PREPARED BY : DATE	S H A R P	SPEC No. LCY-99160A
		FILE No.
APPROVED BY : DATE		ISSUE : MAR. 31. 2000
	TFT LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION	PAGE : 20 pages
	SPECIFICATION	APPLICABLE GROUP TFT LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No. **LQ039Q2DS53**

☐ CUSTOMER'S APPROVAL

DATA

BY

PRESENTED

BY

S. YASUDA
DIVISION DEPUTY GENERAL MANAGER
DEVELOPMENT ENGINEERING DEPT. II
TFT DIVISION I
TFT LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

SHARP

RECORDS OF REVISION

MODEL No : LQ039Q2DS53

SPEC No : LCY-99160

	NO.	PAGE	SUMMARY	NOTE
1999.10.27	LCY-99160	-	-	1 st Issue
2000.03.31	LCY-99160A	7	Table 7-2 :	Added
			Lamp current :	
			MIN 1.5[mArms] , MAX 5.5[mArms]	

NOTICE

The application circuit examples in this publication are provided to explain the representative applications of SHARP's devices and are not intended to guarantee any circuit design or permit any industrial property right or other rights to be executed. SHARP takes no responsibility for any problems related to any industrial property right or a third party resulting from the use of SHARP's devices, except for those resulting directly from device manufacturing processes.

In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP's devices shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP's device.

SHARP reserves the right to make changes in the specifications, characteristics, data, materials, structures and other contents described herein at any time without notice in order to improve design or reliability. Contact SHARP in order to obtain the latest specification sheets before using any SHARP's device. Manufacturing locations are also subject to change without notice.

Observe the following points when using any device in this publication. SHARP takes no responsibility for damage caused by improper use of the devices.

The devices in this publication are designed for use in general electronic equipment designs, such as:
Personal computers / Office automation / Telecommunication equipment
Test and measurement equipment / Industrial control / Audio visual and multimedia equipment
Consumer electronics

The appropriate design measures should be taken to ensure reliability and safety when SHARP's devices are used for equipment such as:
Transportation control and safety equipment(i.e., aircraft, trains, automobiles, etc.)
Traffic signal / Gas leakage sensor breakers
Alarm equipment / Various safety devices etc.

SHARP's devices shall not be used for equipment that requires extremely high level of reliability, such as:
Military and space applications / Nuclear power control equipment
Medical equipment for life support

Contact a SHARP representative in advance, when intending to use SHARP's devices for any "specific" applications other than those recommended by SHARP.
Contact and consult with a SHARP representative, if there are any questions about the contents of this publication.

(1) Application

This specification applies to color TFT-LCD module, LQ039Q2DS53.

(2) Overview

This module is a color reflective and active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor), named HR-TFT (High Reflective TFT). It is composed of a color TFT-LCD panel, driver ICs, an FPC, a front light, a touch panel and a back sealed casing. It isn't composed control circuit. Graphics and texts can be displayed on 320 x 3 x 240 dots panel with 262,144 colors by supplying.

Optimum view angle is 12 o'clock. An inverted display mode is selective in the vertical or the horizontal direction.

(3) Mechanical specifications

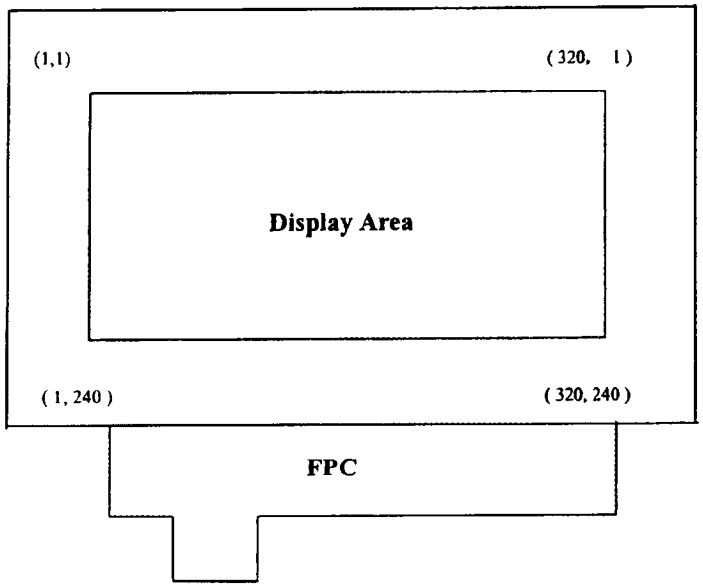
Table 3

Parameter	Specifications	Units	Remarks
Screen size (Diagonal)	9.84 [3.9"] Diagonal	cm	
Active area	79.2 (H) x 58.32 (V)	mm	
Touch panel active area	81.2 (H) x 60.32 (V)	mm	
Pixel format	320(H) x 240(V) (1 pixel = R+G+B dots)	pixels	
Pixel pitch	0.248 (H) x 0.243 (V)	mm	
Pixel configuration	R,G,B vertical stripe		
Unit outline dimension	105.4(W) x 73.86(H) x 5.55(D)	mm	[Note3-1]
Mass	78± 5	g	
Surface hardness (Touch panel)	3H		

[Note 3-1]

Excluding protrusion. For detailed measurements and tolerances, please refer to Fig. 1.

(4) Pixel configuration



(5) Input/Output terminal

5-1)TFT-LCD panel driving section

Table 5-1

Pin No.	Symbol	I/O	Description	Remarks
1	VDD	-	Power supply of gate driver(high level)	
2	VCC	-	Power supply of gate driver(logic high)	
3	MOD	I	Control signal of gate driver	[Note5-1]
4	MOD	I	Control signal of gate driver	[Note5-1]
5	U/L	I	Selection for vertical scanning direction	[Note5-2]
6	SPS	I	Start signal of gate driver	
7	CLS	I	Clock signal of gate driver	
8	VSS	-	Power supply of gate driver(logic low)	
9	VEE	-	Power supply of gate driver(low level)	
10	VEE	-	Power supply of gate driver(low level)	
11	VCOM	I	Common electrode driving signal	
12	VCOM	I	Common electrode driving signal	
13	SPL	I/O	Sampling start signal	
14	R0	I	RED data signal(LSB)	
15	R1	I	RED data signal	
16	R2	I	RED data signal	
17	R3	I	RED data signal	
18	R4	I	RED data signal	
19	R5	I	RED data signal(MSB)	
20	G0	I	GREEN data signal(LSB)	
21	G1	I	GREEN data signal	
22	G2	I	GREEN data signal	
23	G3	I	GREEN data signal	
24	G4	I	GREEN data signal	
25	G5	I	GREEN data signal(MSB)	
26	B0	I	BLUE data signal(LSB)	
27	B1	I	BLUE data signal	
28	B2	I	BLUE data signal	
29	B3	I	BLUE data signal	
30	B4	I	BLUE data signal	
31	B5	I	BLUE data signal(MSB)	
32	VSHD	-	Power supply of digital	
33	DGND	-	Ground(digital)	
34	PS	I	Power save signal	
35	LP	I	Data latch signal of source driver	
36	DCLK	I	Data sampling clock signal	
37	LBR	I	Selection for horizontal scanning direction	[Note5-3]

Pin No.	Symbol	I/O	Description	Remarks
38	SPR	I/O	Sampling start signal	
39	VSHA	-	Power supply(Analog)	
40	V0	I	Standard voltage to generate gray scale voltage	
41	V1	I	Standard voltage to generate gray scale voltage	
42	V2	I	Standard voltage to generate gray scale voltage	
43	V3	I	Standard voltage to generate gray scale voltage	
44	V4	I	Standard voltage to generate gray scale voltage	
45	V5	I	Standard voltage to generate gray scale voltage	
46	V6	I	Standard voltage to generate gray scale voltage	
47	V7	I	Standard voltage to generate gray scale voltage	
48	V8	I	Standard voltage to generate gray scale voltage	
49	V9	I	Standard voltage to generate gray scale voltage	
50	AGND	-	Ground(Analog)	

[Note5-1]See section (7-1)-(A) "*Cautions when you turn on or off the power supply".

[Note5-2]Selection for vertical scanning direction

U/L	Scanning direction (Pixel configuration)
High	Normal scanning (X, 1) ⇓ (X, 240)
Low	Inverted scanning (X, 1) ⇑ (X, 240)

[Note5-3]Selection for horizontal scanning direction

LBR	SPL	SPR	Scanning direction (Pixel configuration)
High	Input	Output	Normal scanning (1,Y) to (320,Y)
Low	Output	Input	Inverted scanning (1,Y) to (320,Y)

5-2) Front light driving section

Table 5-2

Pin No.	Symbol	I/O	Description	Remark
L1	VL1	I	Power supply for fluorescent tube (High voltage)	
L2	VL2	I	Power supply for fluorescent tube (Low voltage)	[Note5-4]

[Note5-4]L2 terminal should be connected to either GND voltage terminal of DC/AC inverter.

5-3) Touch panel driving section

Table 5-3

Pin No.	Symbol	I/O	Description	Remark
T1	Y1	-	Lower electrode Y (12 o'clock side)	
T2	X2	-	Upper electrode X (right side)	
T3	Y2	-	Lower electrode Y (6 o'clock side)	
T4	X1	-	Upper electrode X (left side)	

(6) Absolute Maximum Ratings

Table 6

Parameter	Symbol	Condition	Ratings	Unit	Remark
Power Supply(Source/Analog)	VSHA	Ta=25°C	-0.3 ~ +7.0	V	
Power Supply(Source/Digital)	VSHD	Ta=25°C	-0.3 ~ +7.0	V	
Power Supply (Gate)	VDD	Ta=25°C	-0.3 ~ +35.0	V	
Power Supply (Gate)	VEE-VSS	Ta=25°C	-0.3 ~ +35.0	V	
Power Supply (Gate)	VCC-VSS	Ta=25°C	-0.3 ~ +7.0	V	
Power Supply (Gate)	VDD-VEE (VSS)	Ta=25°C	-0.3 ~ +35.0	V	
Input Voltage (Analog)	VIA	Ta=25°C	-0.3 ~ VSHA+0.3	V	[Terminal 1]
Input Voltage (Digital)	VID	Ta=25°C	-0.3 ~ VSHD+0.3	V	[Terminal 2]
Input Voltage (Touch Panel)	VIT	Ta=25°C	0 ~ +7.0	V	[Note6-1]
Input Current (Touch Panel)	IIT	Ta=25°C	28	mA	[Note6-2]
Operating Temperature (Panel Surface)	Topp	-	0 ~ 50	°C	[Note6-3]
Storage Temperature	Tstg	-	-25 ~ 70	°C	[Note6-4]

[Terminal 1] V0,V1,V2,V3,V4,V5,V6,V7,V8,V9

[Terminal 2] MOD,U/L,SPS,CLS,SPL,R0~R5,G0~G5,B0~B5,LP,DCLK,LBR,SPR,PS

[Note6-1]Terminal of touch panel (X1, X2, Y1, Y2,) are applied.

[Note6-2]Humidity: 95%RH Max.(at Ta ≤ 40°C). Maximum wet-bulb temperature is less than 39°C (at Ta>40°C). Condensation of dew must be avoided.

(7)Electrical characteristics

7-1) Recommended operating conditions

A) TFT-LCD panel driving section

Table 7-1 GND=0V

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage for source driver (Analog)		VSHA	+4.5	+5.0	+5.5	V	
Supply voltage for source driver (Digital)		VSHD	+3.0	+3.3	+3.6	V	
Standard input voltage		V0~V9	0	-	VSHA	V	[Note 7-1]
Supply voltage for gate driver	High voltage	VDD	+14.5	+15.0	+15.5	V	
	Logic high voltage	VCC	VSS+VSHD -0.1	VSS+VSHD	VSS+VSHD +0.1	V	[Note 7-2]
	Logic low voltage	VSS	-14.3	-15.0	-15.7	V	
	Low voltage (AC)	VEEAC	-	VCOMAC	-	Vp-p	[Note 7-3]
	Low voltage (DC)	VEEDC	-9.5	-9.0	-8.5	V	[Note 7-3]
Input voltage for source driver (Low)		VILS	GND	-	0.3VSHD	V	[Note 7-4]
Input voltage for source driver (High)		VIHS	0.8VSHD	-	VSHD	V	[Note 7-4]
Input current for source driver (Low)		IILS	-	-	40	μA	[Note 7-4]
Input current for source driver (High)		IIHS1	-	-	40	μA	[Note 7-5]
		IIHS2	-	-	800	μA	[Note 7-6]
Input voltage for gate driver (Low)		VILG	GND	-	0.2VSHD	V	[Note 7-7]
Input voltage for gate driver (High)		VIHG	0.8VSHD	-	VSHD	V	[Note 7-7]
Input current for gate driver (Low)		IILG	-	-	2	μA	[Note 7-7]
Input current for gate driver (High)		IIHG	-	-	2	μA	[Note 7-7]
Common electrode driving signal	AC component	VCOMAC	-	±2.5	±2.6	Vp-p	[Note 7-8]
	DC component	VCOMDC	+0.4	+1.4	+2.4	V	[Note 7-8]

*Cautions when you turn on or off the power supply

(a) Turn on or off the power supply with simultaneously or the following sequence.

Turn on --- VSHD and VSHA first, then VCC, then VSS, then VEE ,then VDD.

Turn off --- VDD first, then VEE, then VSS, then VCC, then VSHD and VSHA

(b) [illegible]

and it is held until more than double vertical periods after VCC is turned on completely. After then, give it HIGH level voltage until power off.

[Note 7-1]These are standard input voltages for gray scale. When VCOM is alternated polarity, these voltage should be alternated polarity. V0(black) is different polarity alternating signal of VCOM. V9(white) is the same polarity alternating signal of VCOM. Center voltage of each standard input voltage shift positive way for LCD characteristics (namely V0 shifts positive first, then V1, then V2, then V3, then V4, then V5, then V6, then V7, then V8, and then V9). This sift amount is adjusted so as to no flicker of each standard input voltage after DC bias voltage of VCOM and V0 is adjusted.

[Note 7-2] It must be kept that 3.0V ≤ (VCC-VSS) ≤ 3.6V.

① must be held high voltage until turning off the power supply. (Connect Pin No.3 and No.4 terminals to the same signal.)

[Note 7-3]The same phase and amplitude with VCOM. VEEDC is center of VEE.

[Note 7-4]DCLK,SPL,SPR,LBR,LP,PS,R0~R5,G0~G5 and B0~B5 terminals are applied.

[Note 7-5]DCLK,SPL,SPR,LBR,LP,R0~R5,G0~G5 and B0~B5 terminals are applied.

[Note 7-6]PS terminal is applied.

[Note 7-7]MOD,CLS,SPS and U/L terminals are applied.

[Note 7-8]VCOMAC should be alternated on VCOMDC every 1 horizontal period and 1 vertical period. VCOMDC bias is adjusted so as to minimize flicker or maximum contrast every each module .

B) Front light driving section

Table 7-2 Ta=25°C

Parameter	Symbol	MIN	TYP	MAX	Units	Remarks terminal
Lamp voltage	VL	270	300	330	Vrms	(at 5.0mArms)
Lamp current	IL	1.5	5.0	5.5	mArms	
Frequency	fL	30	-	70	kHz	
Kick-off voltage	VS	-	-	550	Vrms	(Ta=25°C)
		-	-	850	Vrms	(Ta=0°C)
Power consumption	WL	-	1.5	-	W	[Note 7-9]

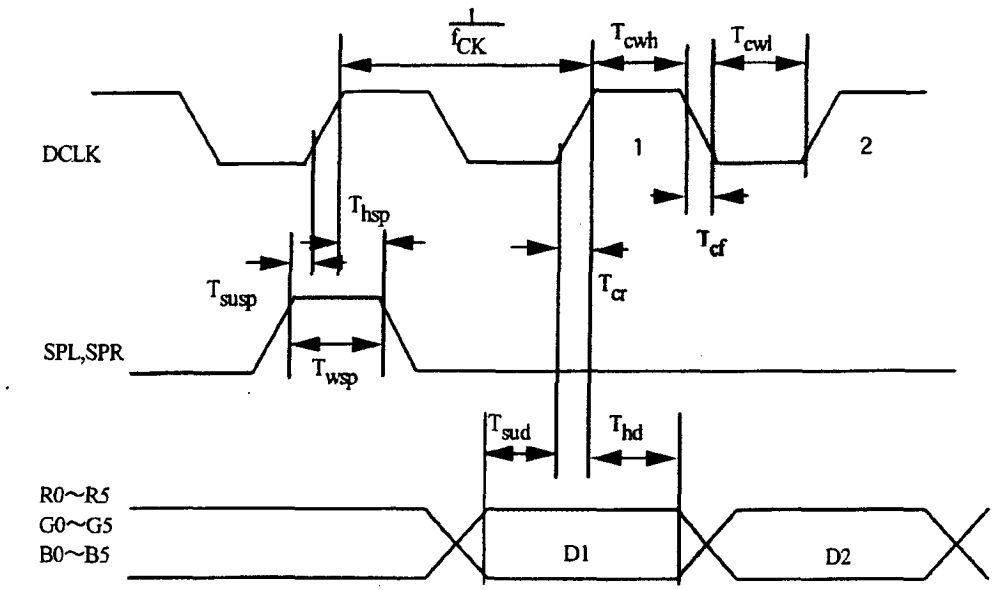
[Note 7-9]Calculated reference value(IL x VL)

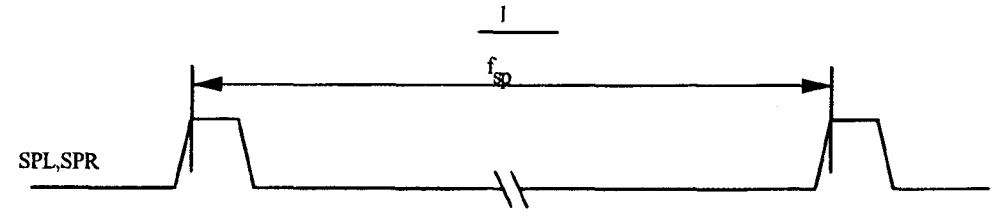
7-2) Timing Characteristics of input signals

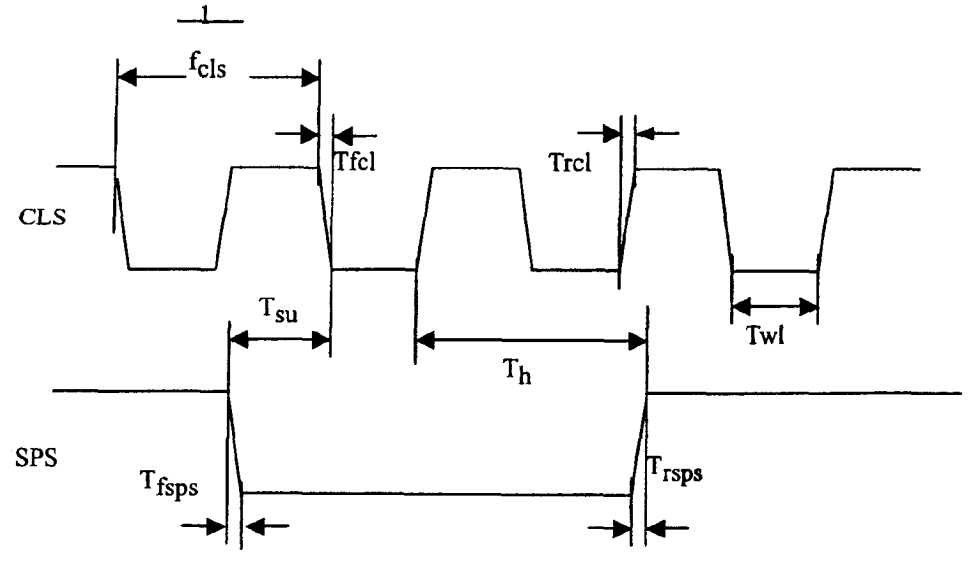
Table 7-3 AC Characteristics (1) (VSHA=+5V, VSHD=+3.3V, Ta=25°C)

Paramcter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock frequency of source driver		fCK	4.5	-	6.8	MHz	
Source driver	Rising time of clock	Tcr	-	-	20	ns	DCLK
	Falling time of clock	Tcf	-	-	20	ns	
	Pulse width (High level)	Tcwh	40	-	-	ns	
	Pulse width (Low level)	Tcwl	40	-	-	ns	
	Frequency of start pulse	fsp	12.5	-	20	kHz	SPL,SPR
	Setup time of start pulse	Tsusp	15	-	-	ns	
	Hold time of start pulse	Thsp	10	-	-	ns	
	Pulse width of start pulse	Twsp	-	-	1.5/fCK	ns	[Note 7-10]
Set up time of data		Tsud	15	-	-	ns	R0~R5,G0~G5,
Hold time of data		Thd	10	-	-	ns	B0~B5
Gate driver	Clock frequency	fcls	12.5	-	20	kHz	CLS
	Pulse width of clock	Twh	5	-	(1/fclk)-45	µs	
	Rising time of clock	Trcl	-	-	100	ns	
	Falling time of clock	Tfcl	-	-	100	ns	
	Frequency of start pulse	fsps	50		78	Hz	SPS
	Setup time of start pulse	Tsu	100	-	-	ns	
	Hold time of start pulse	Th	300	-	-	ns	
	Rising time of start pulse	Trsp	-	-	100	ns	
	Falling time of start pulse	Tfsp	-	-	100	ns	

[Note 7-10]There must be only one up-edge of DCLK (includes Tsusp and Thsp time) in the period of SPL(or SPR)="Hi".


1/fCK
Tcwh
Tcwl
DCLK
1
2
Thsp
Tcf
Tsusp
Tcr
SPL,SPR
Twsp
Tsud
Thd
R0~R5
G0~G5
B0~B5
D1
D2


1/fsp
SPL,SPR


1/fcls
Tfcl
Trcl
CLS
Tsu
Twl
Th
SPS
Tfsps
Trsps

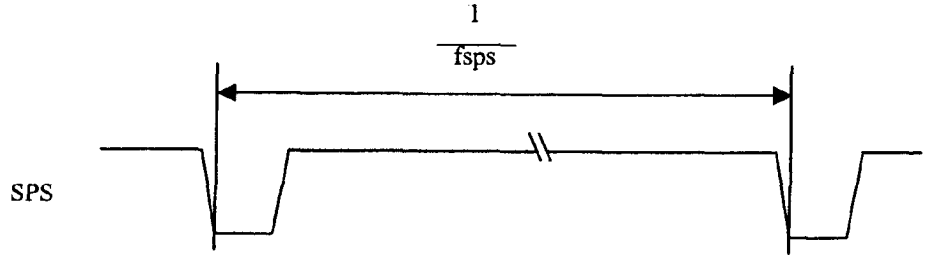
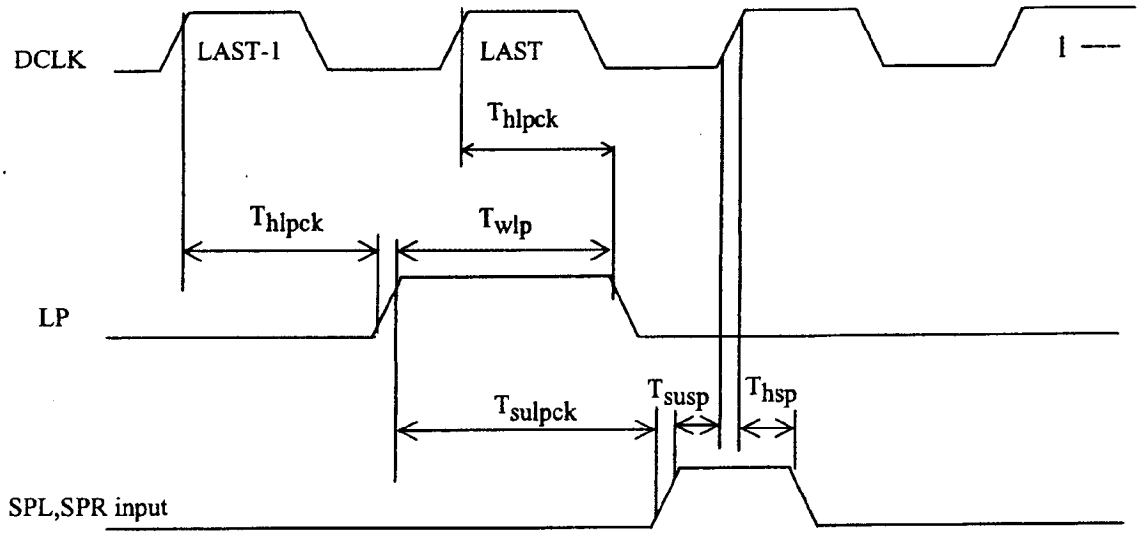

1/fsps
SPS

Table 7-4 AC Characteristics (2)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
LP	Setup time (CK)	Tsulpck	20	-	-	ns	
	Hold time (CK)	Thlpck	20	-	-	ns	
Source LP , High level width		Twlp	20	-	-	ns	



7-3) Power consumption

Measurement condition : SPS=60Hz,CLS=15.73kHz,SPL(SPR)=15.73kHz,DCLK=6.3MHz

The term of PS="Lo" in one horizontal period --- 44μsec(280DCLK)

Ta=25°C

Table 7-5 when normal scan mode

Parameter		Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
Source current	Analog	ISHA	VSHA=+5.0V	-	15	24	mA	[Note 7-11]
	Digital	ISHD	VSHD=+3.3V	-	3.0	5.0	mA	[Note 7-11]
Gate current	High	IDD	VDD=+15.0V	-	0.15	0.45	mA	[Note 7-12]
	Low	IEE	VEE=-9.0±2.5V	-	-0.1	-0.3	mA	[Note 7-12]
	Logic High	ICC	VCC=-11.7V	-	0.05	0.15	mA	[Note 7-12]
	Logic Low	ISS	VSS=-15.0V	-	-0.2	-0.6	mA	[Note 7-12]

[Note 7-11]Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot.

[Note 7-12]64-Gray-bar vertical pattern (GS0 ~ GS63 for horizontal way)

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

Table 8

	Colors & Gray scale	Data signal																	
		Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	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	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	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	0	1	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	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
Gray Scale of bleu	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	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
	⇧	↓			↓						↓						↓			
	⇩	↓			↓						↓						↓			
	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
	Bleu	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

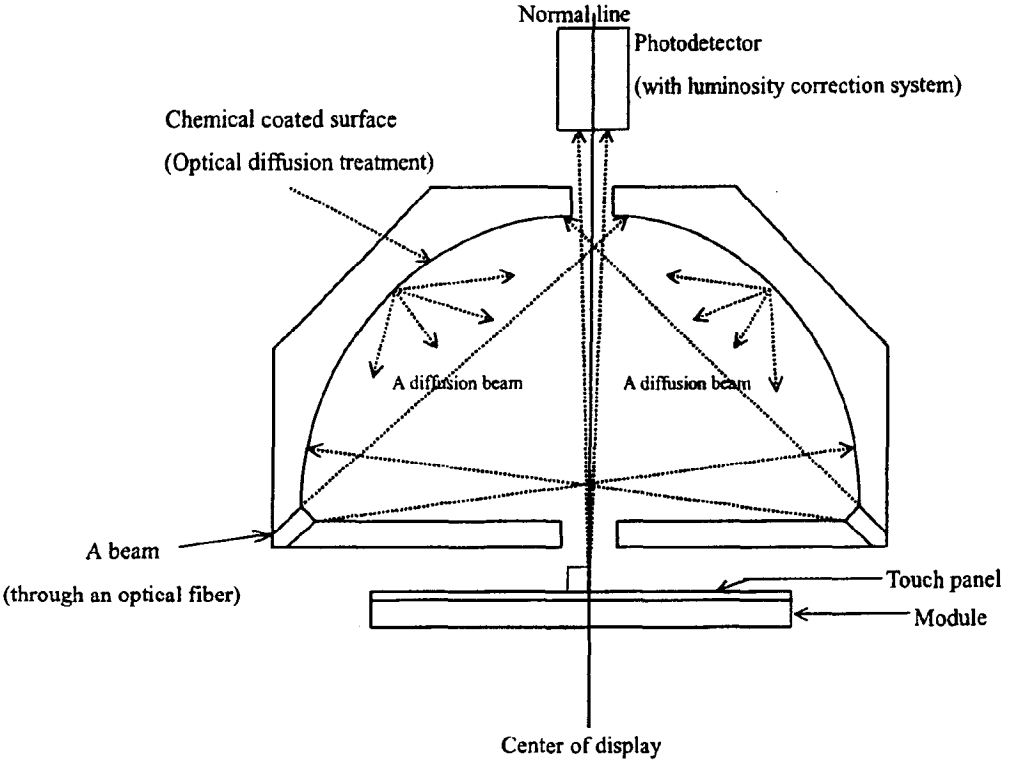
9-1)Not driving the front light condition

Table 11 Ta=25°C

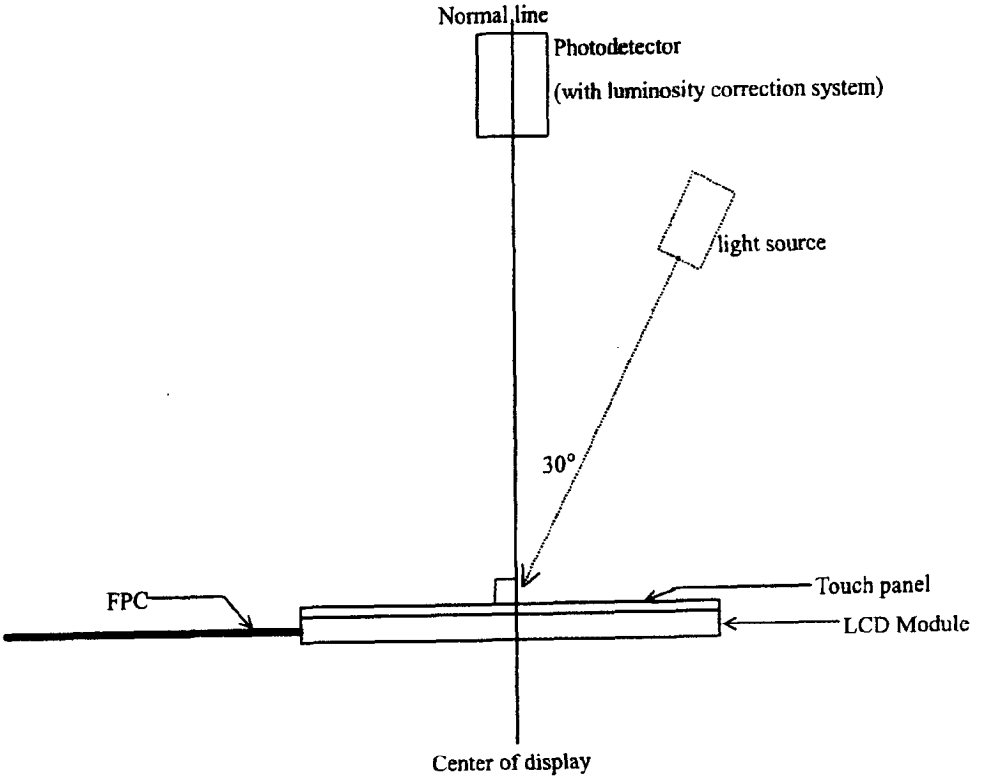
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		θ21,22	CR≥1.2	35	50	-	degree	[Note 9-1,2,8]
		θ11		35	50	-	degree	
		θ12		35	50	-	degree	
Contrast ratio		CRmax	θ =0°	4	5	-		[Note 9-2,5]
				(10)	(20)	-		[Note 9-2,3]
Response time	Rise	τ r		-	30	60	ms	[Note 9-3,4]
	Fall	τ d		-	50	100	ms	
White chromaticity		x		(0.26)	(0.30)	(0.33)		[Note 9-5]
		y		(0.31)	(0.34)	(0.39)		
Reflection ratio		R		8	11	-	%	[Note 9-3,6]

* The measuring method of the optical characteristics is shown by the following figure.

* A measurement device is Otsuka luminance meter LCD5000.(With the diffusion reflection unit.)



Measuring method (a) for optical characteristics



Measuring method (b) for optical characteristics

9-2)Driving the front light condition

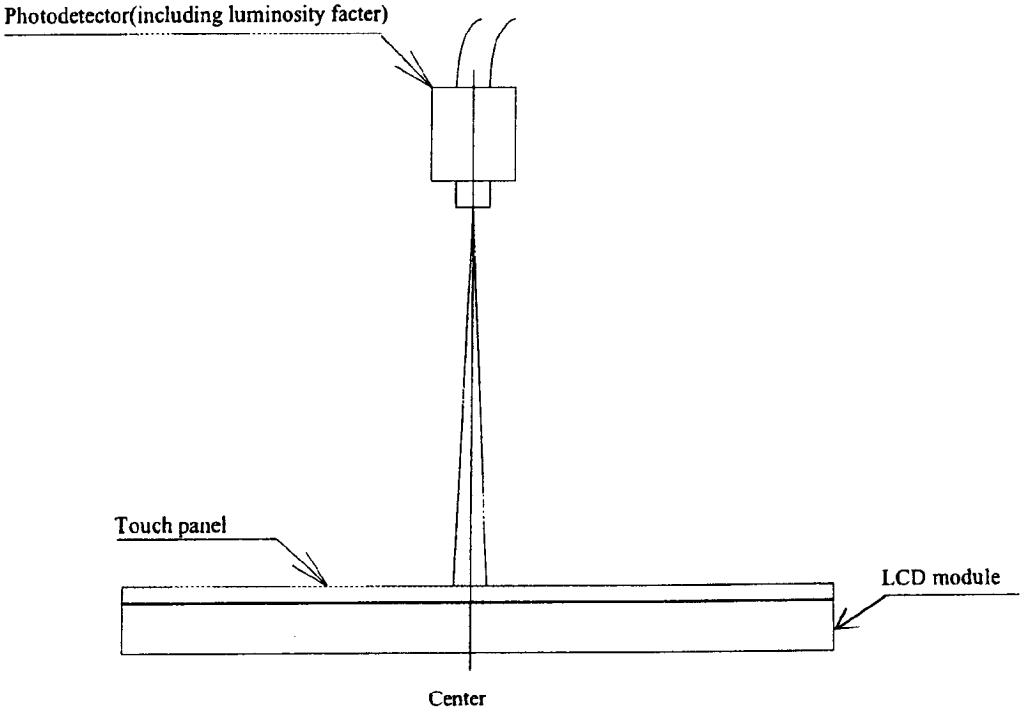
Table 12

Ta=25°C

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		θ21,22	CR≥2	50	60	-	degree	[Note 9-1,2]
		θ11		35	40	-	degree	
		θ12		35	40	-	degree	
Contrast ratio		Crmax	θ = 0°	7	11	-		[Note 9-2]
Response time	Rise	τ r		-	30	60	ms	[Note 9-3]
	Fall	τ d		-	50	100	ms	
White chromaticity		x		(0.26)	(0.28)	(0.33)		
		y		(0.28)	(0.31)	(0.39)		
Brightness		Y	θ = 0° IL=5.0mA	25	40	-	(cd/m2)	
Lamp life time		LL	IL=5.0mA	10000	-	-	hour	[Note 9-7]

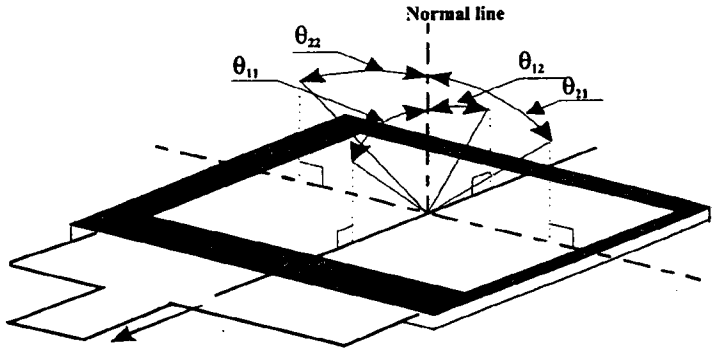
* The measuring method of the optical characteristics is shown by the following figure.

* A measurement device is TOPCON luminance meter BM-5(A).(Viewing cone 1)



Measuring method (c) for optical characteristics

[Note 9-1] Viewing angle range is defined as follows.



6o'clock direction

Definition for viewing angle

[Note 9-2] Definition of contrast ratio:

The contrast ratio is defined as follows:

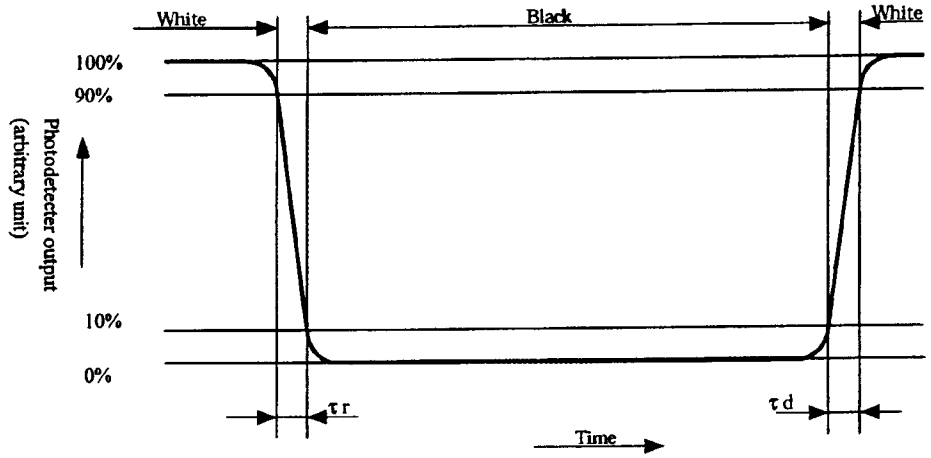
$$\text{Contrast ratio(CR)} = \frac{\text{Photodetecter output with all pixels white(GS63)}}{\text{Photodetecter output with all pixels black(GS0)}}$$

V_{COMAC}=5.0Vp-p,V0=4.0Vp-p,V9=-4.0Vp-p

[Note 9-3] These values are under the condition of measuring method (b) with a point light source (lighting angle=30°).

[Note 9-4] 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".



[Note 9-5] A measurement device is Minolta CM-2002.

[Note 9-6] Definition of reflection ratio

$$\text{Reflection ratio} = \frac{\text{Light detected level of the reflection by the LCD module}}{\text{Light detected level of the reflection by the standard white board}}$$

[Note 9-7] The lamp life time is defined as a time when brightness not to become under 50% of the original value.

[Note 9-8] These values are under the condition of measuring method(a) with a diffusion light source.

(10) Touch panel characteristics

Table 10

Parameter	Min.	Typ.	Max.	Unit	Remark
Input voltage	-	5.0	-	V	
Resistor between terminals(X1-X2)	200	320	600	Ω	Provisional specification
Resistor between terminals(Y1-Y2)	400	560	1000	Ω	
Accuracy of detecting dimension	-		±1.0	%	
Line linearity(X direction)	-	-	1.5	%	
Line linearity(Y direction)	-	-	1.5	%	
Insuration resistance	20	-	-	MΩ	at DC25V
Minimum tension for detecting	-	24	-	g	

(11) Display quality

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

(12) Mechanical characteristics

12-1) External appearance

See Fig. 1

12-2) FPC (for LCD panel) characteristics

(a) Specific connector

FH12-50S-0.5SH (HIROSE)

(c) Bending endurance of the bending slits portion(See Fig.1)

No line of the FPC is broken for the bending test (Bending radius =0.6mm and angle =90°) in 30 cycles.

(13) Handling Precautions

13-1) Insertion and taking out of FPC

Be sure insert and take out of the FPC into the connector of the set after turning off the power supply on the set side.

13-2) Handling of FPC

The FPC shall be bent only slit portion. The bending slit shall be bent uniformly on the whole slit portion with bending radius larger than 0.6mm ,and the direction is only inner side (back side of the module). Don't bend it outer side (display surface side). Don't give the FPC too much force, for example, hanging the module with holding FPC.

13-3) Handling of lead wire of CCFT

(a) Don't pull GND line for CCFT in order to avoid the trouble on CCFT.

(b) Handle with care not to scratch the lead wire of CCFT or FPC by the edge of metal case.

13-4) Installation of the module

On mounting the module, be sure to fix the module on the same plane. Take care not to warp or twist the module.

13-5) Precaution when mounting

(a) The polarizer can be easily scratched. Handle it with sufficient care.

(b) If water droplets and oil attaches to it for a long time, discoloration and staining occurs. Wipe them off

immediately.

(c) Glass is used for the TFT-LCD panel and touch panel. If it is dropped or bumped against a hard object, it may be broken. Handle it with sufficient care.

(d) As the CMOS IC is used in this module, pay attention to static electricity when handling it. Take a measure for grounding on the human body.

13-6) Others

(a) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.

(b) If it is kept at a temperature below the rated storage temperature, it becomes coagulated and the panel may be broken. Also, if it is kept at a temperature above the rated storage temperature, it becomes isotropic liquid and does not return to its original state. Therefore, it is desirable to keep it at room temperature as much as possible.

(c) If the LCD breaks, don't put internal liquid crystal into the mouth. When the liquid crystal sticks to the hands, feet and clothes, wash it out immediately.

(d) Wipe off water droped or finger grease immediately. Long contact with water may cause discoloration or spots.

(e) Observe general precautions for all electronic components.

(f) VCOM must be adjusted on condition of your final product. No adjustment causes the deterioration for display quality.

(g) Static image should not be displayed more than 5 minutes in order to prevent from occurrence of residual image.

(14) Forwarding form

(a) Piling number of cartons: MAX 16

(b) Package quantity in one cartons: 20 pcs.

(c) Carton size: 420 mm(W) x 360 mm(D) x 120mm(H)

(d) Total mass of 1 carton filled with full modules: 2500 g

Fig.2 shows packing form.

(15) Reliability Test Conditions for TFT-LCD Module

Table 15

No.	Test items	Test conditions
1	High temperature storage test	Ta=+70°C 240h
2	Low temperature storage test	Ta=-25°C 240h
3	High temperature and high humidity operating test	Tp=+40°C, 95%RH 240h (But no condensation of dew)
4	High temperature operating test	Tp=+50°C 240h
5	Low temperature operating test	Tp=0°C 240h
6	Electro static discharge test	±200V · 200pF(0Ω) 1 time for each terminals
7	Shock test	980 m/s^2, 6 ms ±X, ±Y, ±Z 3 times for each direction (JIS C0041, A-7 Condition C)
8	Vibration test	Frequency range: 10Hz~55Hz Stroke: 1.5 mm Sweep: 10Hz~55Hz X,Y,Z 2 hours for each direction (total 6 hours) (JIS C0040,A-10 Condition A)
9	Heat shock test	Ta=-25°C ~+70°C / 5 cycles (1h) (1h)
10	Point activation test (Touch panel)	Hit it 1,000,000 times with a silicon rubber of R8 HS 60. Hitting force : 250g Hitting speed : 3 times per second
11	Writing friction resistance test (Touch panel)	Write according to the right illustration in the under – mentioned conditions: Pen : 0.8R Polyacetal stylus Load : 250gf Speed : 3 strokes per second Stroke : 35mm Frequency : 50000 times x 4 pieces Testing apparatus : shown in Fig (I)

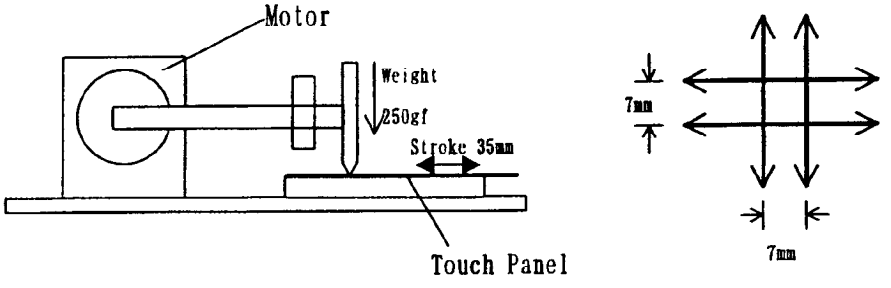


Fig. 15

[Note]Ta = Ambient temperature, Tp = Panel temperature

[Check items]

(a) Test No.1~9

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

(b) Test No.10~No.11

The measurements after the tests satisfy (10) Table 10. (Touch panel characteristics)

(16) Others

16-1) Indication of serial number

The serial number is shown on a label. Attached location is shown in Fig.1 (Outline Dimensions).

Indicated contents of the label

LQ039Q2DS53 OOOOOOOO
model No. serial No.

16-2) Used Regulation of Chemical Substances Breaking Ozone Stratum

Substances with the object of regulating : CFCS, Carbon tetrachloride, Halon

1,1,1-Trichloro ethane (Methyl chloroform)

(a) This LCD module, Constructed part and Parts don't contain the above substances.

(b) This LCD module, Constructed part and Parts don't contain the above substances in processes of manufacture.

16-3) 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.

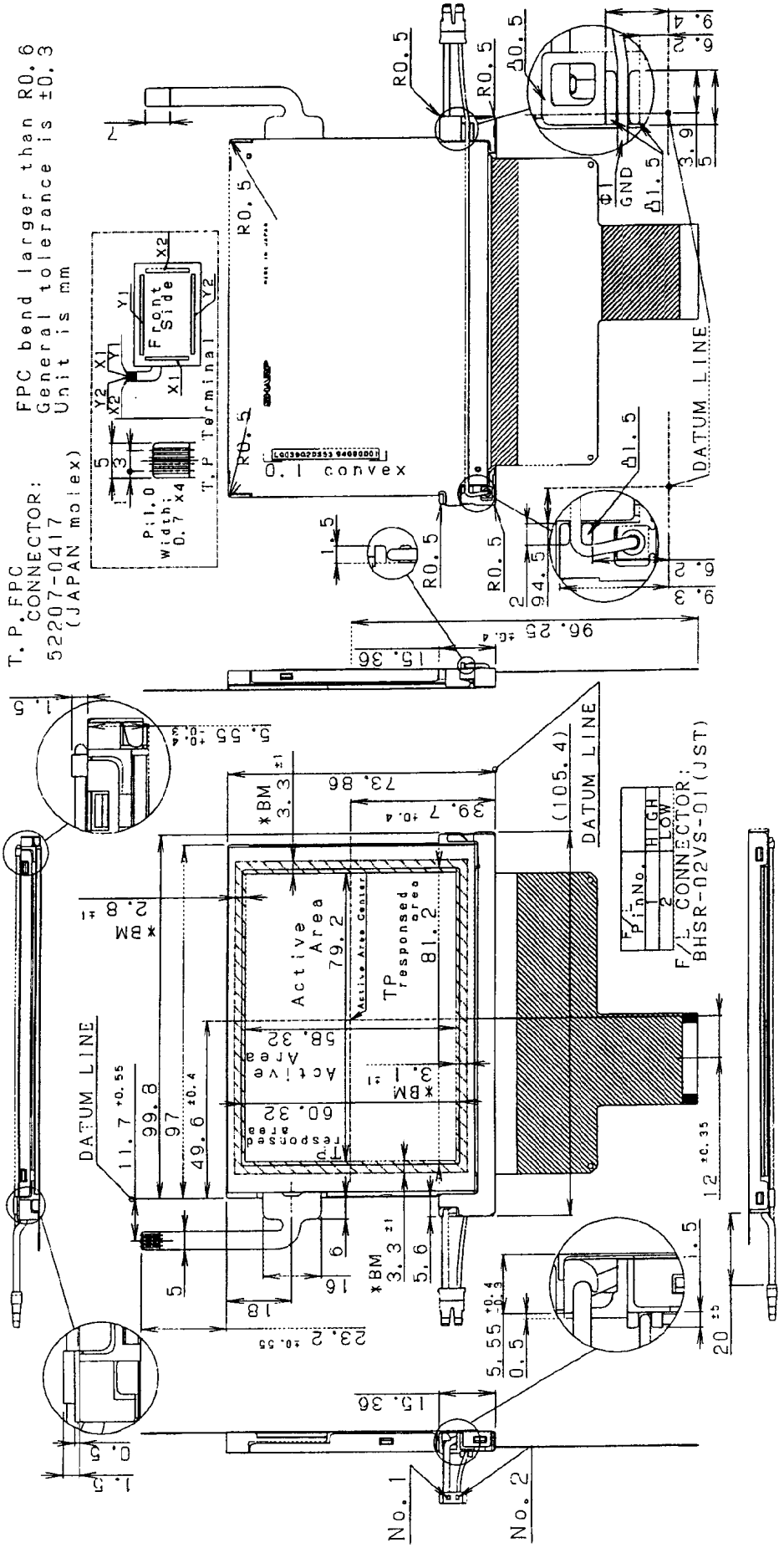


Fig. 1 Outline dimensions

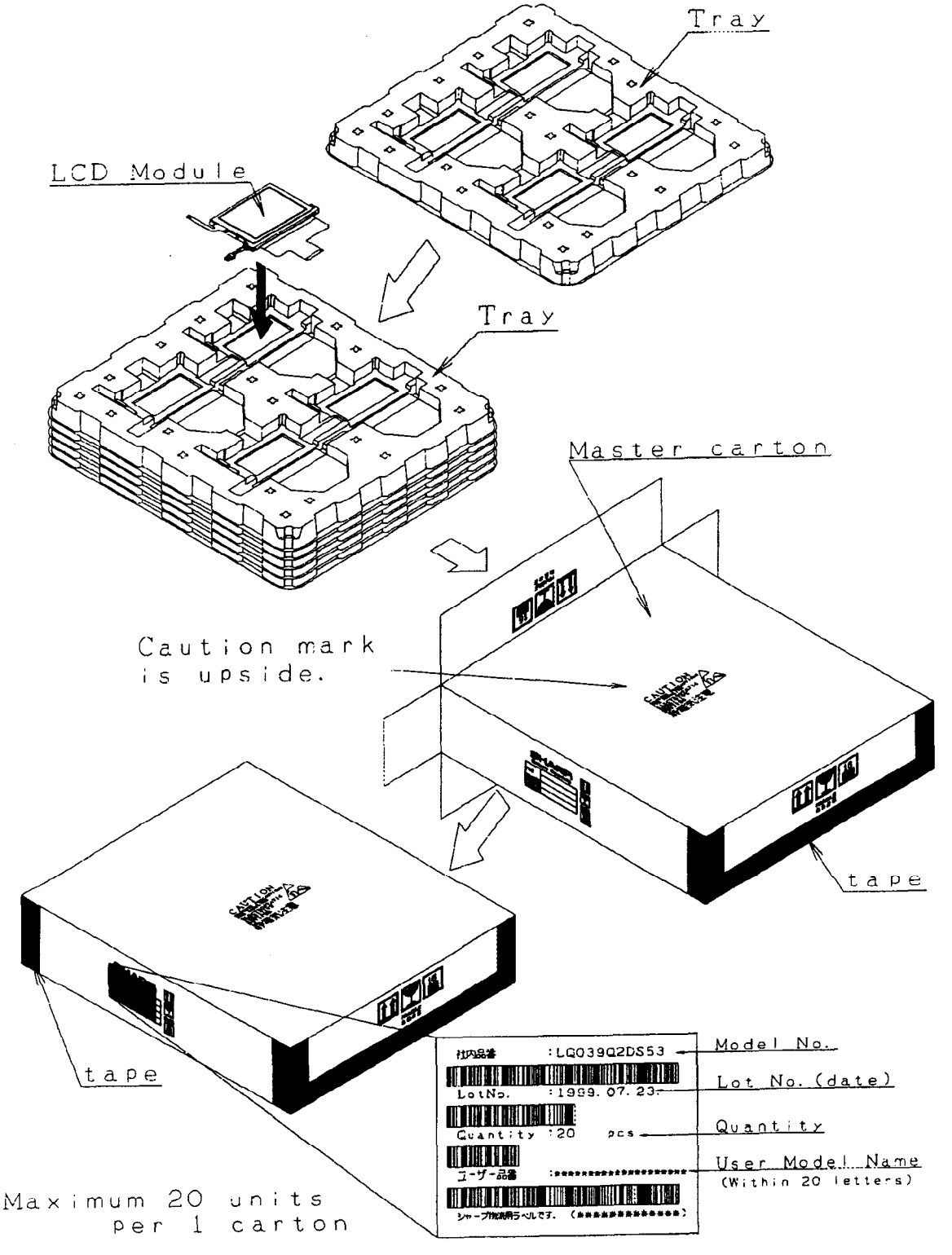


Fig. 2 Packing Form