

PREPARED BY: _____	DATE _____	<h1>SHARP</h1> <p>LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION</p> <h2>SPECIFICATION</h2>	SPEC No. LD-5202
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			APPLICABLE GROUP Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.
LQ10DX01

CUSTOMER'S APPROVAL

DATE _____

BY _____

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1. Application

These specifications apply to color TFT-LCD module, LQ10DX01.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 1024x768 pixel panel in 512 colors by supplying 9x2 bit parallel data signals, three kinds of timing signals, +5V and +12V DC supply voltages for TFT-LCD panel driving and supply voltage for backlight. Optimum viewing direction is 6 o'clock.

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

3. Mechanical Specifications

Parameter	Specifications	Unit
Screen size	26 (Diagonal)	cm
	10.4(Diagonal)	inch
Effective display area	212.0(H) × 159.0(V)	mm
Display pixels	1024(H) × 768(V)	pixel
	(1 pixel = R + G + B dots)	
Pixel pitch	0.207(H) × 0.207(V)	mm
Pixel configuration	R.G.B vertical stripe	
Display mode	Normally white	
Outline dimension *1	283(W) × 215.6(H) × 12.5(D)	mm
Mass	870±30	g
Surface treatment	anti-glare and hard-coating 2H	

*1 NOTE: excluding backlight cables.

Outline dimensions is shown in Fig.1.

4. Input Terminals and function

4-1) TFT-LCD panel driving

CN1 (Data signals)

Used connector:DF9B-21P-1V(Hirose Electoric Co.,Ltd)

Corresponding connector:DF9B-21S-1V(Hirose Electoric Co.,Ltd)

Pin No.	Symbol	Function
1	GND	
2	R00	Red data signal of the odd pixels (LSB)
3	R01	Red data signal of the odd pixels
4	R02	Red data signal of the odd pixels (MSB)
5	R10	Red data signal of the even pixels (LSB)
6	R11	Red data signal of the even pixels
7	R12	Red data signal of the even pixels (MSB)
8	GND	
9	G00	Green data signal of the odd pixels (LSB)
10	G01	Green data signal of the odd pixels
11	G02	Green data signal of the odd pixels (MSB)
12	G10	Green data signal of the even pixels (LSB)
13	G11	Green data signal of the even pixels
14	G12	Green data signal of the even pixels (MSB)
15	GND	
16	B00	Blue data signal of the odd pixels (LSB)
17	B01	Blue data signal of the odd pixels
18	B02	Blue data signal of the odd pixels (MSB)
19	B10	Blue data signal of the even pixels (LSB)
20	B11	Blue data signal of the even pixels
21	B12	Blue data signal of the even pixels (MSB)

CN2 (Power supply & signals)

Used connector:DF9B-15P-1V(Hirose Electric Co.,Ltd)

Corresponding connector:DF9B-15S-1V(Hirose Electric Co.,Ltd)

Pin No.	Symbol	Function
1	GND	
2	CK	Clock signal for sampling each data signal
3	GND	
4	Hsync	Horizontal sync. signal (negative)
5	GND	
6	Vsync	Vertical sync. signal (negative)
7	TEST1	This shall be electrically opened during operation
8	TEST2	This shall be electrically opened during operation
9	TEST3	This shall be connected to Vcc
10	Vdd	+12V power supply
11	Vdd	+12V power supply
12	Vdd	+12V power supply
13	Vcc	+5V power supply
14	Vcc	+5V power supply
15	Vcc	+5V power supply

※The shielding case is connected with signal GND.

4-2) Backlight

Used connector:QZ-19-3F01(HONDA TSUSHIN KOGYO CO.,LTD)

CNA,CNB Corresponding connector:QZ-19-3MYL(HONDA TSUSHIN KOGYO CO.,LTD)

Pin NO.	Symbol	Function
1	V _{HIGH}	Power supply for lamp (High voltage side)
2	N C	
3	V _{LOW}	Power supply for lamp (Low voltage side)

*Cable length: CNA&CNB 50±1 $\frac{1}{2}$ mm

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	$T_a=25^\circ\text{C}$	$-0.3 \sim V_{CC}+0.3$	V	【Note1】
+5V supply voltage	V_{CC}	$T_a=25^\circ\text{C}$	$-0.3 \sim +7$	V	
+12V supply voltage	V_{DD}	$T_a=25^\circ\text{C}$	$-0.3 \sim +14$	V	
Storage temperature	T_{stg}	-	$-25 \sim +60$	$^\circ\text{C}$	【Note2】
Operating temperature (Ambient temp.)	T_{opa}	-	$0 \sim +50$	$^\circ\text{C}$	

【Note1】 CK, Hsync, Vsync, R00~R02, G00~G02, B00~B02, R10~R12, G10~G12, B10~B12

【Note2】 Relative humidity 95%RH Max. (at $T_a \leq 40^\circ\text{C}$)

Maximum wet-bulb temperature 39°C or less. (at $T_a > 40^\circ\text{C}$)

No condensation.

6. Electrical Characteristics

6-1. Electrical Characteristics & current dissipation

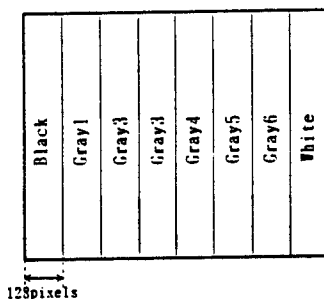
6-1-a) TFT-LCD panel driving

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

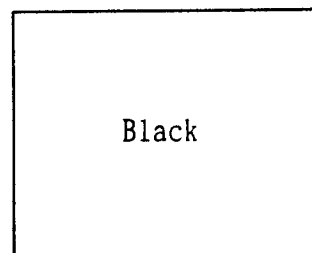
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+5V	Supply voltage	V_{CC}	+4.5	+5.0	+5.5	V	
	Current dissipation	I_{CC}	-	320	550	mA	【NOTE1】
+12V	Supply voltage	V_{DD}	+10.8	+12.0	+13.2	V	
	Current dissipation	I_{DD}	-	370	450	mA	【NOTE1】
Input voltage (Low)		V_{IL}	-	-	1.5	V	$V_{CC}=+5V$
Input voltage (High)		V_{IH}	+3.5	-	-	V	
Permissive input ripple voltage		V_{RP}	-	-	100	mV _{P-P}	V_{CC}, V_{DD}
Input low current		I_{OL}	-10	-	-	μA	$V_I=0V$
Input high current		I_{OH}	-	-	+10	μA	$V_I=V_{CC}$

【NOTE1】 Current dissipation are measured as follows.

Typical :



Max :



6-1-b) Backlight

The backlight system is an edge lighting type. (a couple of CCFT)
The characteristics of single lamp are shown in the following table.
Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp voltage	V _L	-	455	-	Vrms	Just for reference
Lamp current	I _L	6.5	7.0	7.5	mArms	
Lamp power consumption	P _L	-	3.2	-	W	【Note 1】
Frequency	F _L	20	-	60	KHz	【Note 2】
Kick-off voltage	V _s	-	-	1000	Vrms	Ta=25°C
		-	-	1200	Vrms	Ta=0°C
Lamp life time	T _L	10000	-	-	hour	【Note 3】

【Note 1】 Calculated values for reference. (I_L × V_L)

【Note 2】 Lamp frequency may produce interference with horizontal sync. frequency, and interference may cause beat on the display. Therefore lamp frequency shall be as different as possible from that of horizontal sync. signal to avoid interference.

【Note 3】 Brightness becomes 50% of the original value under standard condition. (I_L = 7.0 mArms)

6-2. Timing Characteristics of input signals

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	-	27.0	28.4	MHz	【Note 1】
	High time	Tch	5	-	-	ns	
	Low time	Tcl	10	-	-	ns	
Data	Setup time	Tds	0	-	-	ns	
	Hold time	Tdh	10	-	-	ns	
Horizontal sync. signal	Cycle	TH	-	19.259	-	μs	
			516	520	-	clock	
	Pulse width	THp	4	4	32	clock	
CK-Hsync. phase difference		THC	0	-	Tc-10	ns	
Vertical sync. signal	Cycle	TV	-	14.868	-	ms	
			772	772	-	line	
	Pulse width	TVp	4	4	8	line	
H-Vsync. phase difference		TVH	0	-	100	ns	

【Note 1】 Two pixel-data are sampled at a time.

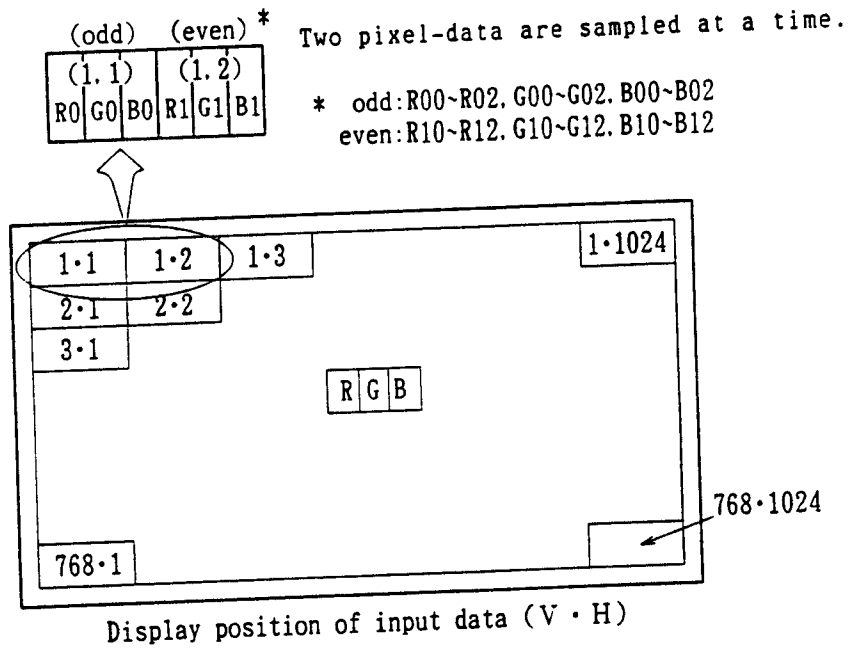
- Note 1. Make sure that of the signals are above data to ensure right display position and display quality.
2. If the frequency is lower, deterioration of display quality, such as flickering, may occur.

※ Input signal waveforms are shown in Fig. 2.

6-3. Display period

Items	Standards	Beginning	Ending	Unit	Remark
Horizontal	falling edge of Hsync.	4	5 1 6	clock	
Vertical	falling edge of Vsync.	4	7 7 2	line	

6-4. Input Signals and Display on the screen



6-4. Input Signals. Basic Display Colors and Gray Scale of Each Color

	color & gray scale	Data signal									
		odd	R00	R01	R02	G00	G01	G02	B00	B01	B02
		even	R10	R11	R12	G10	G11	G12	B10	B11	B12
Basic color	Black	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	1	1	1
	Green	0	0	0	0	1	1	1	0	0	0
	Light blue	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	0	0	0	0	0	0	0
	Purple	1	1	1	0	0	0	0	1	1	1
	Yellow	1	1	1	1	1	1	1	0	0	0
	White	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0
	↑	1	1	0	0	0	0	0	0	0	0
	↓	0	0	1	0	0	0	0	0	0	0
	Brighter	1	0	1	0	0	0	0	0	0	0
	↓	0	1	1	0	0	0	0	0	0	0
Red	1	1	1	0	0	0	0	0	0	0	
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	1	0	0	0	0	0	0
	Darker	0	0	0	0	1	0	0	0	0	0
	↑	0	0	0	1	1	0	0	0	0	0
	↓	0	0	0	0	0	1	0	0	0	0
	Brighter	0	0	0	1	0	1	0	0	0	0
	↓	0	0	0	0	1	1	0	0	0	0
Green	0	0	0	1	1	1	0	0	0	0	
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	1	0	0	
	Darker	0	0	0	0	0	0	0	1	0	
	↑	0	0	0	0	0	0	1	1	0	
	↓	0	0	0	0	0	0	0	0	1	
	Brighter	0	0	0	0	0	0	1	0	1	
	↓	0	0	0	0	0	0	0	1	1	
Blue	0	0	0	0	0	0	1	1	1		

0: Low level
voltage
1: High level
voltage

Each color is displayed in 8 gray scales from 3 bit data signals input. According to the combination of total 9 bit data, 512 colors are displayed.

7. Optical Characteristics

Ta=25°C, Vcc=+5.0V, Vdd=+12.0V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	$\theta_{21,22}$	CR > 10	45	-	-	Deg.	【Note1】
	Vertical	θ_{11}		10	-	-	Deg.	
		θ_{12}		30	-	-	Deg.	
Contrast ratio		CR	$\theta = 0^\circ$	60	-	-		【Note2】
Response time	Rise	τ_r		-	30	-	ms	【Note3】
	Fall	τ_f		-	50	-	ms	
Luminance of white		Y_L		50	70	-	cd/m ²	
Chromaticity of white		X		-	0.313	-		
		Y		-	0.329	-		
White uniformity		δ_w		-	-	1.25		【Note4】

※ The measurement shall be executed 15-20 minutes after lighting at rating. ($I_L=7.0\text{mA rms}$)

The optical characteristics are measured in a darkroom or equivalent state with the method shown in Fig.3. And these characteristics except for White uniformity are measured at the center of the screen.

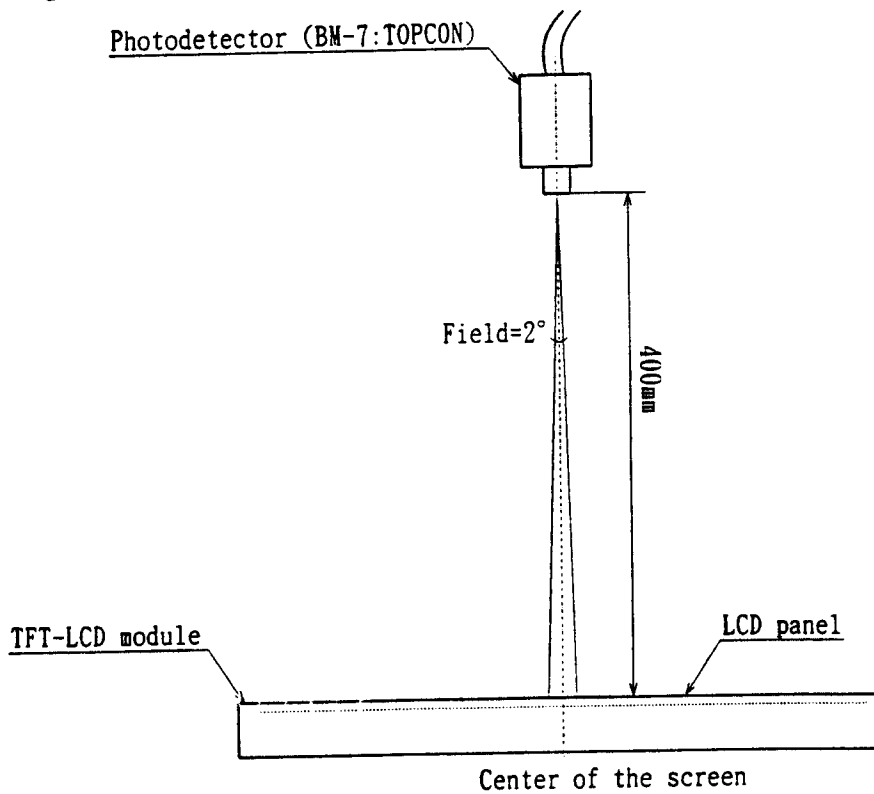
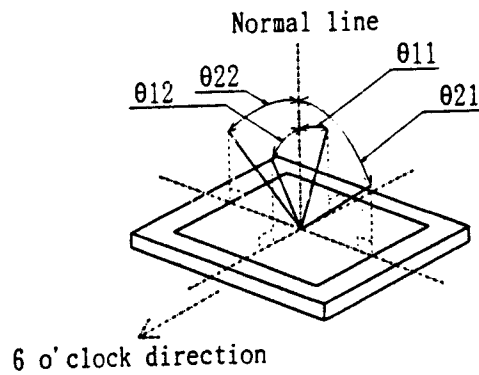


Fig.3 Optical characteristics measurement method

【Note1】 Definitions of viewing angle:



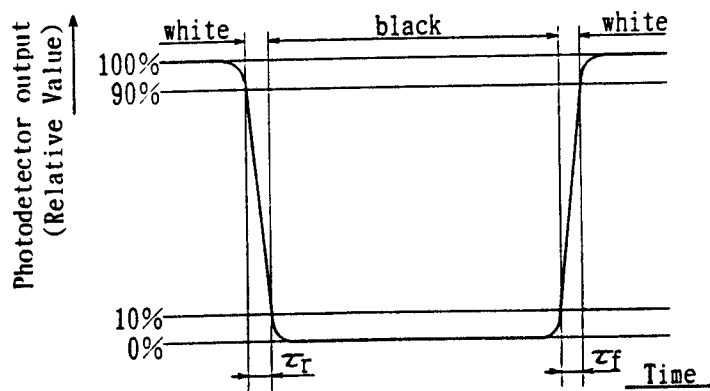
【Note2】 Definitions of Contrast Ratio:

The contrast ratio is defined as follows.

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

【Note3】 Definitions of Response Time:

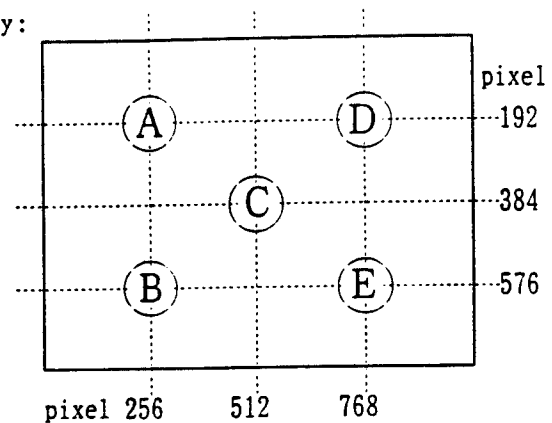
The response time shall be measured as the following figure by switching the input signals for "black" ON and OFF.



【Note4】 Definition of White uniformity:

The white uniformity is defined as the following equation among the values measured at the 5 spots(A~E).

$$\frac{\text{maximum luminance (brightness)}}{\text{minimum luminance (brightness)}}$$



8. Display quality

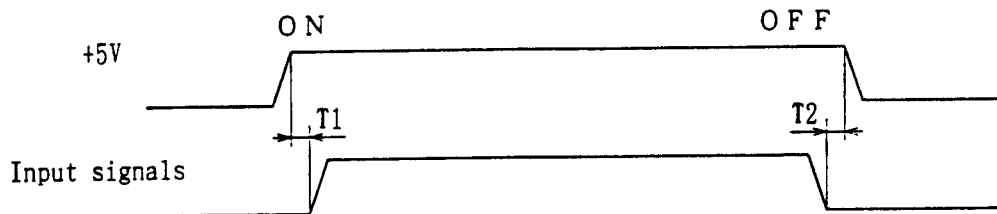
The display quality of this module shall be in compliance with the Delivery Inspection Standard.

9. Handling Precautions

9-1) Be sure to insert the cable into the connector or take out of the connector after turning off the power supply on the set side.

9-2) Power ON/OFF sequential timing

To prevent the latch-up of the circuit in the module, keep the sequential timing between the input signals and supply voltage as follows.



$$0 \leq T1 \leq 1\text{sec}, 0 \leq T2 \leq 1\text{sec}$$

9-3) Others

- 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 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 the glass is used in the module, it may break or crack if dropped or bumped on hard surface. Handle with care.
- f) Since CMOS LSI is used in this module, take care of static electricity and ground your body when handling.
- g) Observe all other precautionary requirements in handling components.

10. Packing form

- a) Piling number of cartons: MAX. 6
 - b) Package quantity in one carton: MAX. 10
 - c) Carton size: 420mm(W) \times 330mm(H) \times 400mm(D)
 - d) Total weight of 1 carton filled with full modules: 12000g
- Packing form is shown in Fig.4.

11. Reliability test items

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

【Result Evaluation Criteria】

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

12. Others

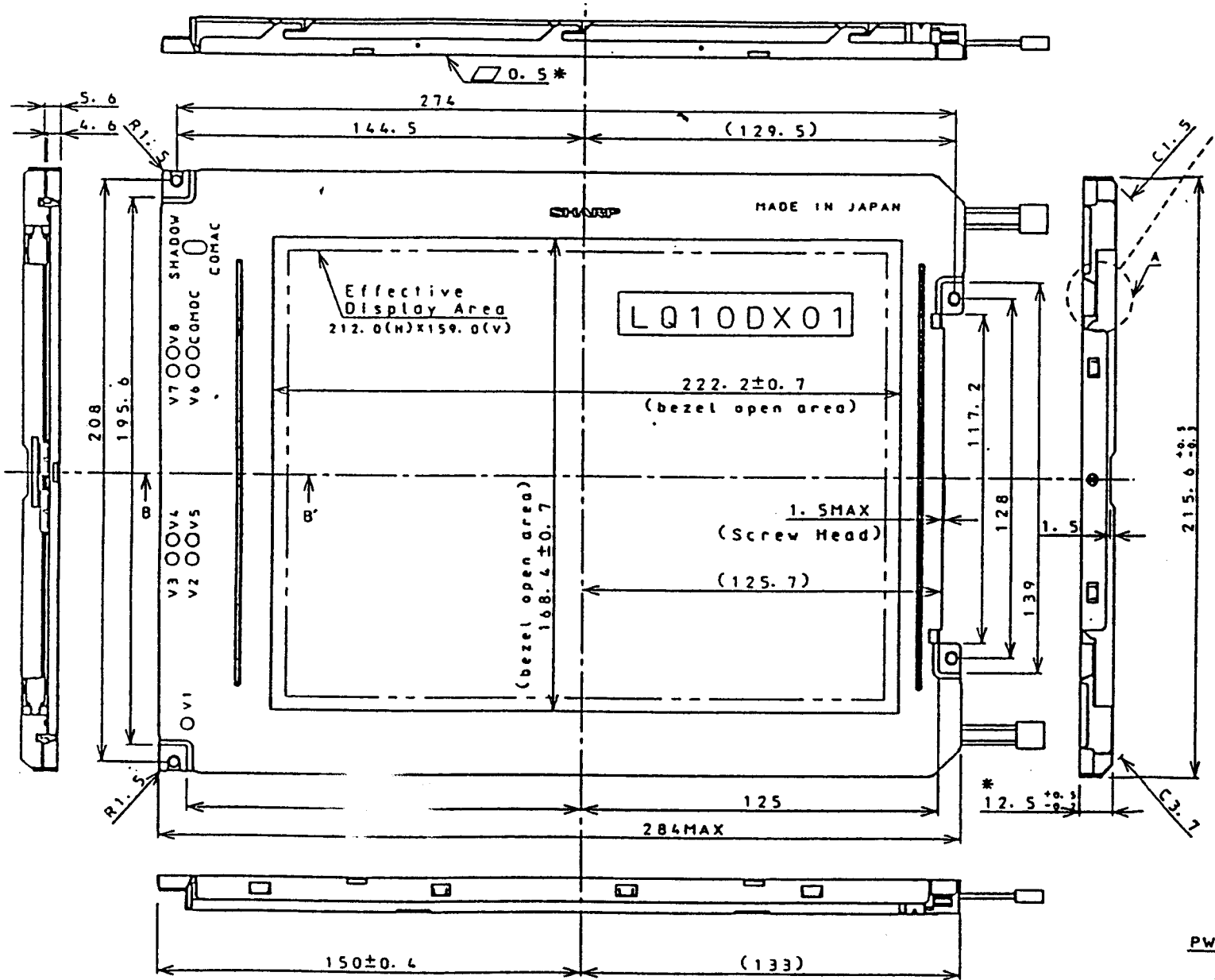
- 1) Adjusting volumes have been set optimally before shipment, so do not change any adjusted values. If adjusted values are changed, the data mentioned in this technical literature may not be satisfied.
- 2) Disassembling the module can cause permanent damage and should be strictly avoided.
- 3) If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

A

OUTLINE DIMENSIONS T-LCD MODULE

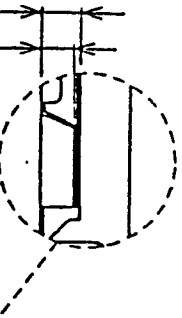
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5.1
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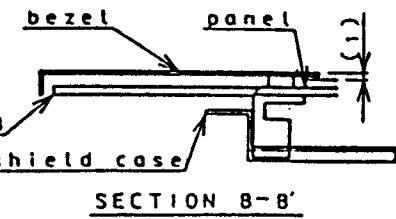
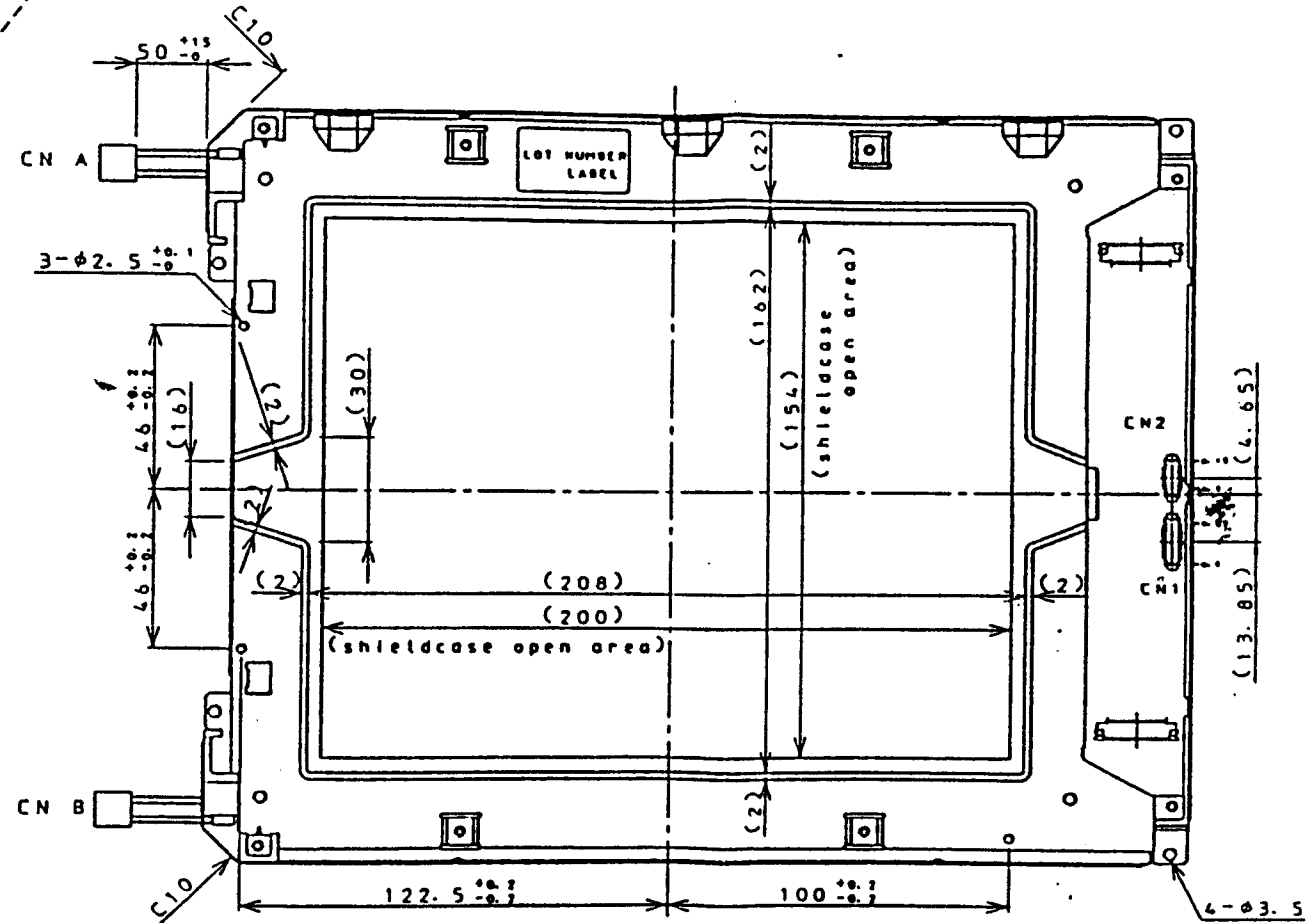


*The flatness is not included in the specified tolerance.

Fig1: Outline



ENLARGED DETAIL A



NOTES

- 1: $\phi 2$. Shole(x3) is location hole of module.
- 2: Inserted depth of locating pin is 1.5mm maximum.
- 3: Tolerance ± 0.3 mm except when specified.

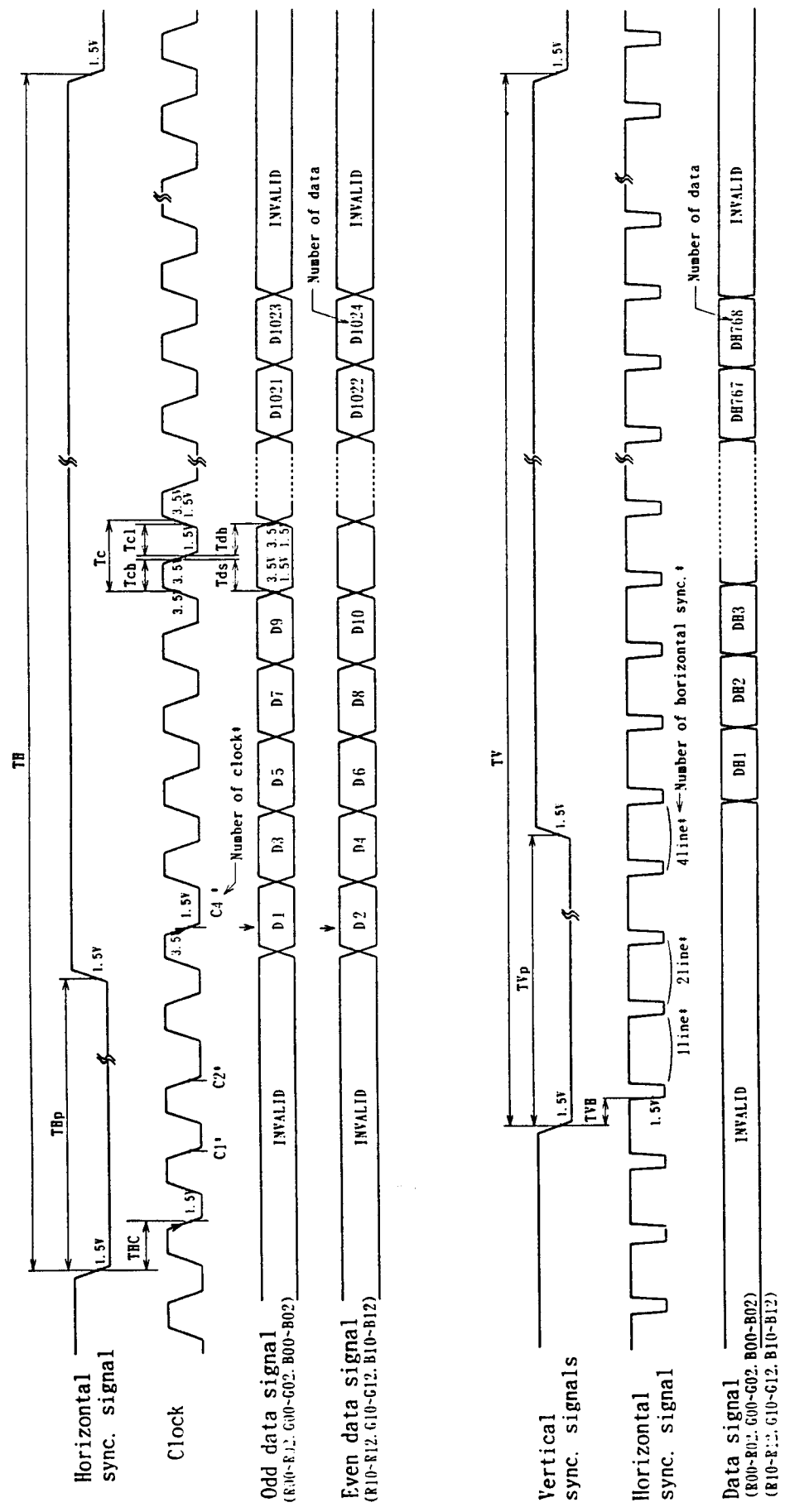


Fig.2 Input signal waveforms

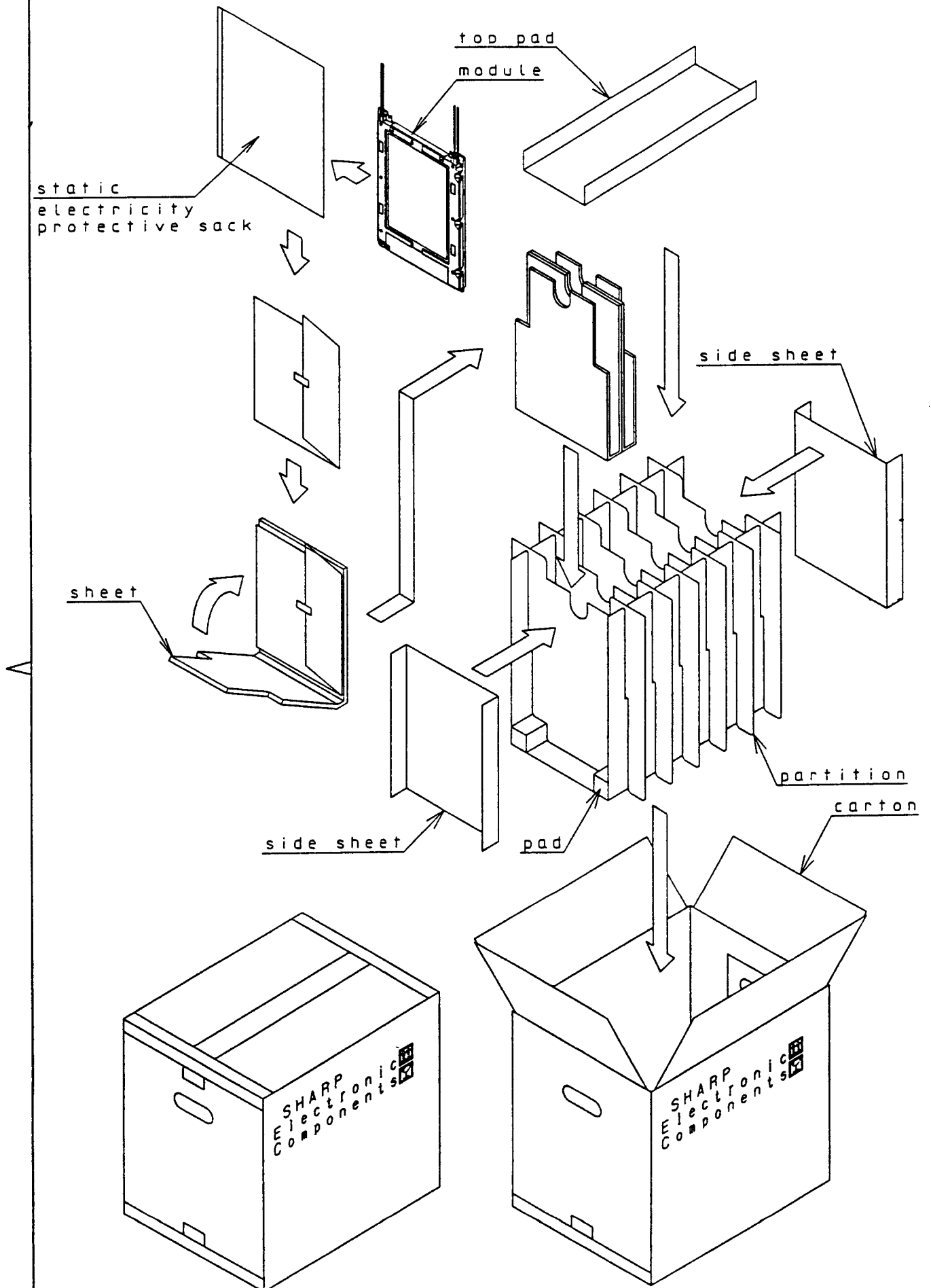


Fig4 packing form