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DEVICE SPECIFICATION FOR

## TFT-LCD module

MODEL No.    LQ070T5DG01

☐ CUSTOMER'S    APPROVAL

DATA \_\_\_\_\_

BY \_\_\_\_\_

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**(1) Application**

This specification applies to color TFT-LCD module ,LQ070T5DG01.

**(2) Summary and Features**

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-pwb, FPC, flex rigid -pwb, frame, sealed front case, and sealed back case, backlight unit. Graphics and texts can be displayed on a  $854 \times 3 \times 480$  dots panel with 262,144 colors by supplying.

It isn't composed DC/AC inverter .

Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.

The 7.0 screen produces a high resolution image that is composed of 409,920 pixel elements in a stripe arrangement.

Wide viewing field angle technology is employed. (The most suitable viewing angle is in the 6 o'clock direction.)

By adopting an active matrix drive, a picture with high contrast is realized.

Reflection due to external light is minimized through the use of a low reflection, black matrix and an antiglare (AG) plate. A thin, light and compact module is accomplished through the use of COG mounting technology.

Through the use of TN-normally white mode, an image with highly natural color reproduction is realized.

An antiglare (AG) surface polarization plate is used.

An inverted video display in the vertical and horizontal directions is possible.

**(3) Mechanical specifications**

table 3-1

Parameter	Specifications	Units	Remarks
Display format	409,920	pixels	
	2562(W) × 480(H)	dots	
Active area	155.0 (W) × 87.1 (H)	mm	
Screen size (Diagonal)	17.8 [7.0" ]	cm	
Dot pitch	0.0605 (W) × 0.1815 (H)	mm	
Pixel configuration	R,G,B Stripe configuration		
Outline dimension	176.9(W) × 109.3(H) × 14.9(D)	mm	【Note3-1】
Mass	300 ± 20	g	

**【Note 3-1】**

Typical values are given. For detailed measurements and tolerances, please refer to Fig. 1.

## (4) Input terminal

## 4-1) TFT-LCD panel driving part

Used connector: DF9MA-31P-1V (Gilding type: Hirose Electric Co., Ltd)

Fit connector: DF9□-31S-1V (Gilding type: Hirose Electric Co., Ltd)

(□: A, B or M type)

Table 4-1

Pin No.	Symbol	Description	Remarks
1	VGH	+10V power supply	
2	VSH	+5V power supply	
3	VSH	+5V power supply	
4	ENAB	Signal to settle the horizontal display position	[Note4-2]
5	HVR	Selection for horizontal and vertical scanning direction	[Note4-3]
6	B5	BLUE data signal(MSB)	
7	B4	BLUE data signal	
8	B3	BLUE data signal	
9	B2	BLUE data signal	
10	B1	BLUE data signal	
11	B0	BLUE data signal(LSB)	
12	GND	ground	
13	G5	GREEN data signal(MSB)	
14	G4	GREEN data signal	
15	G3	GREEN data signal	
16	G2	GREEN data signal	
17	G1	GREEN data signal	
18	G0	GREEN data signal(LSB)	
19	GND	ground	
20	R5	RED data signal(MSB)	
21	R4	RED data signal	
22	R3	RED data signal	
23	R2	RED data signal	
24	R1	RED data signal	
25	R0	RED data signal(LSB)	
26	VGL	-10V power supply	
27	Vsync	Vertical synchronous signal	[Note4-1]
28	Hsync	Horizontal synchronous signal	[Note4-1]
29	GND	ground	
30	CK	Clock signal for sampling each data signal	
31	GND	ground	

## [Note 4-1]

Hsync	negative
Vsync	negative

## [Note 4-2]

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 Fig7-1.

(Don't keep ENAB "High" during operation.(7-2).)

## [Note 4-3]

HVR="High": Regular video

HVR="Low": Horizontally and Vertically inverted video

## 4-2) Backlight fluorescent tube driving part

Used connector:BHR-02VS-1N(Gilding type: JST Co.,Ltde)

Fit connector:SM02(8.0)B-BHS-1N(Gilding type: JST Co.,Ltde)

Table 4-2

No.	symbol	i/o	function	Color of FL cable
1	VL1	i	input terminal	RED
2	VL2	i	input terminal	BLACK

## (5) Absolute maximum ratings

Table 5-1

GND = 0 V

Parameter	Symbol	MIN	MAX	Unit	Note
Input voltage	$V_I$	-0.3	+6.0	V	【Note 5-1】 $T_a = 25^\circ\text{C}$
+5V power supply	VSH	0	+6.0	V	$T_a = 25^\circ\text{C}$
+10V power supply High	VGH	0	+12	V	"
-10V power supply Low	VGL	0	-12	V	"
Storage temperature	$T_{stg}$	-30	+85	$^\circ\text{C}$	【Note 5-2】
Operating temperature (panel surface)	$T_{opr1}$	-30	+85	$^\circ\text{C}$	【Note 5-2】
Operating temperature (Ambient temperature)	$T_{opr2}$	-30	+65	$^\circ\text{C}$	【Note 5-3】

【Note 5-1】 CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, HVR

【Note 5-2】 The electric leak occurs when there is a dewfall of don't make do the Maximum wet-bulb temperature of equal to or less than  $58^\circ\text{C}$ , a dewfall. and doesn't sometimes meet this specification.

【Note 5-2】 Ambient temperature when the backlight is lit (reference value).

## (6) Electrical characteristics

## 6-1) TFT-LCD panel driving section

Table 6-1

GND = 0 V,  $T_a = 25^\circ\text{C}$ 

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
+5V Supply voltage	VSH	+4.5	+5.0	+5.5	V	【Note 6-1】
+5V Current dissipation	ISH	—	70	180	mA	【Note 6-2】
+10V Supply voltage	VGH	+9.5	+10.0	+10.5	V	
+10V Current dissipation	IGH	—	40	65	mA	【Note 6-2】
-10V Supply voltage	VGL	-9.5	-10.0	-10.5	V	
-10V Current dissipation	IGL	—	-30	-55	mA	【Note 6-2】
Permissive input ripple	$V_{RF}$	—	—	100	mVpp	
Input Low voltage	$V_{IL}$	—	—	0.3VCC	V	
Input High voltage	$V_{IH}$	0.7VCC	—	—	V	【Note 6-3】
Input current (Low)	$I_{IL}$	—	—	1.0	$\mu\text{A}$	$V_I = 0\text{V}$ 【Note 6-4】
Input current (High)	$I_{IH}$	—	—	1.0	$\mu\text{A}$	$V_I = \text{VCC}$ 【Note 6-3】

◎Turn on : VGL→VSH→VGH or at the same time

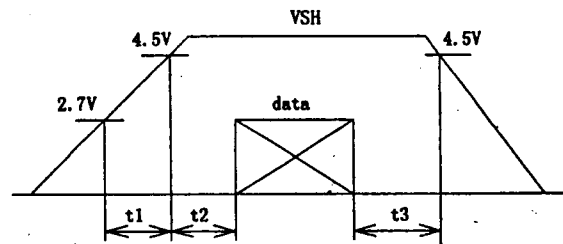
◎Turn off : VGH→VSH→VGL or at the same time

**【Note 6-1】****VSH-turn-on conditions**

$t_1 \leq 10\text{ms}$

$0 < t_2 \leq 10\text{ms}$

$0 < t_3 \leq 1\text{s}$

**VSH-dip conditions**

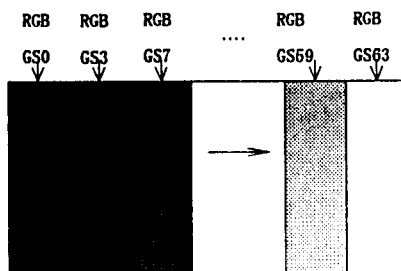
VSH-dip conditions should also follow the VSH-turn-on conditions.

**【Note 6-2】**

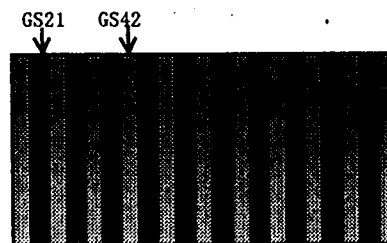
Typical current situation: 16-gray-bar pattern timing; Typical

Max current situation: Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot. timing; Typical

$$\text{VSH}=+5.0\text{V} \quad \text{VGH}=+10\text{V} \quad \text{VGL}=-10\text{V}$$



Typical current situation



Max current situation

**【Note 6-3】**  $\text{VCC}=3.3\text{V}$ 

CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, HVR

**【Note 6-4】** CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, HVR**6-2) Backlight driving section**

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube). The characteristics of Lamp are shown in the following table.

Table 6-2

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
lamp voltage	V L 7	770	860	950	Vrms	I L = 6.5mA <sub>rms</sub>
lamp current	I L	3.0	6.5	7.0	mA <sub>rms</sub>	ordinary state
	I L B	—	—	9.0	mA <sub>rms</sub>	within 5 minutes at low temperature
lamp frequency	f L	—	5.6	6.7	kHz	
kick-off voltage	V S	—	—	1900	Vrms	Ta = +25°C
		—	—	1950	Vrms	Ta = -30°C

Note: Please use the inverter which has the one of the sine wave. With regards to the inverter, it should be negative/positive wave symmetry and the spike wave should not be occurred.

## 7) Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.7-1

## 7-1) Timing characteristics

Table 7-1

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Clock	frequency	1/Tc	—	33.2	36.2	MHz	
	High time	Tch	5	—	—	ns	
	Low time	Tcl	5	—	—	ns	
Data	Setup time	Tds	3	—	—	ns	
	Hold time	Tdh	10	—	—	ns	
Horizontal sync. signal	Cycle	TH	30.0	31.8	—	$\mu s$	
			1010	1056	1088	clock	
	Pulse width	THp	2	114	177	clock	
Vertical sync. signal	Cycle	TV	515	525	560	line	
	Pulse width	TVp	1	4	6	line	
Horizontal display period		THd	854	854	854	clock	
Hsync-Clock phase difference		THc	10	—	Tc-10	ns	
Hsync-Vsync phase difference		TVh	0	—	TH-THp	ns	
Vertical display start position		TVs	23	23	23	line	

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

## 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
Enable signal	Setup time	Tes	5	—	Tc-10	ns	
	Pulse width	Tep	2	854	TH-10	clock	
Hsync-Enable signal phase difference		THe	58	88	170	clock	

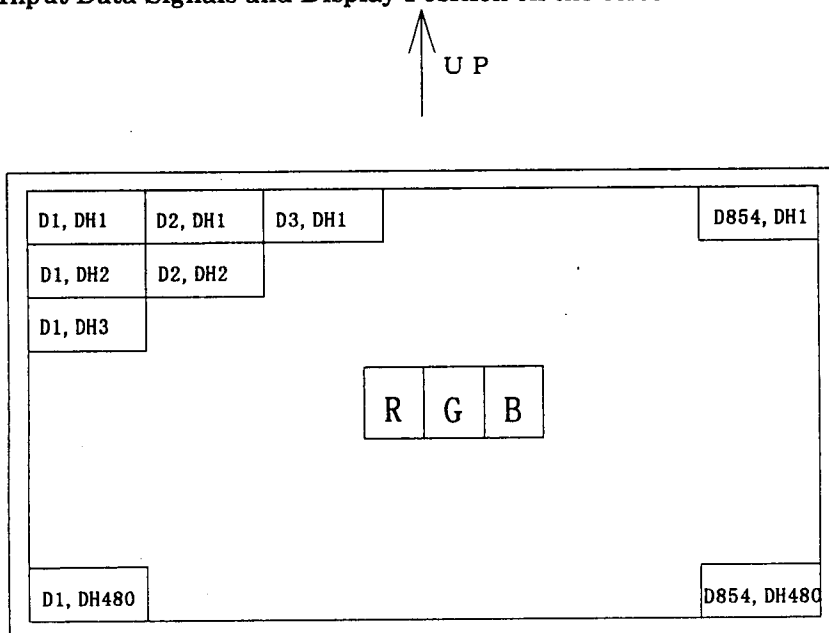
Note) When ENAB is fixed "Low", the display starts from the data of C88(clock) as shown in Fig.7-1.

### 7-3) Vertical display position

The Vertical display start position (TVs) is fixed 23 line.

ENAB signal has no relation to the vertical display position.

### 7-4) Input Data Signals and Display Position on the screen



Display position of input data (H, V)



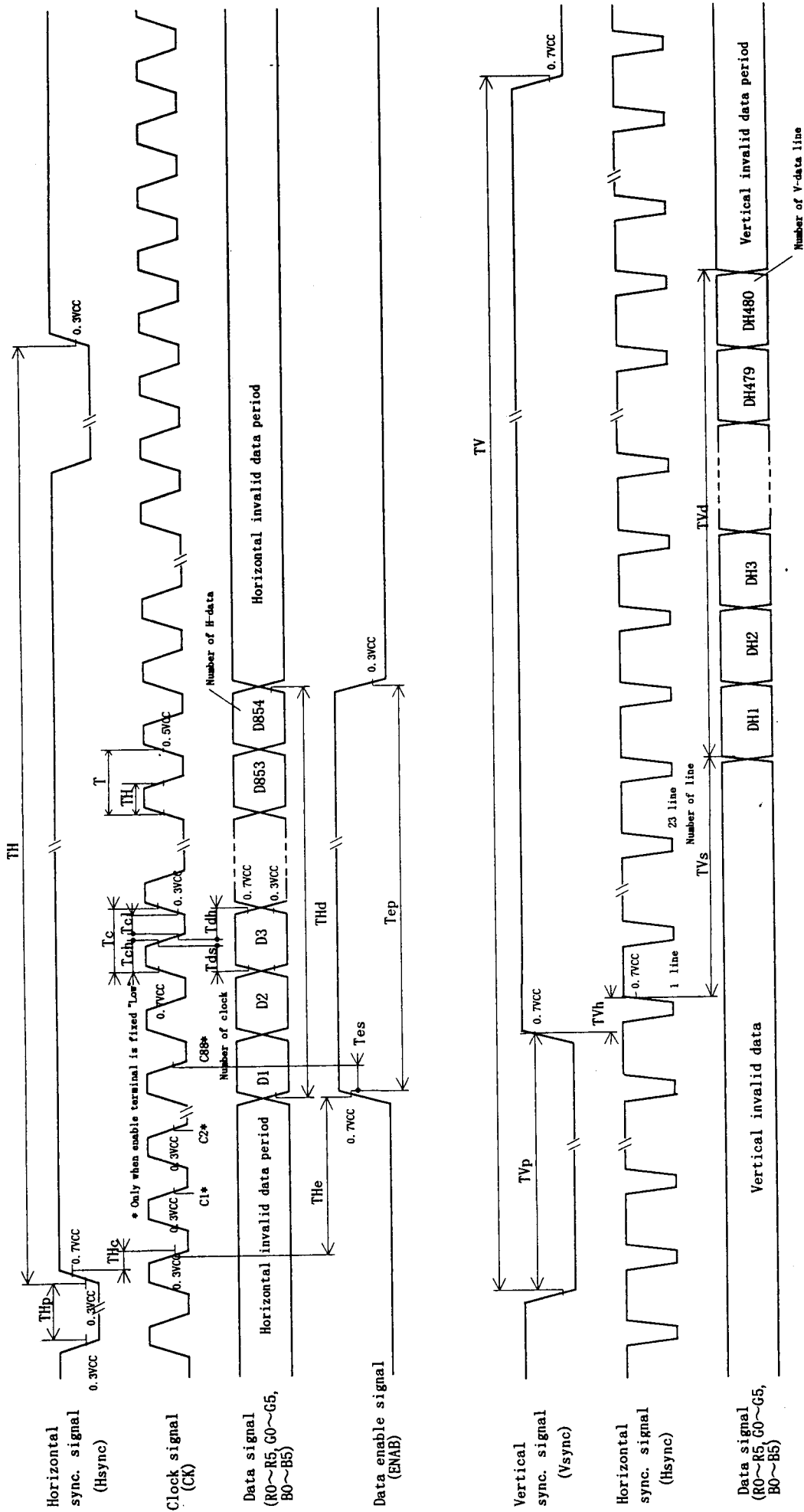


Fig7-1 Input signal waveform

## (8) Input Signals, Basic Display Color and Gray Scale of Each Color

(8) Input Signals, Basic Display Color and Gray Scale of Each Color																				
Colors &		Data signal																		
Gray scale	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	
	Blue	—	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	
	Cyan	—	0	0	0	0	0	0	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	
	Magenta	—	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	
	Yellow	—	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	
Gray Scale of red	Black	GS0	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	
	Darker	GS2	0	1	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	
	↓	GS62	0	1	1	1	1	1	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	
Gray Scale of green	Black	GS0	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	
	Darker	GS2	0	0	0	0	0	0	0	1	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	
	↓	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	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	
	↑	GS1	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	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

Table 9-1

Ta=25°C, VSH=+5V,VGH=+10V,VGL=-10V

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range	$\Delta \theta 11$	$CR \geq 5$	60	65	—	° (degree)	【Note 9-1,4】
	$\Delta \theta 12$		35	40	—	° (degree)	
	$\Delta \theta 2$		60	65	—	° (degree)	
Contrast ratio	CRmax	Optimal	60	—	—		【Note 9-2】
Response time	Rise $\tau r$	$\theta = 0^\circ$	—	30	60	ms	【Note 9-3】
	Fall $\tau d$		—	50	100	ms	
Luminance	Y	IL=6.5mA <sub>rms</sub>	300	410	—	cd/m <sup>2</sup>	【Note 9-4】
White chromaticity	x	IL=6.5mA <sub>rms</sub>	0.263	0.313	0.363		
	y	IL=6.5mA <sub>rms</sub>	0.279	0.329	0.379		
lamp life time	+25°C	continuation	10,000	—	—	hour	【Note 9-5】
	-30°C	intermission	2,000	—	—	time	【Note 9-6】

DC/AC inverter for external connection shown in following.HIU-288( Harison electric co.,ltd)

※measuring after 30minutes

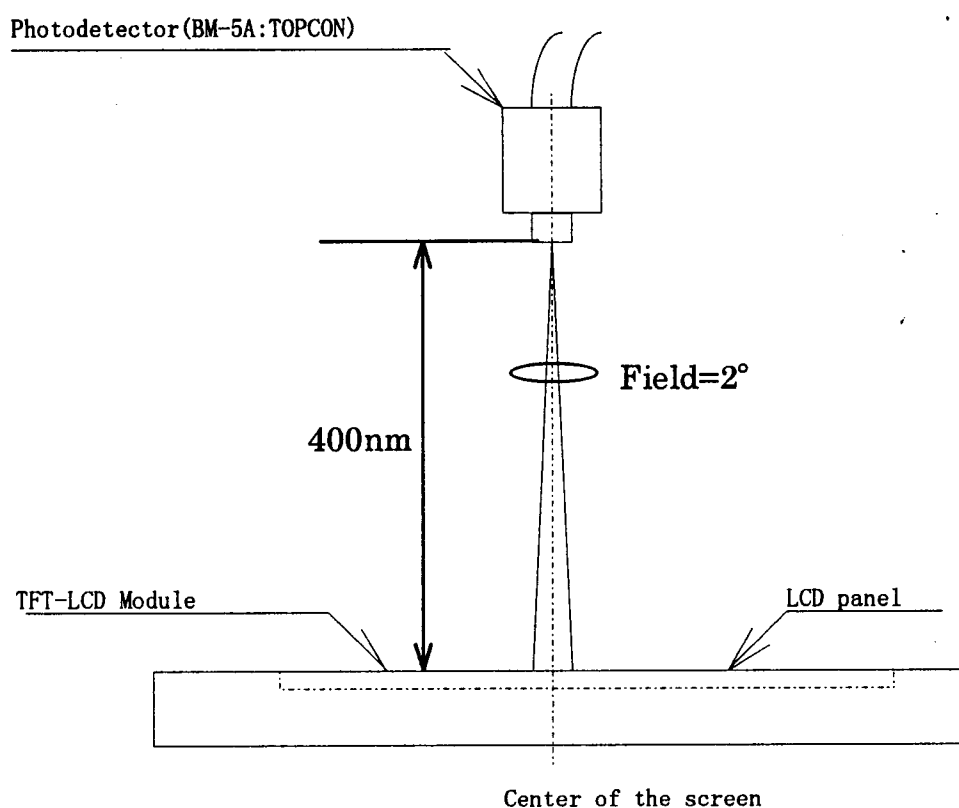
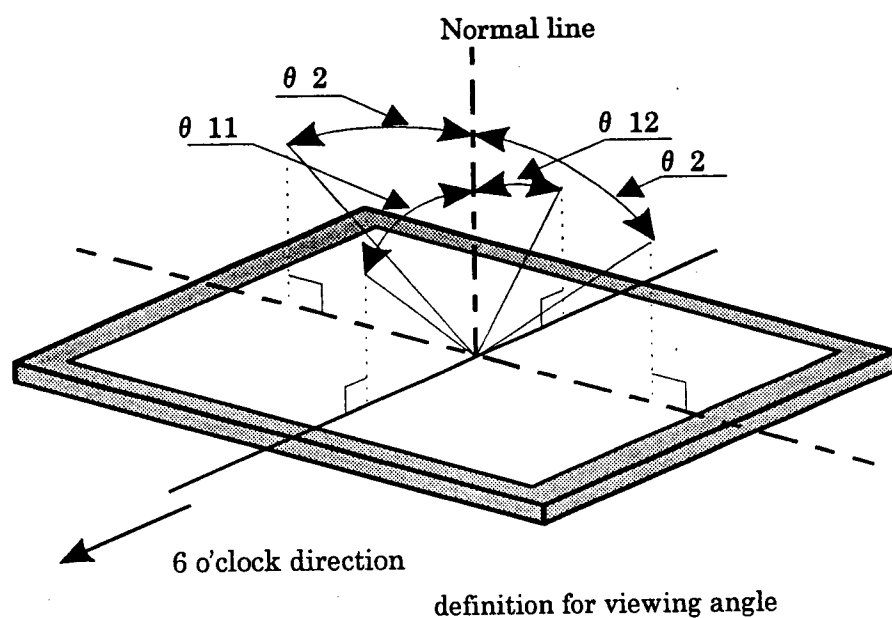


Fig.9-1 Optical characteristics measurement method

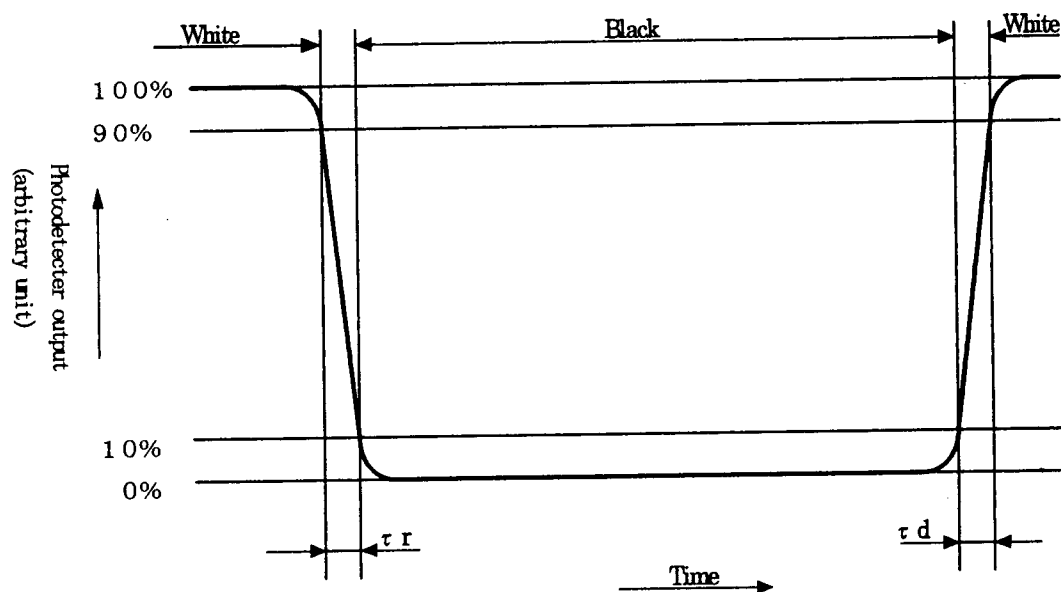
【Note 9-1】 Viewing angle range is defined as follows.



【Note 9-2】 Contrast ratio is defined as follows:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output with LCD being "white"}}{\text{Photo detector output with LCD being "black"}}$$

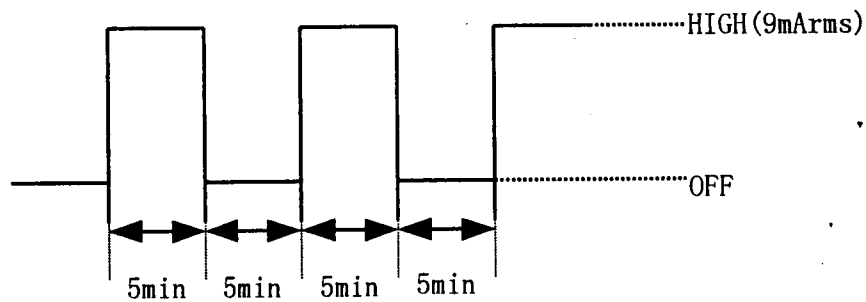
【Note 9-3】 Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".



【Note 9-4】 Measured on the center area of the panel at a viewing cone  $1^\circ$  by  
TOPCON luminance meter BM-7. (After 30 minutes operation)  
DC/AC inverter driving frequency: 49kHz

【Note 9-5】 Lamp life time is defined as the time when either or occurs in the  
continuous operation under the condition of lamp current  $I_L=3.0\sim 7.0\text{mA}_{\text{rms}}$   
and PWM dimming 100%~5% ( $T_a=25^\circ\text{C}$ )  
Brightness not to become under 50% of the original value.

【Note 9-6】 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:  $-30^\circ\text{C}$



**(10) Display quality**

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

**(11) Handling instructions****11-1) Mounting of module**

The TFT-LCD module is designed to be mounted on equipment using the mounting tabs in the four corners of the module at the rear side.

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

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.

Please connect the metallic shielding cases of the module and the ground pattern of the inverter circuit surely. If that connection is not perfect, there may be a possibility that the following problems happen.

- a). The noise from the backlight unit will increase.
- b). The output from inverter circuit will be unstable. Then, there may be a possibility that some problems happen.
- c). In some cases, a part of module will heat.

**11-2) 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 dirties. 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**

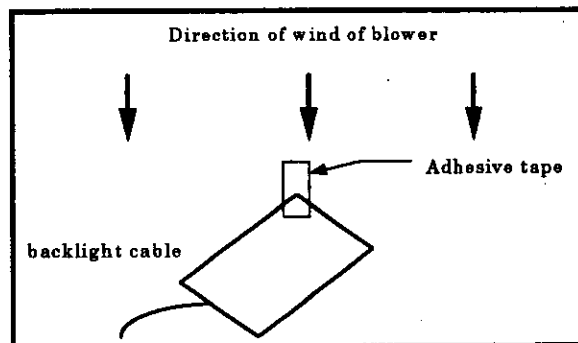
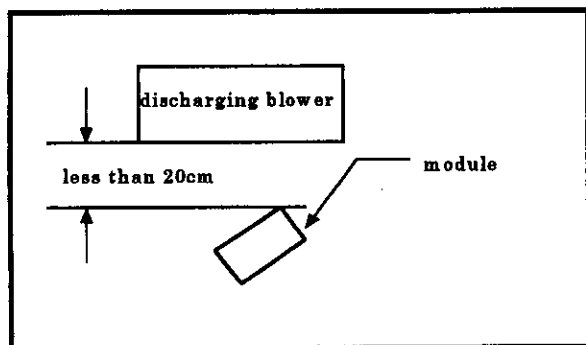
When the laminator is peeled off, static electricity may cause dust to stick to the polarizer surface. To avoid this, the following working environment is desirable.

- a) Floor: Conductive treatment of 1M $\Omega$  or more on the tile  
(conductive mat or conductive paint on the tile)
- b) Clean room free from dust and with an adhesive mat on the doorway
- c) Advisable humidity: 50%~70%      Advisable temperature: 15°C~27°C
- 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 adhesive 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 taking 5 or more second.

- 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.
- 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 dirties, wipe the part, breathing on it. Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots. 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.

### 11-3) 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.

### 11-4) 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.

### 11-5) 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.

## (12) Packing form

- a) Piling number of cartons : MAX 10
- b) Package quantity in one carton 20 pcs
- c) Carton size: 460(W) × 300(H) × 240(D) mm
- d) Total mass of one carton filled with full modules: 6.8 kg
- e) Conditions for storage.

## Environment

- ① Temperature : 0~40°C
- ② Humidity : 60%RH or less (at 40°C)  
No dew condensation at low temperature and high humidity.
- ③ Atmosphere : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.
- ④ Period : about 3 months
- ⑤ Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

## (13) Others

- a) 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.
- b) Disassembling the module can cause permanent damage and should be strictly avoided.
- c) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- d) 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

LQ070T5DG01	○○○○○○○○
model No.	lot No.

contents of lot No. the 1st figure ·· production year (ex. 1996 : 6)  
the 2nd figure ·· production month 1,2,3,·····,9,X,Y,Z  
the 3rd~7th figure ·· serial No. 00001~  
the 8th figure ·· revision marks A,B,C··



## (13) Reliability Test Conditions for TFT-LCD Module

Table 13-1

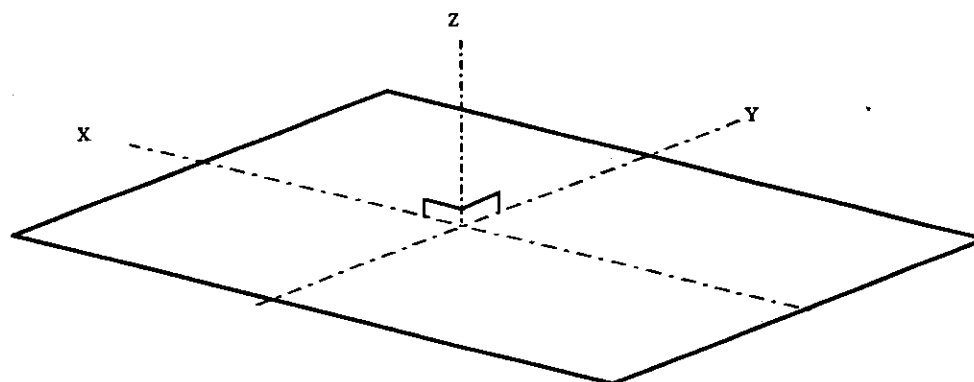
Remark) Temperature condition is based on operating temperature conditions on (5)-Table 5-1.

No.	Test items	Test conditions
1	High temperature storage test	Ta= +85°C 240h
2	Low temperature storage test	Ta= -30°C 240h
3	High temperature and high humidity operating test	Tp= +60°C , 90%RH 240h
4	High temperature operating test	Tp= +85°C 240h
5	Low temperature operating test	Tp= -30°C 240h
6	Electro static discharge test	$\pm 200V \cdot 200pF(0\Omega)$ 1 time for each terminals
7	Shock test	980m/s <sup>2</sup> · 6ms, $\pm X; \pm Y; \pm Z$ 3 times for each direction (JIS C0041, A-7 Condition C)
8	Vibration test	Frequency range : 8~33.3Hz Stroke : 1.3mm Sweep : 33.3Hz~400Hz Acceleration : 28.4m/s <sup>2</sup> 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	Ta= -30°C~+85°C / 200 cycles (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:



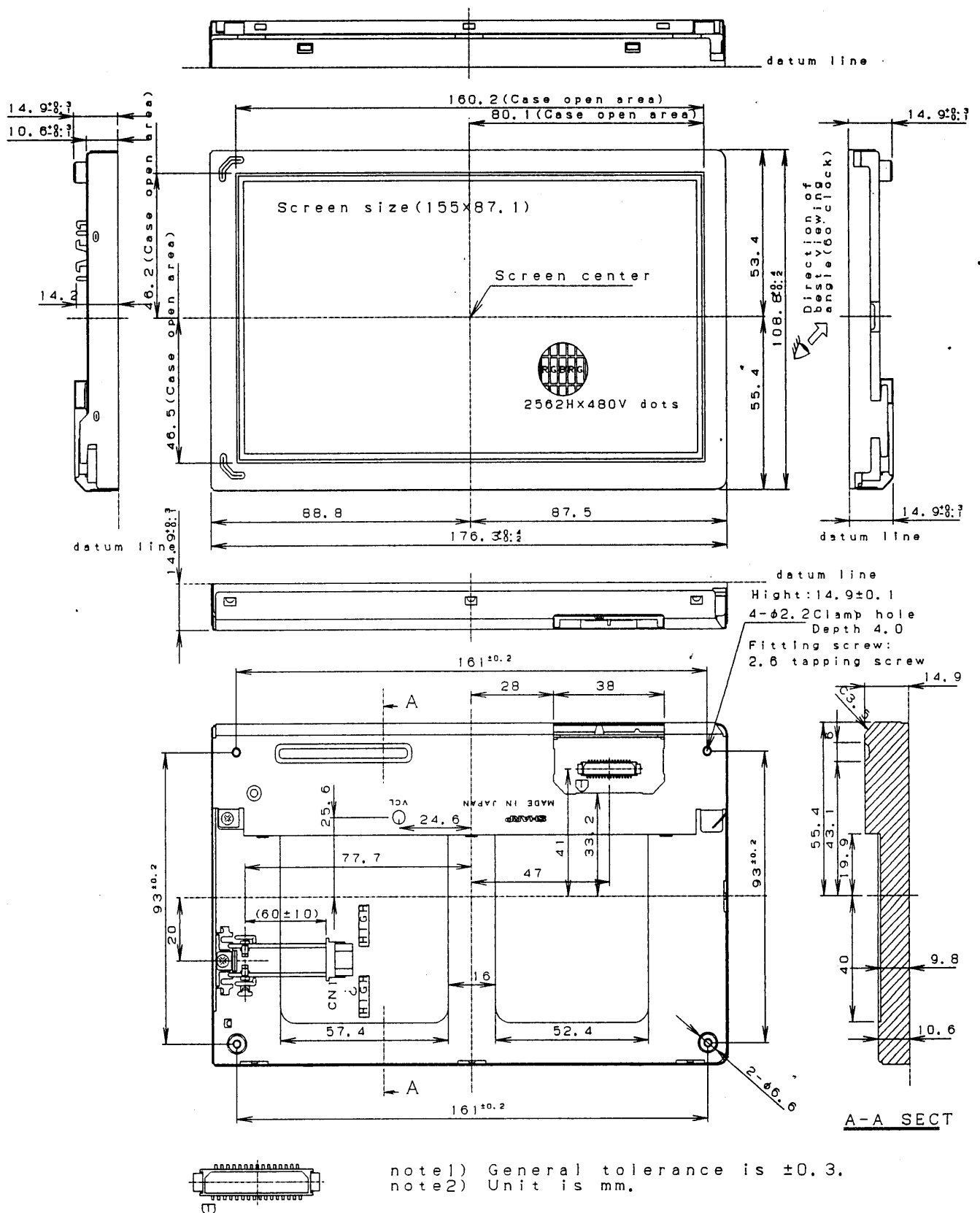


Fig1. Outline Dimensions

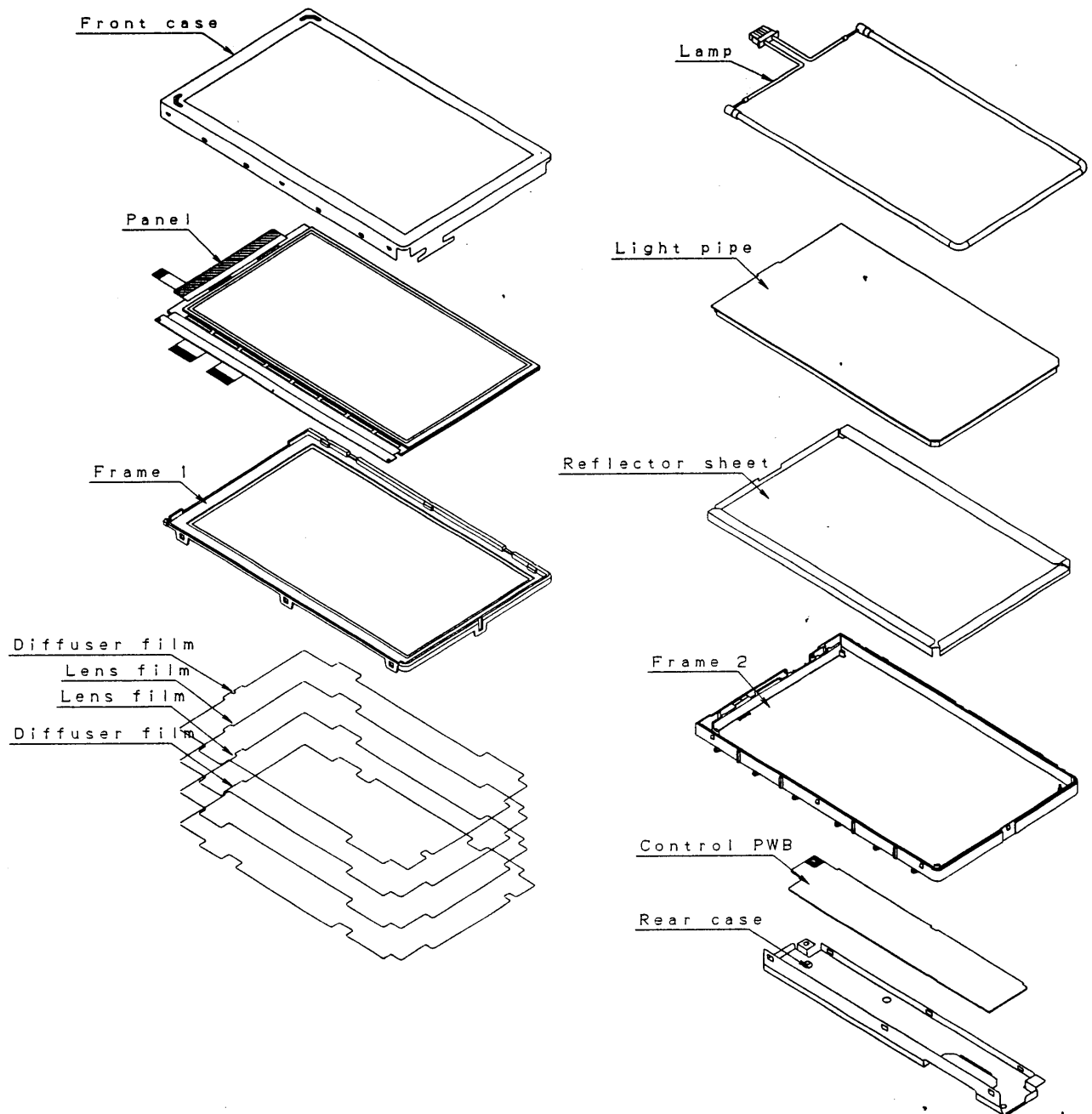


Fig.2 Structure of the Module

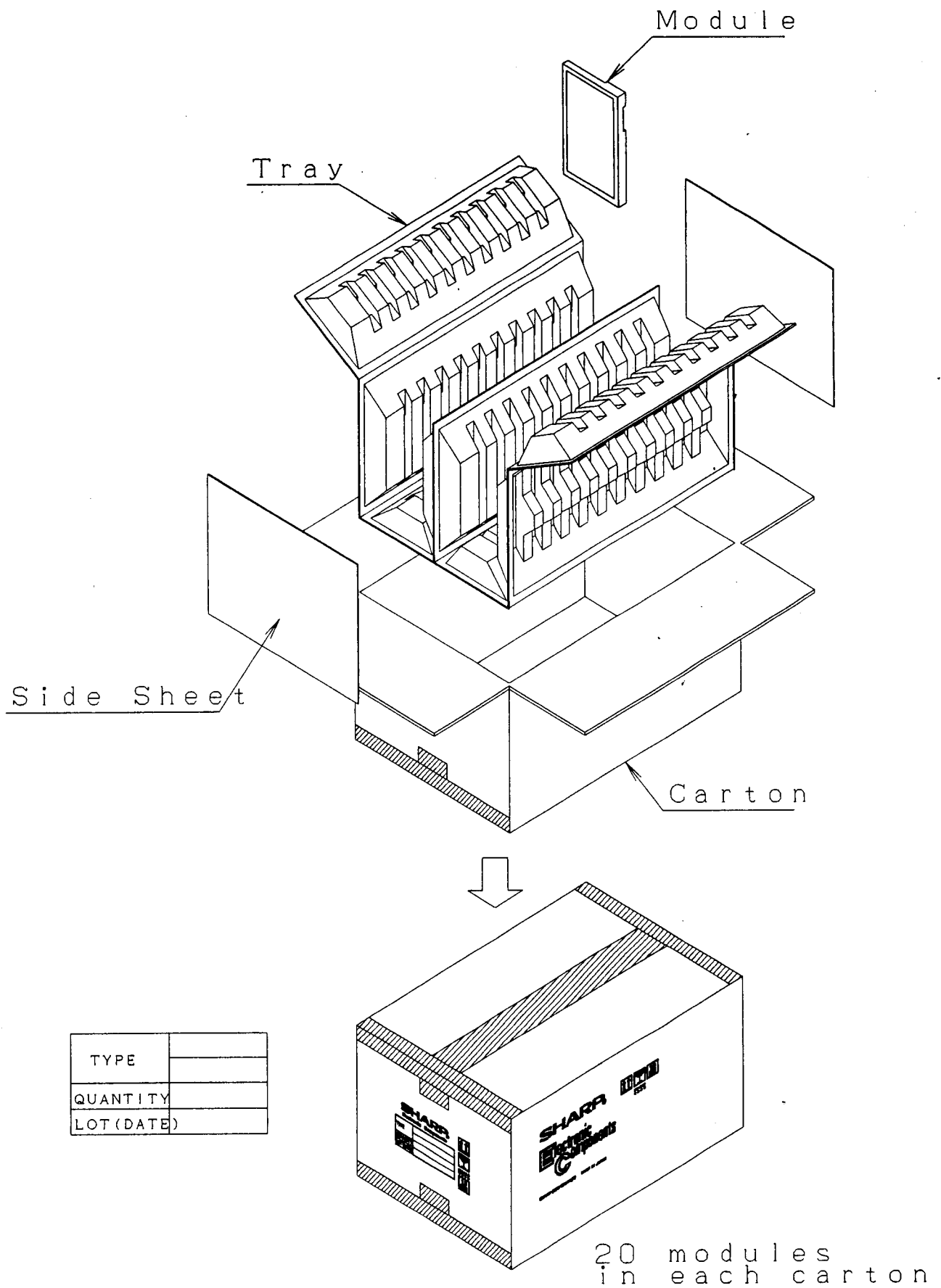


Fig.3 Packing Form