

LQ121S1DG61

TFT-LCD Module

Spec. Issue Date: Jan. 27, 2006

No: LD-18121A

PREPARED BY : DATE	<h1 style="text-align: center;">SHARP</h1> <p style="text-align: center;">MOBILE LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION SPECIFICATION</p>	SPEC No. LD-18121A
APPROVED BY : DATE		FILE No.
		ISSUE : Jan. 27. 2006
		PAGE : 18 pages
		APPLICABLE GROUP MOBILE LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR
TFT-LCD Module
 MODEL No.
LQ121S1DG61

These parts have corresponded with the RoHS directive.

☐ CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

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RECORDS OF REVISION

LQ121S1DG61

[illegible]

1. Application

This specification applies to color TFT-LCD module, LQ121S1DG61

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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, power supply circuit and a backlight unit. Graphics and texts can be displayed on a $800 \times 3 \times 600$ dots panel with 262,144 colors by supplying 18 bit data signal (6bit/color), four timing signals, +3.3V/ +5V DC supply voltage for TFT-LCD panel driving.

This module is super-high brightness (450cd/m^2) and high contrast (600:1).

This module is the type of wide viewing angle the viewing angle is 6 o'clock direction.

Backlight-driving DC/AC inverter is not built in this module.

3. Outline Specifications

Parameter	Specifications	Unit
Display size	31 (12.1") Diagonal	cm
Active area	246.0 (H) X 184.5 (V)	mm
Pixel format	800 (H) X 600 (V)	pixel
	(1 pixel=R+G+B dots)	
Number of colors (Number of gray scale level)	262, 144 colors (64 gray scales per color)	
Pixel pitch	0.3075 (H) X 0.3075 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	276.0(W)×209.0(H)×Max.11.0 (D) *Outline dimensions is shown in Fig.1	mm
Mass	Max. 800	g
Surface treatment	Anti-glare and hard-coating 3H	

[Note] excluding backlight cables.

4. Input Terminals

CN1

Corresponding connector: DF9-41S-1V, DF9A-41S-1V, DF9B-41S-1V, DF9M-41S-1V

(Hirose Electric Co., Ltd.)

Pin No.	Symbol	Function	Remark
1	GND	-	
2	CK	Clock signal for sampling each data signal	
3	GND	-	
4	Hsync	Horizontal synchronous signal	[Note1]
5	Vsync	Vertical synchronous signal	[Note1]
6	GND	-	
7	GND	-	
8	GND	-	
9	R0	RED data signal(LSB)	
10	R1	RED data signal	
11	R2	RED data signal	
12	GND	-	
13	R3	RED data signal	
14	R4	RED data signal	
15	R5	RED data signal(MSB)	
16	GND	-	
17	GND	-	
18	GND	-	
19	G0	GREEN data signal(LSB)	
20	G1	GREEN data signal	
21	G2	GREEN data signal	
22	GND	-	
23	G3	GREEN data signal	
24	G4	GREEN data signal	
25	G5	GREEN data signal(MSB)	
26	GND	-	
27	GND	-	
28	GND	-	
29	B0	BLUE data signal(LSB)	
30	B1	BLUE data signal	
31	B2	BLUE data signal	
32	GND	-	
33	B3	BLUE data signal	
34	B4	BLUE data signal	
35	B5	BLUE data signal(MSB)	
36	GND	-	
37	ENAB	Signal to settle the horizontal display position	[Note2]
38	R/L	Horizontal display mode select signal	[Note3]
39	Vcc	+3.3V / +5.0V power supply	
40	Vcc	+3.3V / +5.0V power supply	
41	U/D	Vertical display mode select signal	[Note4]

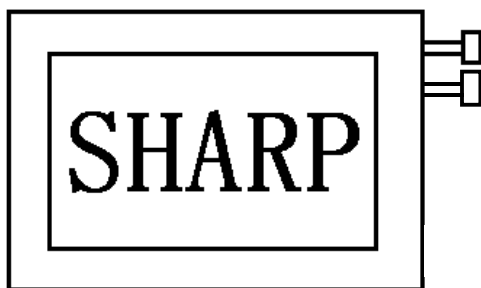
※The shielding case is connected with GND.

[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.

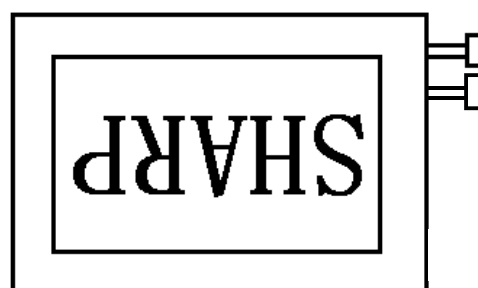
[Note 1],[Note 2]
R/L = High, U/D = Low

R/L = Low, U/D = Low



R/L = High, U/D = High

R/L = Low, U/D = High



4-3. Backlight driving CN2 ,CN3

Used connector : BHR-02(8.0)VS-1N (JST)

Corresponding connector : SM02(8.0)B-BHS-1-TB(LF)(SN) or -1N-TB(LF)(SN) (JST)

Pin no.	symbol	function	Color of FL cable
1	VHIGH	Power supply for lamp (High voltage side)	Pink / Blue
2	VLOW	Power supply for lamp (Low voltage side)	White / Gray

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Pin name	Ratings	Unit	Remark
+3.3V / +5.0V supply voltage	Vcc	Ta=25°C	Vcc	0 to + 6.0	V	
Input voltage	VI2	Ta=25°C		-0.3 to Vcc+0.3	V	
Lamp input voltage	VHIGH	-	-	1800	Vrms	
Storage temperature	Tstg	-	-	-30 to +80	°C	[Note1]
Operating temperature	Topa	Panel surface	-	-30 to +80	°C	

[Note1] Humidity: 95%RH Max. at Ta=<40°C.

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

No condensation.

6. Recommended operation condition

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	Vcc	+3.0	+3.3/+5.0	+5.5	V	[Note2]
Input voltage	VI	0		Vcc	V	[Note1]
Temperature(Panel surface)	Topa	-30		+80	°C	[Note3]

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

[Note2]

Vcc-turn-on conditions

 $0 < t_1 \leq 15\text{ms}$ $0 < t_2 \leq 10\text{ms}$ $0 < t_3 \leq 100\text{ms}$ $0 < t_4 \leq 1\text{s}$ $t_5 > 200\text{ms}$

Vcc-dip conditions

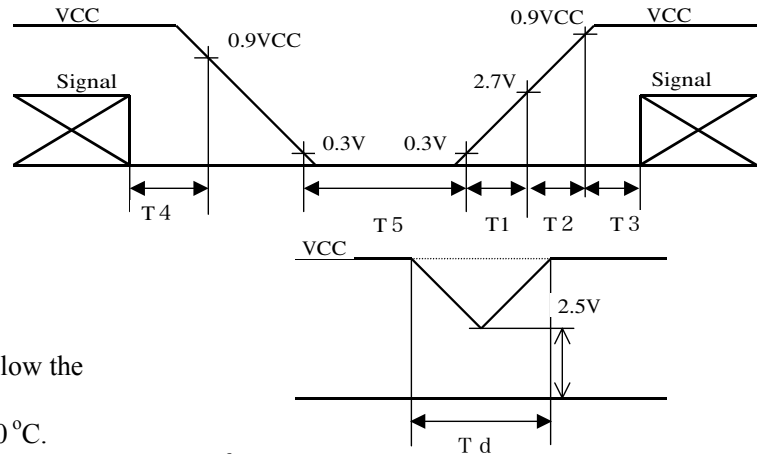
1) $2.5\text{V} \leq V_{cc}$ $t_d \leq 10\text{ms}$ 2) $V_{cc} < 2.5\text{V}$

Vcc-dip conditions should also follow the

Vcc-turn-on conditions

[Note3] Humidity: 95%RH Max. at $T_a \leq 40^\circ\text{C}$.Maximum wet-bulb temperature at 39°C or less at $T_a > 40^\circ\text{C}$.

No condensation.



7. Electrical Characteristics

7-1. TFT-LCD panel driving

 $T_a = 25^\circ\text{C}$

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Current dissipation	Vcc=3.3V	Icc	-	380	480	mA	[Note1]
	Vcc=5.0V	Icc	-	230	280	mA	
Permissive input ripple voltage		VRP	-	-	100	mVp-p	
Input voltage	Low	VIL	-	-	0.8	V	[Note2]
Input voltage	High	VIH	2.1	-	-	V	
Input current 1	Low(VI=0V)	IOL1	-10.0	-	10.0	μA	[Note3],[Note6]
	Hogh(VI=Vcc)	IOH1	-10.0	-	10.0	μA	
Input current 2	Low(VI=0V)	IOL2	-800	-	-	μA	[Note4],[Note6]
	Hogh(VI=Vcc)	IOH2	-10.0	-	10.0	μA	
Input current 3	Low(VI=0V)	IOL3	-10.0	-	10.0	μA	[Note5],[Note6]
	Hogh(VI=Vcc)	IOH3	-	-	800	μA	

[Note1] Typical current situation : 16-gray-bar pattern.

Vcc=+3.3V/+5.0V

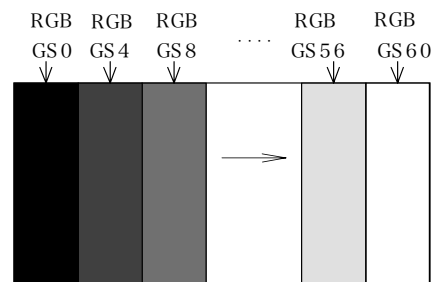
[Note2] CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,R/L,U/D

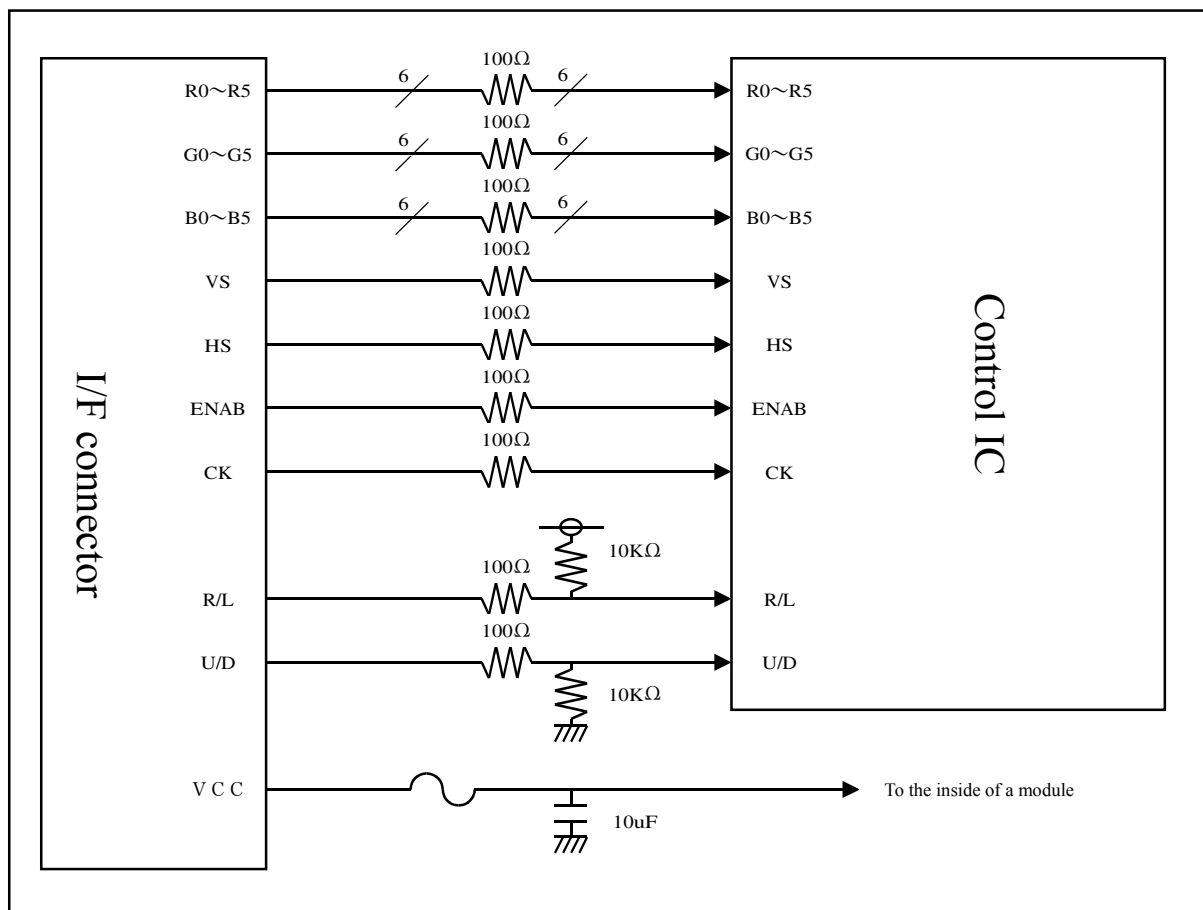
[Note3] CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,

[Note4] R/L

[Note5] U/D

[Note6] See below block diagram of input interface.





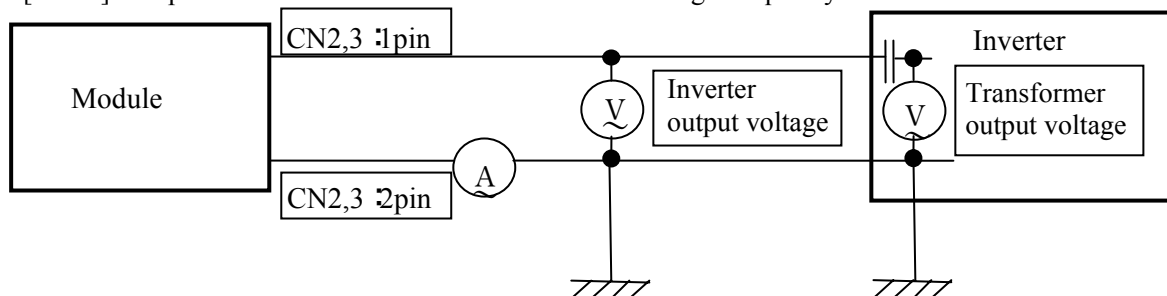
7-2. Backlight driving

The backlight system is an edge-lighting type with two CCFT (Cold Cathode Fluorescent Tube).

The characteristics of single lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp current range	IL	3.0	6.0	6.5	mA _{rms}	[Note1]	
Lamp power consumption	PL	-	3.5	-	W	[Note2]	
Lamp frequency	FL	40	60	70	kHz	[Note3]	
Kick-off voltage	Vs	-	-	1300	V _{rms}	Inverter output	[Note4] Ta=-30 °C
		-	-	(2000)	V _{rms}	Transformer output at barast capacitor =12pF	
Lamp life time	LL	50000	-	-	hour	IL=6.0 mA _{rms}	[Note5]
		60000	-	-	hour	IL=5.0 mA _{rms}	[Note5]

[Note1] Lamp current is measured with current meter for high frequency as shown below.



[Note2] Referential data per one CCFT by calculation. ($I_L \times V_L$)

The data don't include loss at inverter. ($I_L=6.0\text{mA}_{\text{rms}}$)

[Note3] Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

[Note4] The voltage above this value should be applied to the lamp for more than 1 second to start-up. Otherwise the lamp may not be turned on.

[Note5] Since lamp is consumables, the life time written above is referential value and it is not guaranteed in this specification sheet by SHARP.

Above value is applicable when lamp (the long side of LCD module) is placed horizontally.

(Landscape position)

Lamp life time is defined that it applied either ① or ② under this condition

(Continuous turning on at $T_a=25^\circ\text{C}$, $I_L=6.0\text{mA}_{\text{rms}}$)

① Brightness becomes 50% of the original value under standard condition.

② Kick-off voltage at $T_a=-30^\circ\text{C}$ exceeds maximum value, 1300V_{rms}.

(Lamp lifetime may vary if lamp is in portrait position due to the change of mercury density inside the lamp.)

In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower. (Continuous operating for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)

In case of such usage under lower temp environment, periodical lamp exchange is recommended.

[Note6] The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Be sure to use a back light power supply with the safety protection circuit such as the detection circuit for the excess voltage, excess current and or electric discharge waveform.

Be sure to use the detect circuit by which one side of the CCFT lamps can be controlled independently.

Otherwise, when one side of the CCFT is open, the excess current may possibly be applied to the other side of the lamp. Recommended inverter is "CXA-0454(TDK)".

("CXA-P1212B-WJL(TDK)" is also recommended under general temperature condition.)

[Note7] It is required to have the inverter designed so that to allow the impedance deviation of the two CCFT lamps and the capacity deviation of barast capacitor.

[Note8] Under the environment of 10lx or less, miss-lighting or lighting delay may occur.

8. Timing Characteristics of input signals

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

8-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	35	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	5	-	-	ns	-
Horizontal sync. signal	Cycle	TH	20.8	26.4	39.9	μs	-
			832	1056	1395	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	3	-	Tc-10	ns	-
Hsync-Vsync phase difference		TVh	1	-	TH-THp	clock	-
Vertical data start position		TVs	23	23	23	line	-

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

8-2. 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	800	TH-10	clock	-
Hsync-Enable signal phase difference		THE	0	-	TH-THp-800	clock	-

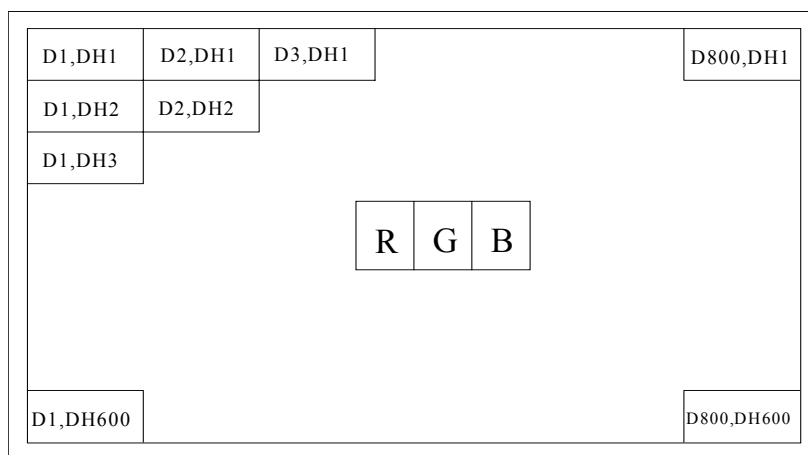
[Note] When ENAB is fixed "Low", the display starts from the data of C88(clock) as shown in Fig.2.

8-3. Vertical display position

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

8-4. Input Data Signals and Display Position on the screen

Display position of input data



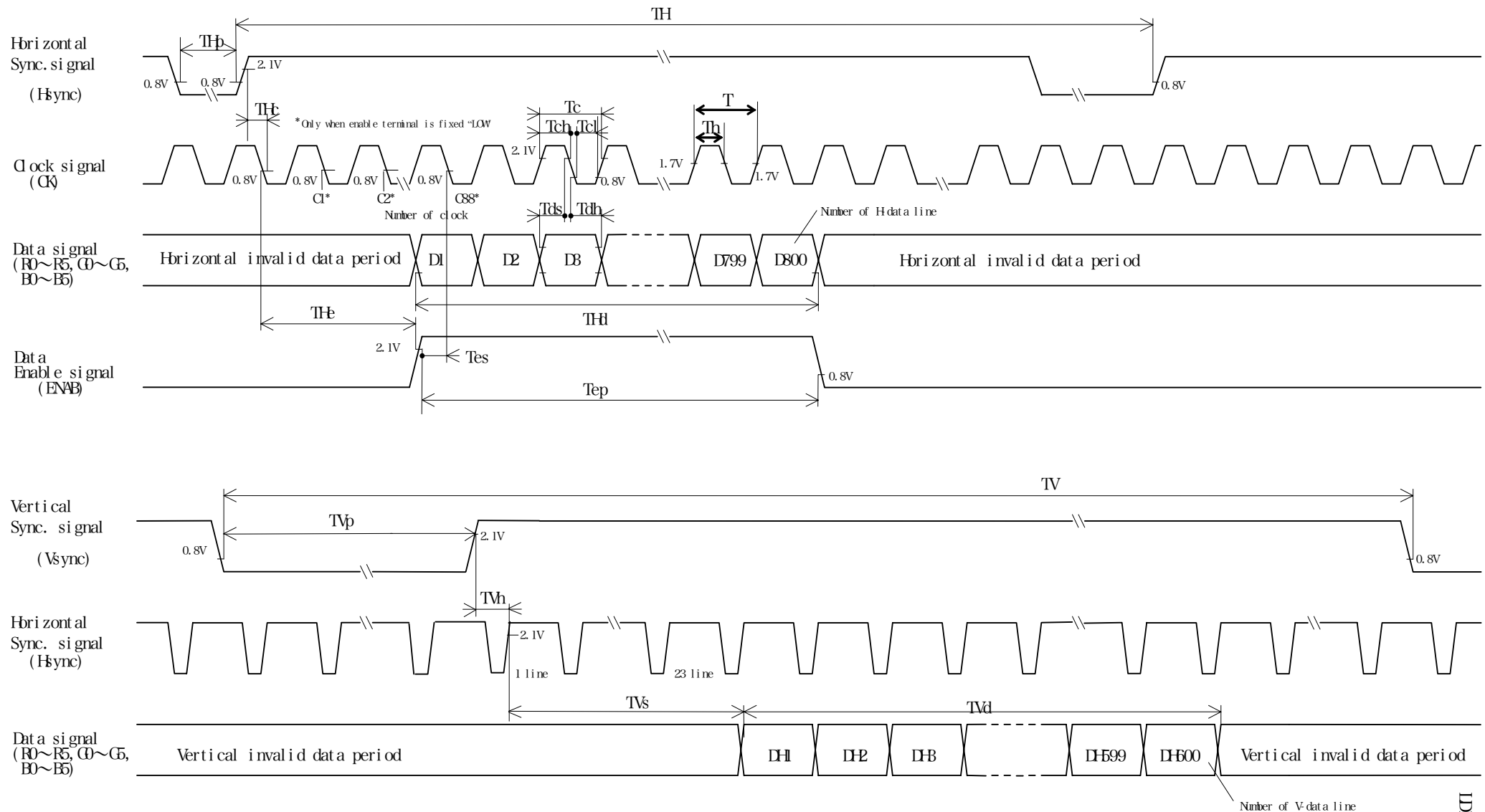


Fig. 2 Input signal waveforms

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

	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	0	1	1	1	1	1	1	0	0	0	0	0
	Cyan	-	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
	Red	-	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Magenta	-	1	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	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 Blue	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
	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.

10. Optical Characteristics

Ta=25°C, Vcc=+3.3V / +5.0V

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ_{21}, θ_{22}	60	70	-	Deg.	[Note1]
	Vertical	θ_{11}	35	50	-	Deg.	[Note4]
		θ_{12}	55	60	-	Deg.	
Contrast ratio	CRn	$\theta = 0^\circ$	300	-	-	-	[Note2]
	CRo	Optimum viewing angle	-	600	-	-	[Note4]
Response time	Rise	τ_r	-	10	-	ms	[Note3]
	Decay	τ_d	-	25	-	ms	[Note4]
Chromaticity of white	x	$\theta = 0^\circ$	0.263	0.313	0.363	-	[Note4]
	y		0.279	0.329	0.379	-	
Chromaticity of red	x		0.546	0.596	0.646	-	
	y		0.279	0.329	0.379	-	
Chromaticity of green	x		0.260	0.310	0.360	-	
	y		0.502	0.552	0.602	-	
Chromaticity of blue	x		0.117	0.167	0.217	-	
	y		0.132	0.182	0.232	-	
Luminance of white	Y_{L1}		360	450	-	cd/m ²	IL=6.0mArms fL=60kHz
White Uniformity	δW		-	-	1.35	-	[Note5]

[Note]

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.

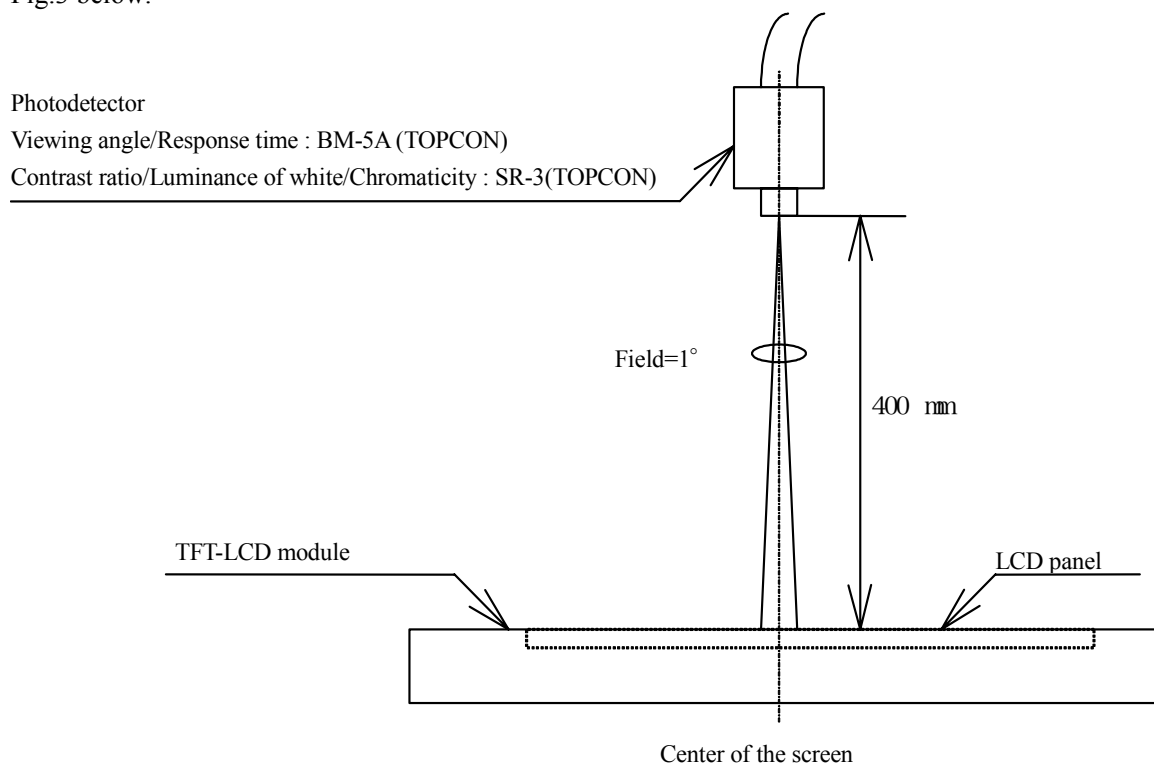
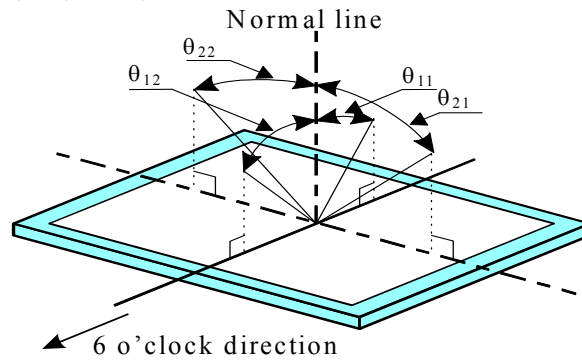


Fig.3 Optical characteristics measurement method

[Note1]Definitions of viewing angle range:



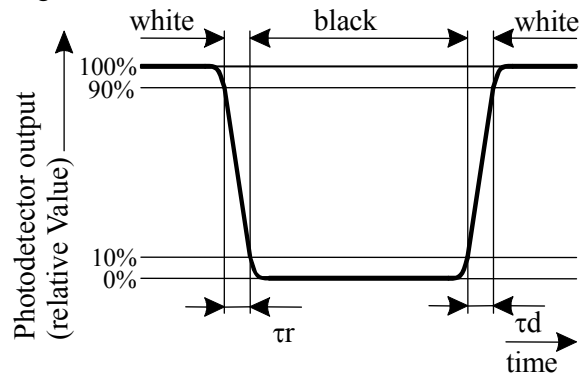
[Note2]Definition of contrast ratio:

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:

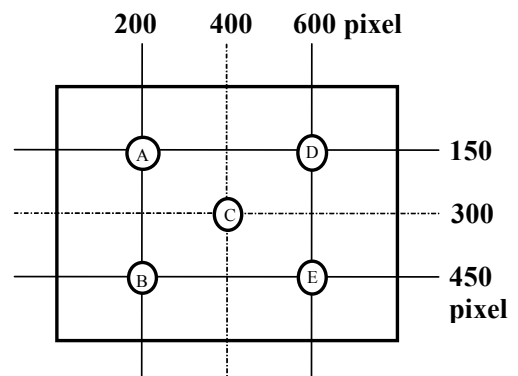
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



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

[Note5]Definition of white uniformity:

White uniformity is defined as the following with five measurements (A~E).



$$\delta w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

11. Display Quality

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

12. Handling Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Since the front polarizer is easily damaged, pay attention not to scratch it.
- d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
Handle with care.
- g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.
- h) Since there is a circuit board in the module back, stress is not added at the time of a design assembly. Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.
- i) Protection film is attached to the module surface to prevent it from being scratched .
Peel the film off slowly , just before the use, with strict attention to electrostatic charges.
Blow off 'dust' on the polarizer by using an ionized nitrogen.
- j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
- k) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment
- l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.
- m) There are high voltage portions on the backlight and very dangerous. Careless touch may lead to electrical shock. When exchange lamps or service, turn off the power without fail.
- n) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
- o) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.
- p) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.
- q) When install LCD modules in the cabinet, please tighten with “torque= $0.294 \pm 0.02 \text{N} \cdot \text{m}$ ($3.0 \pm 0.2 \text{kgf} \cdot \text{cm}$)”.
- r) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
- s) Notice: Never dismantle the module , because it will cause failure.
- t) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
- u) 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.
- v) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

13. Packing form

Product countries / Areas	JAPAN	TAIWAN	CHINA
Piling number of cartons	6		
Package quantity in one carton	10pcs		
Carton size	388(L) x 334(W) x 263(H)		
Total mass of one carton filled with full modules	10,000g		
Packing form is shown	Fig4		

14. Reliability test items

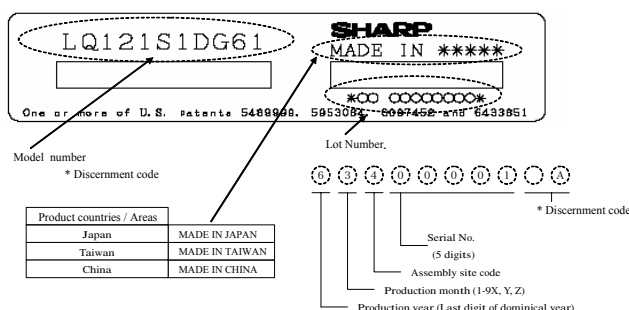
No.	Test item	Conditions	Remark
1	High temperature storage test	Ta=80°C 240h	Panel surface
2	Low temperature storage test	Ta= -30°C 240h	
3	High temperature & high humidity operation test	Ta=40°C ; 95%RH 240h (No condensation)	
4	High temperature operation test	Ta=80°C 240h	Panel surface
5	Low temperature operation test	Ta= -30°C 240h	
6	Vibration test (non- operating)	Frequency: 10~57Hz/Vibration width (one side):0.153mm : 57~500Hz/Gravity: 14.7 m/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 : 11ms, half sine wave Direction : ±X, ±Y, ±Z once for each direction.	
8	ESD test	Contact discharge (150pF 330Ω) non-operating = ±10kV, operating = ±8kV Atmospheric discharge (150pF 330Ω) non-operating = ±20kV, operating = ±15kV	
9	EMI	Measurement in 10m site Display position on the screen = "H" (full-screen), GND to 4 place = un-connect, Vcc / Vsignal = typ.	VCCI (Class B)

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state : Temperature:15~35°C, Humidity:45~75%, Atmospheric pressure:86~106kpa)

15. Others

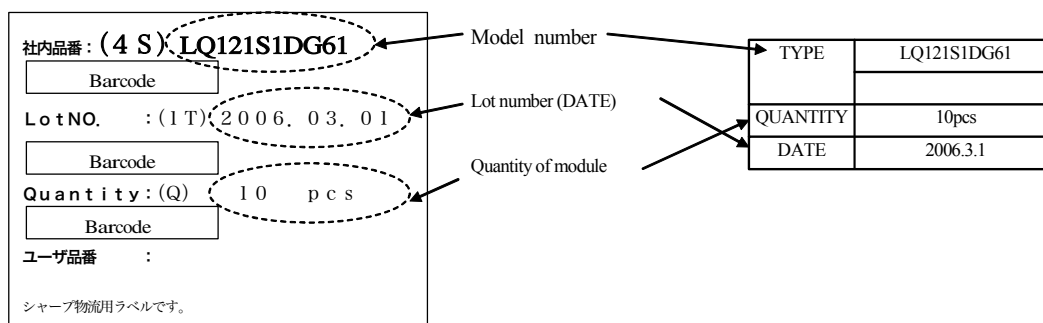
15-1 Lot number Label:



15-2 Packing box Label:

Quantity of module : Japan

Quantity of module : Taiwan or China



15-3 If any problem occurs in relation to the description of this specification, it shall be resolved through discussion with spirit of cooperation.

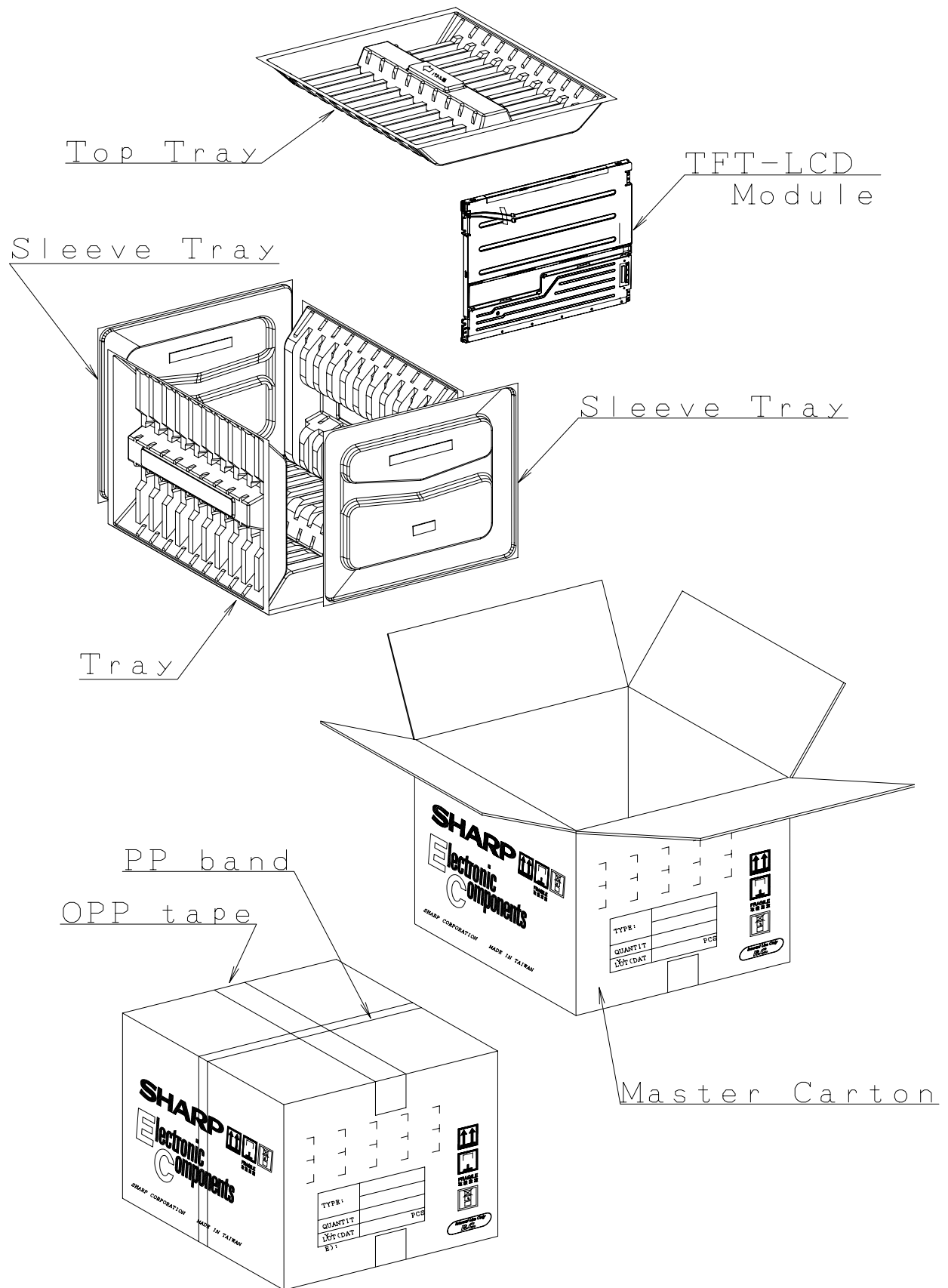


Fig4. Packing Form

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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