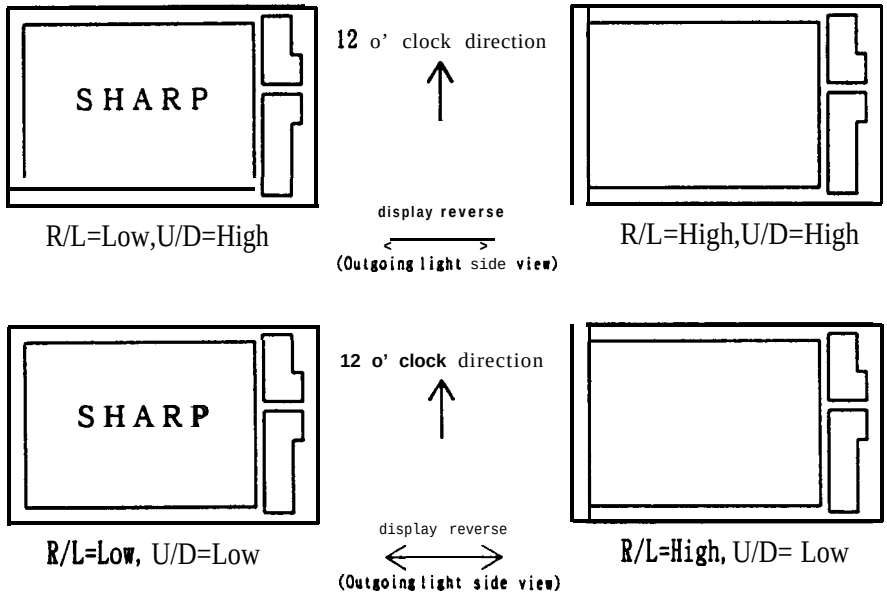
Pin No.	Symbol	Function	Remark
1	GND		
2	CK	Clock signal for sampling each data signal	
3	GND		
4	GND		
5	Hsync	Horizontal synchronous signal	【Note1】
6	Vsync	Vertical synchronous signal	【Note1】
7	GND		
8	R0	RED data signal (LSB)	
9	R1	RED data signal	
10	R2	RED data signal	
11	R3	RED data signal	
12	R4	RED data signal	
13	R5	RED data signal (MSB)	
14	GND		
15	GND		
16	GND		
17	G0	GREEN data signal (LSB)	
18	G1	GREEN data signal	
19	G2	GREEN data signal	
20	G3	GREEN data signal	
21	G4	GREEN data signal	
22	G5	GREEN data signal (MSB)	
23	GND		
24	GND		
25	GND		
26	B0	BLUE data signal (LSB)	
27	B1	BLUE data signal	
28	B2	BLUE data signal	
29	B3	BLUE data signal	
30	B4	BLUE data signal	
31	B5	BLUE data signal (MSB)	
32	GND		
33	GND		
34	GND		
35	ENAB	Signal to settle the horizontal display position	【Note2】
36	V_{cc}	+5.0V power supply	
37	V_{cc}	+5.0V power supply	
38	R/L	Signal to settle the horizontal display reverse	【Note3】
39	U/D	Signal to settle the vertical display reverse	【Note3】
40	GND		

※The shielding case is connected withGND in the module.

【Note1】 The polarity of both synchronous signals are negative.

【Note2】 The horizontal display start timing is settled in accordance with a rising edge of ENAB signal. In case ENAB is fixed “Low”, the horizontal display start timing is determined as described in 7-2. Do NOT keep ENAB “High” during operation.

【Note3】



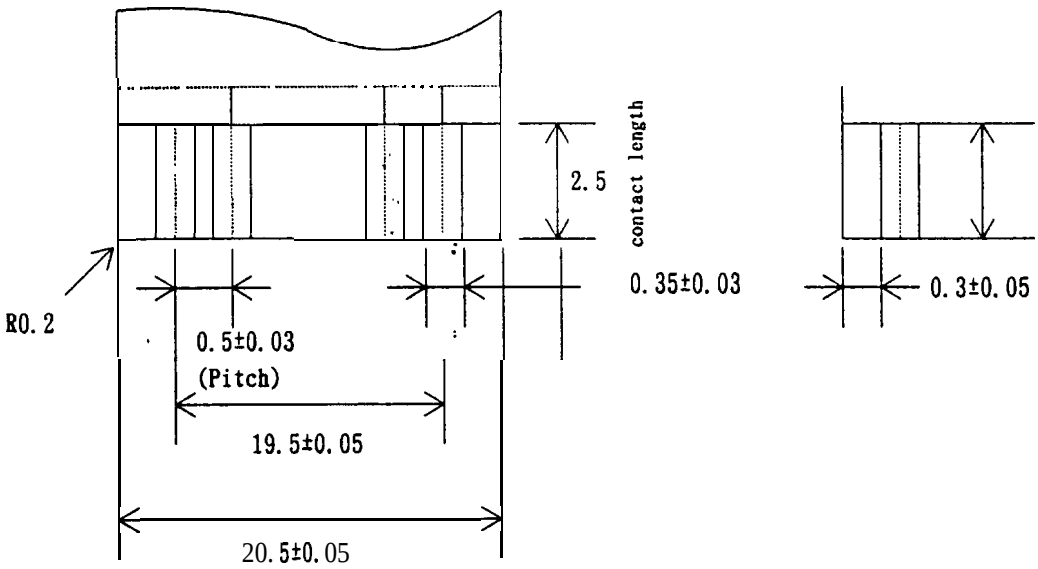


Fig.2 Coressponding FPC Dimensions (Unit: mm)

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25℃	–0.3 ~ V_{CC}+0.3	V	【Note1】
Vcc supply voltage	V_{CC}	Ta=25℃	0 ~ + 7	V	
Storage temperature	T_{stg}	-	-20- +70(TBD)	"C	【Note2】
Operating temperature (Ambient)	T_{opa}	–	0 ~ +60(TBD)	℃	
Panel surface temperature	T_P	–	0 ~ +60(TBD)	℃	【Note5】
Light source wave length	λ_L	–	400s λ_L≤750	nm	
Light source illumination intensity	I_L	–	(TBD)	lx	【Note3. 4

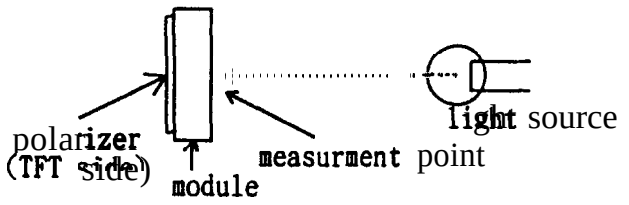
【Note1】 CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D

【Note2】 Humidity : 95%RH Max. at Ta≤40℃.

Maximum wet-bulb temperature at 39℃ or less at Ta>40℃.

No condensation.

【Note3】 Measurement point: panel center(color filter glass side)



【Note4】 Light source shall be placed at incoming light side. (see fig. 1)

【note5】 Temperature difference in panel ‘: less than 5℃

6. Electrical Characteristics

TFT-LCD panel driving Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc Supply voltage	V_{cc}	+4.5	+5.0	+5.5	V	【Note1】
Supply current	I_{cc}	–	(TBD)	(TBD)	mA	【Note2】
Permissive input ripple voltage	V_{RP}	-	-	100	mVp-p	Vcc
Input voltage (Low)	V_{IL}	-	-	$0.3V_{cc}$	V	【Note3】
Input voltage (High)	V_{IH}	$0.7V_{cc}$	-	–	V	
Input current (low)	I_{OL1}	-	-	1.0	μA	V_I=0V ,【Note4】
	I_{OL2}	75	-	1500	μA	" ,【Note5】
	I_{OL3}	-	-	5.0	μA	" ,【Note6】
Input current (High)	I_{OH1}	-	-	1.0	μA	V, =Vcc,【Note5】
	I_{OH2}	-	"	5.0	μA	" ,【Note6】
	I_{OH3}	3	–	60.0	μA	" .【Note6】

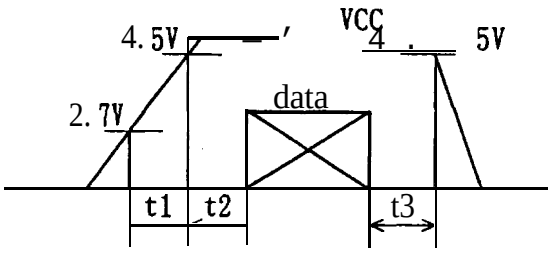
【Note1】

Vcc-turn-on conditions

0≤t1≤10msec

0<t2≤50msec

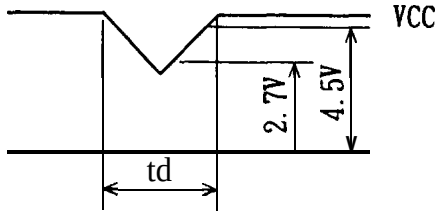
0<t3≤1sec



Vcc-dip conditions

1) 2.7V ≤Vcc<4.5V
td ≤10msec

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.

64-gray-bar pattern.

All of the timing parameters are typical value.

V_{cc}=+5.0V

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

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

【Note5】 R/L, U/D

【Note6】 ENAB

7. Timing Characteristics of input signals

The timing diagrams of the input signals are shown in **Fig. 3.**

7-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/T.	38.0	40.0	42.0	MHz	
	High time	T_{ch}	5	-	–	ns	
	Low time	T_{cl}	5	-	–	ns	
	Duty ration	TH/T	40	50	50	%	
Data	Setup time	T_{ds}	3	–	–	ns	
	Hold time	T_{dh}	10	–	–	ns	
Horizontal sync, signal	Cycle	T_H	20.8	26.4	-	μs	
			832	1056	-	clock	
	Pulse width	T_{Hp}	2	128	200	clock	
Vertical	Cycle	T_V	628	666	798	line	
	Pulse width	T_{Vp}	2	4	6	1 ine	
Horizontal display period		T_{Hd}	800	800	800	clock	
Hsync-Clock phase difference		TH.	10	-	T.-10	ns	
Hsync-Vsync phase difference		T_{vh}	0	-	T_H-T_{Hp}	clock	
Vertical data start position		Tvs	23	23	23	line	

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

7-2. Horizontal display position

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.

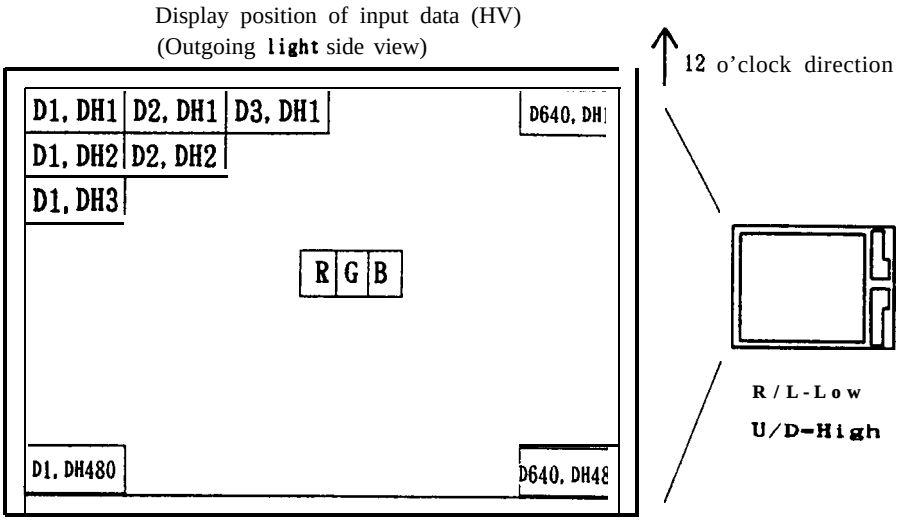
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
ENAB signal	Setup time	T_{es}	5	-	T.-10	ns	
	Pulse width	T_{ep}	2	800	T_H-1	clock	
Hsync-ENAB signal phase difference		TH.	58	88	170	clock	

Note) When **ENAB** is fixed “Low”, the display starts from the data of **C88(clock)** as shown in **Fig. 3.** 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).

7-4. Input Data Signal and Display Position on the screen



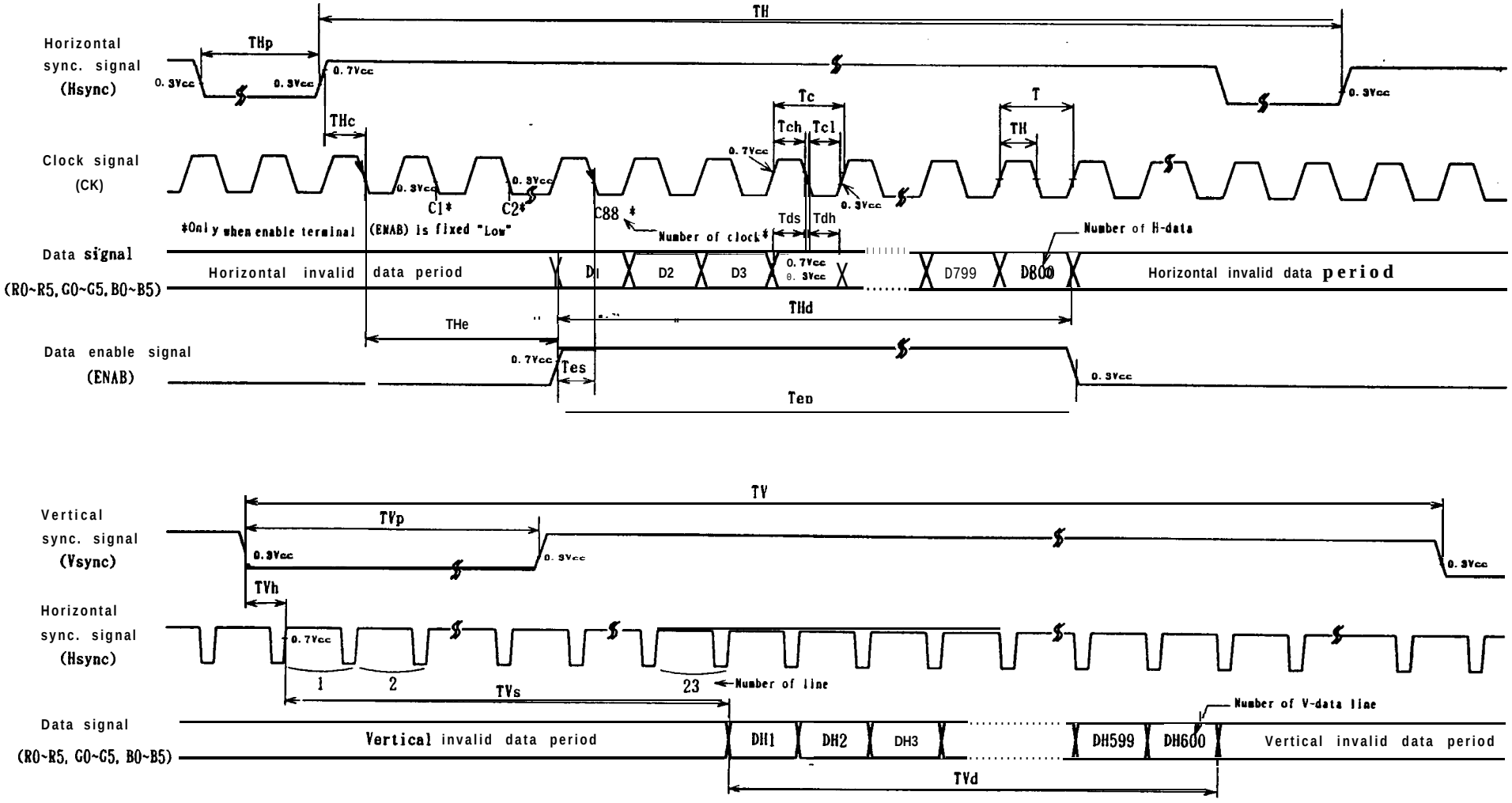


Fig. 3 Input signal waveforms

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

	Color & Gra / scale (GS)	GS	Data signal																	
			RO	R1	R2	R3	R4	R5	GO	G1	G2	G3	G4	G5	BO	B1	B2	B3	B4	B5
Basic color	Black		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue		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	1	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	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
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	↓				↓					↓						↓			
	0	↓				↓					↓						↓			
	Brighter	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
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓					↓						↓			
	⇩	↓				↓					↓						↓			
	Brighter	GS62	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	⇩	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Green		0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	⇧	↓				↓					↓						↓			
	0	↓				↓					↓						↓			
	Brighter	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	1	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℃, Vcc=+5.0V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	$\theta_{21,22}$	$C_R>10$	35	-	-	Deg.	【Note1, 4】
	Vertical	θ_{11}		30	-	-	Deg.	
		θ_{12}		10	-	-	Deg.	
Contrast ratio		C_R		100	-	-		【Note2, 4]
Response time	Rise	τ_r	$\theta=0°$	-	20	-	ms	【Note3, 41
	Decay	τ_d			40	-	ms	
Chromaticity shift		Ax			(TBD)	-		【Note4, 5]
		Ay			(TBD)	-		
Transmissivity		t_r			(TBD)	-	%	*1

*1 Note:excluding the incident side polarizing plate.

The characteristics of the backlight for the measurement of these parameter.

Luminance : I ≧ 3,500cd/m²

Wave length : λ≧ 400nm

The measurement shall be executed 30 ❑ inutes after lighting at rating. This optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.4.

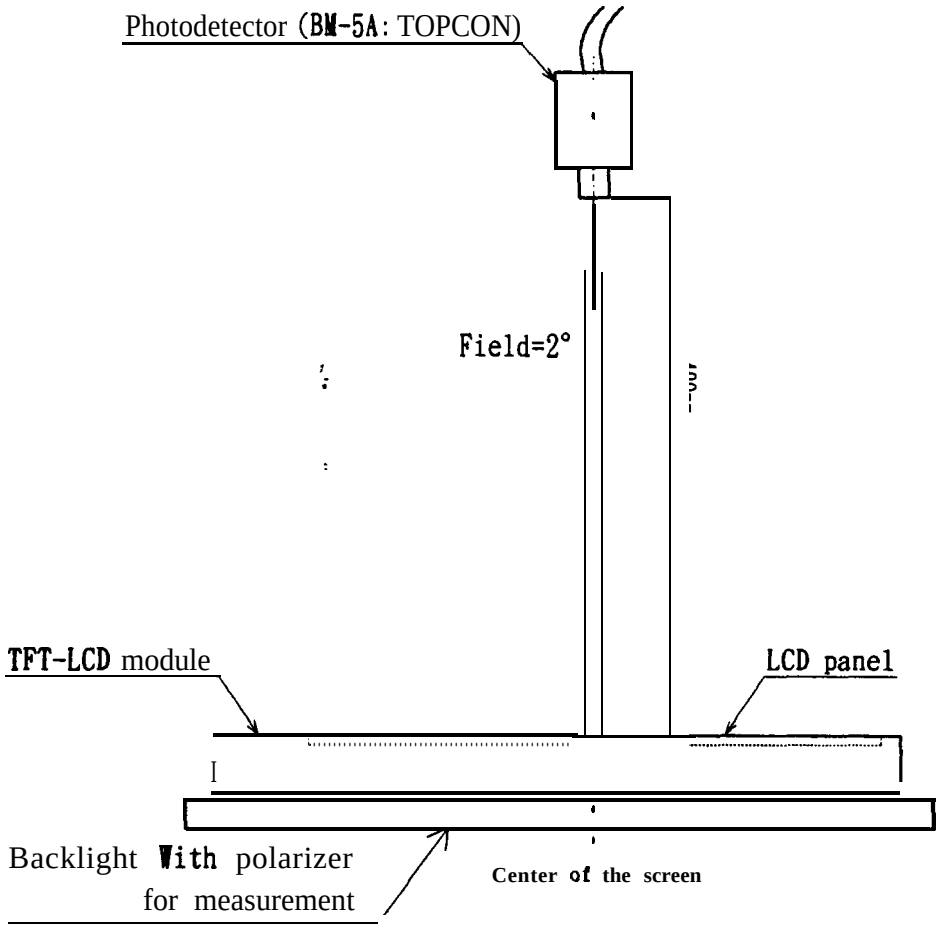
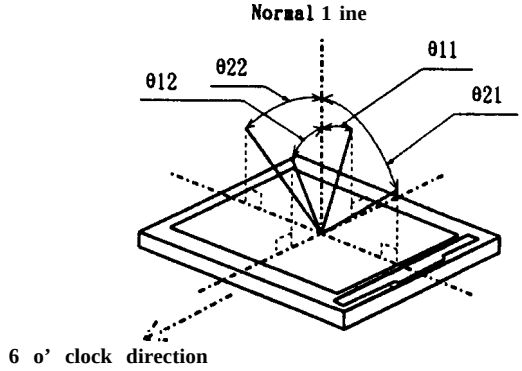


Fig.4 The optical characteristics measuerment method

【Note1】 Definitions of viewing angle range:



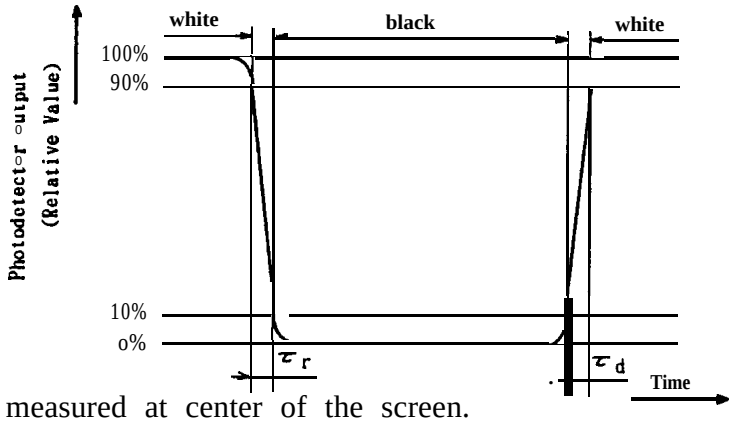
【Note2】 Definition of contrast ratio:

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".



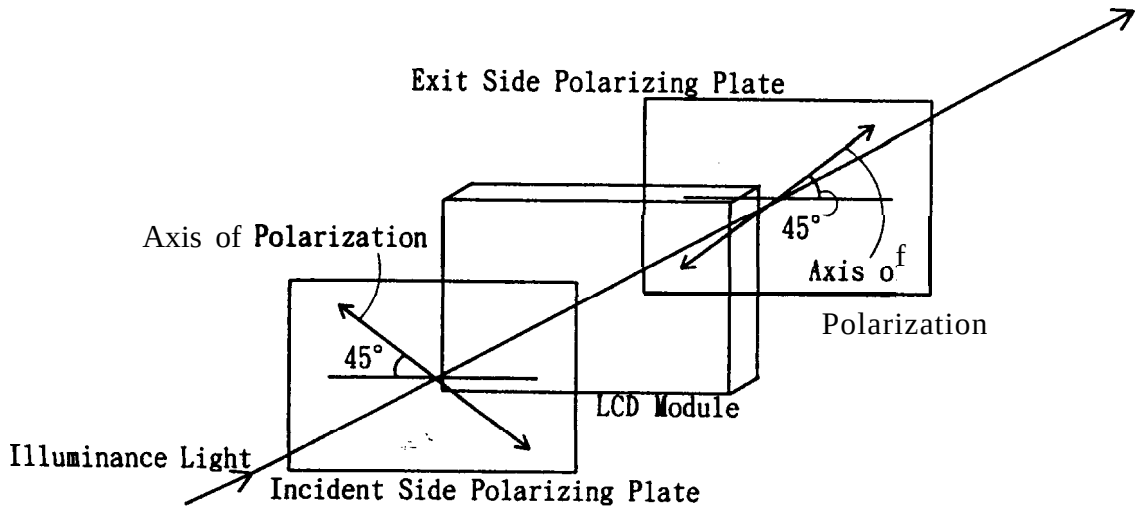
【Note4】 This shall be measured at center of the screen.

【Note5】 Definition of chromaticity shift:

Chromaticity shift is the chromaticity difference of the light source and the outgoing light from the module.

The light source for the measurement is the standard "C", x=O.31O and y=0. 316.

【Note6】 The setting angle of polarizing plate against LC module.



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. Be sure to turnoff the power supply when inserting or disconnecting the cable.

11-2. Precautions in mounting.

a) When installing the module, be sure to fix the module on the same plane, taking care not to warp or twist the module.

b) Since the polarizer is made of soft material, care must be taken not to scratch the surface. Protecive laminated film is attached on the outgoing light side surface glass to protect from scratches or dirts. It is recommended that the laminated film is peeled off, just before the use, with strict attention to electrostatic charges.

※Precautions when peeling off the laminated film:

I) Working environment

When the laminated film is peeled off, there may be cases that some particles like dust are stuck by electrostatic charge, so the following working environment is recommended.

(i) Floor: Anti-electro-static treatment more than 1MΩ on the tile.

(ii) Spread an adhesive mat at a doorway in the clean room.

(i) Humidity: 50% to 70%, Temperature: 15℃ to 27℃.

(iv) Worker needs anti-electro-static shoes, anti-electro-static work wear, anti-electro-static gloves and earth band.

II) Working way

(i) Keep the distance between the module and the heated ionized air blower within 20cm. The module shall be well blown to the wind of the blower. (Fig. ①)

(ii) Attach an adhesive tape toa corner of the laminated film near the heated ionized air blower. (Fig. ②)

(iii) Peel the laminated film pulling the adhesive tape to your side. It is important that it takes more than 5 seconds to peel off the laminated film.

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

(v) The way to remove 'dust' from the polarizer

● B1OW it off by nitrogen blow that is taken measures against electrostatic charges. Ionized air gun is recommended.

•Since polarizer is easily damaged. In unavoidable case, wipe it carefully by the cloth like a wiper for lens, breathing on it.

11-3. The thin liquid crystal layer is packed in theTFT panel. This layer may be disturbed by the external force when the panel surface is pushed strongly an this disturbance may cause the transient display non-uniformity. So do not push the panel surface strongly. If the disturbance occurs, keep the power off for a while.

11-4. Others

a) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

b) Since the front polarizer is easily damaged, pay attention not to scratch it.

c) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

d) When the. panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

e) Since CMOS LSIS are used in this module. take care of static electricity and ensure the human earth when handling.

f) Observe all other precautionary requirements in handling components.

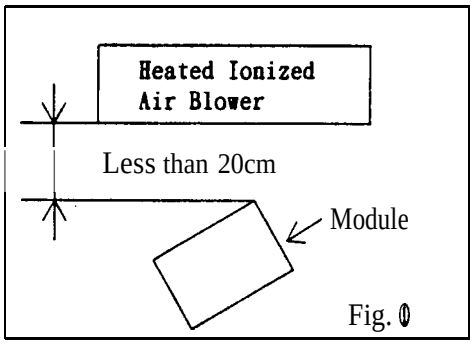


Fig. 0

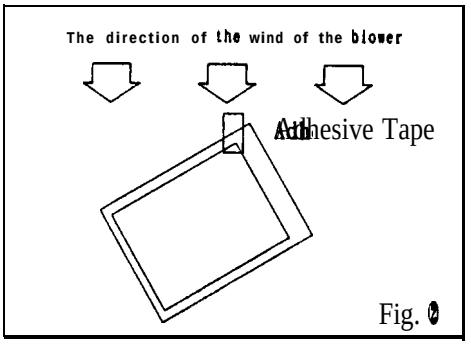


Fig. 0

12. Reliability test items

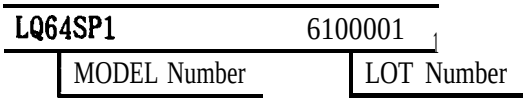
No.	Test item	Conditions
1	High temperature storage test	Ta=70℃ 240h
2	Low temperature storage test	Ta=-20℃ 240h
3	High temperature & high humidity operation test	Ta=40℃;95%RH 240h (No condensation)
4	High temperature operation test	Ta=60℃ 240h (The panel temp. must be less than 60℃)
5	Low temperature operation test	Ta=0℃ 240h
6	Vibration test (non-operating)	Frequency: 10~57Hz/Vibration width (one side): O. 075mm :58~500Hz/Gravity:9. 8m/s² 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/s² Pulse width: 11ms, sine wave Directio$_n$: ±X, ±Y, ±Z once for each direction.

[Evaluation Criteria]

There shall be no change which may affect the practical use of the display under the Display Quality Test conditions.

13. Others

1) Lot No. Label

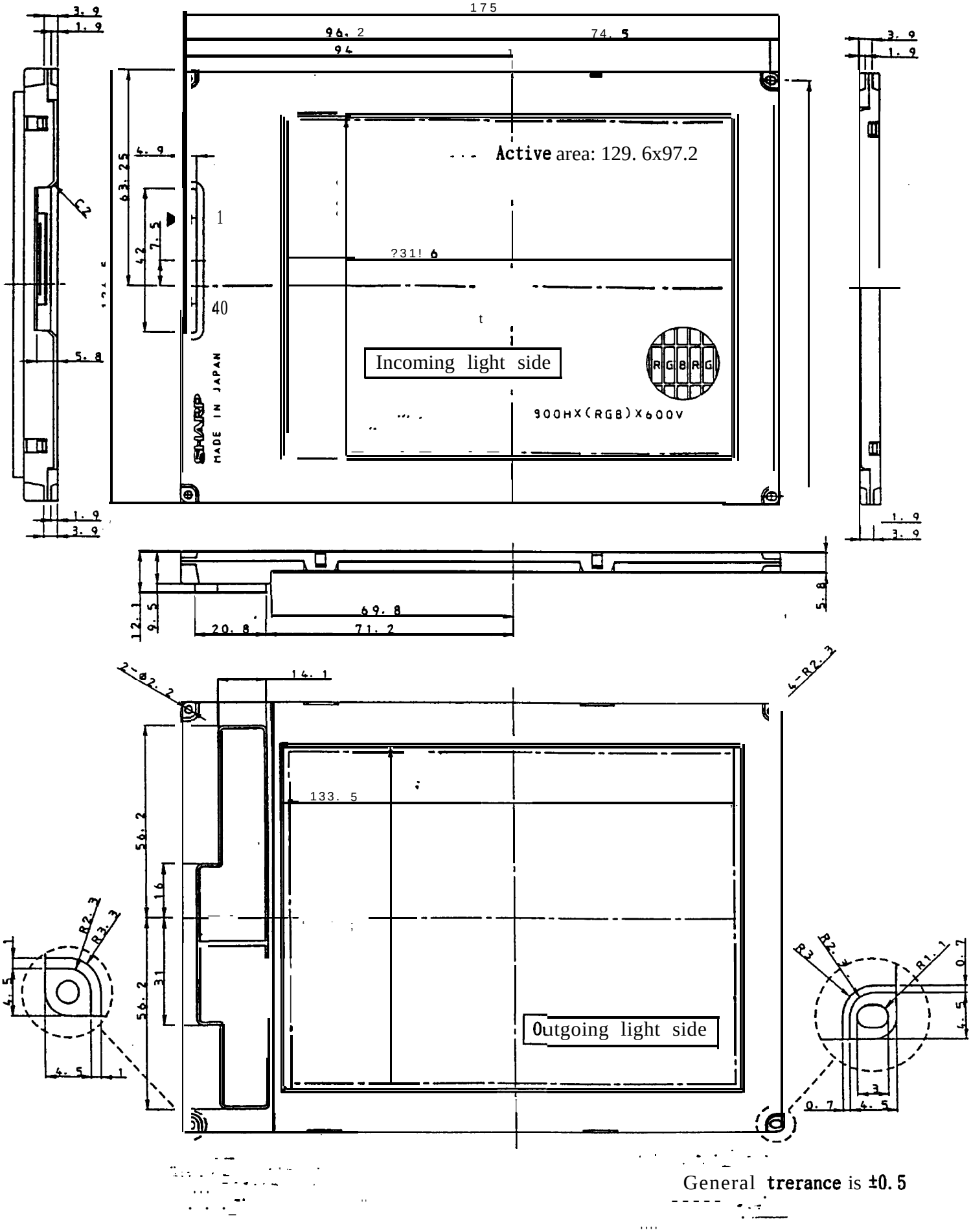


2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the data mentioned in this technical literature may not be satisfied.
3) Disassembling the module can cause permanent damage and should be strictly avoided.
4) If any problem occurs in relation to the description of this technical literature, it shall be resolved through discussion with spirit of cooperation.

14. Packing form

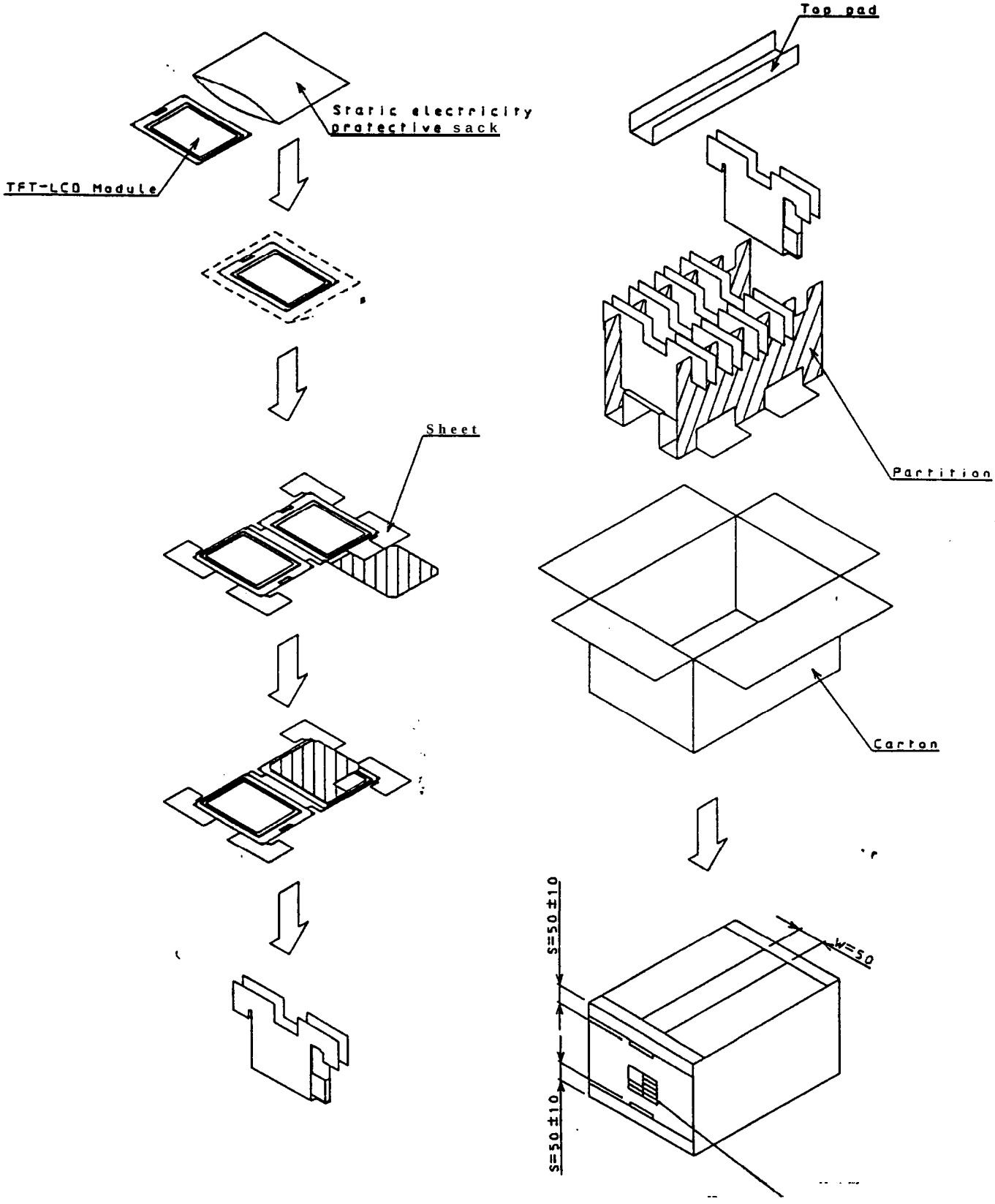
1) Piling number of cartons : MAX. 12
2) Package quantity inone carton : MAX. 10
3) Carton Size : 384(W)x273(H)x219(D)mm

Packing form is shown in Fig.5.



General trerance is ±0.5

Fig. 1 Outline dimensions



TYPE	LQ64SP1
QUANTITY	10
LOT(DATE)	96.**.**

Fig. 5 Packing Form