SHARP

No.	LA-19950A
DATE	Sep. 5, 2007

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ085Y3DG06

These parts have corresponded with the RoHS directive.

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ENGINEERING DEPARTMENT

MOBILE LIQUID CRYSTAL DIVISION III

MOBILE LIQUID CRYSTAL DISPLAY GROUP

SHARP CORPORATION

RECORDS OF REVISION

MODEL No : LQ085Y3DG06

SPEC No : LA-19950A

	NO.	PAGE	SUMMARY	NOTE
2007.9.5	-A		—	1st Issue

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1. Applicable TFT-LCD module

This technical literature applies to the color TFT-LCD module, LQ085Y3DG06.

2. Overview

This module is a color active matrix transmissive LCD module incorporating amorphous silicon TFT (Thin Film Transistor).

It is composed of a color TFT-LCD panel, driver ICs, control circuits and power supply circuitry and a backlight unit. Graphics and texts can be displayed on a 800 x RGB x 480 dots panel with 262,144 colors by feeding 18 bit data signal (6bit/each of R,G,B), 4(four) timing signals, +3.3V DC power supply for TFT-LCD and AC power supply for backlight.

(Note: Backlight-driving DC/AC inverter is not built in this module.)

- Fine images with stripe aligned 384,000 pixels on 8.5 inch diagonal screen.
- Color display capability of 262,144 colors with 18 bit data signal (6 bits for each RGB).
- Adapting a wide viewing angle technology. [best viewing angle: 12 o'clock direction]
- High contrast, thanks to active matrix drive system.
- AG (Anti Glare) polarizing filter.
- Light and slim compact module achieved by COG assemble technology.
- Natural coloring reproducibility by employing normally-white-mode, which has good nature in coloring.
- These LCD modules have corresponded with the RoHS directive.

3 Mechanical Specifications

Items	Specifications	Unit
Display size (Diagonal)	21.6 (8.5")	cm
Active display area	184.8 (H) x 110.88 (V)	mm
Pixel format	800(H) x RGB x 480(V)	dot
	(1 pixel=R+G+B dots)	-
Dot pitch	0.077[H] x 0.231[V]	mm
Pixel configuration	R,G,B vertical stripe	-
LCD mode	Normally white	-
Dimension*	212(W) x 134 (H) x 12.5(D)	mm
Mass	370(TYP)	g

*. Protrusion such as backlight harness and positioning boss are not included.

Fig.1 shows dimensions of the module.

4 Input Signal Assignment

4.1 TFT-LCD Panel driving section

CN1 Employed connector: FH12-40S-0.5SH(55) (HIROSE ELECTRIC CO.,LTD.) Terminal :Au plating【Note 1】

Pin No.	Symbol	Function	Polarity
1	Test1	TEST1(Please be sure to connect 1pin with ground)	
2	GND	Ground	
3	CK	Clock signal for sampling each data signal	
4	GND	Ground	
5	Test2	TEST2(Please be sure to connect 5pin with ground)	
6	Test3	TEST3 (Please be sure to open 6pin)	
7	R0	RED data signal(LSB)	
8	R1	RED data signal	
9	R2	RED data signal	
10	GND	Ground	
11	R3	RED data signal	
12	R4	RED data signal	
13	R5	RED data signal(MSB)	
14	GND	Ground	
15	G0	GREEN data signal(LSB)	
16	G1	GREEN data signal	
17	G2	GREEN data signal	
18	GND	Ground	
19	G3	GREEN data signal	
20	G4	GREEN data signal	
21	G5	GREEN data signal(MSB)	
22	GND	Ground	
23	B0	BLUE data signal(LSB)	
24	B1	BLUE data signal	
25	B2	BLUE data signal	
26	GND	Ground	
27	B3	BLUE data signal	
28	B4	BLUE data signal	
29	B5	BLUE data signal(MSB)	
30	GND	Ground	
31	Hsync	Horizontal synchronous signal	Low active
32	GND	Ground	
33	Vsync	Vertical synchronous signal	Low active
34	FGND	Frame Ground	【Note 2】
35	ENAB	Data enable signal (signal to settle the horizontal display position)	【Note 3】
36	N.C.	No Connect	
37	Vcc	+3.3V power supply	
38	Vcc	+3.3V power supply	
39	N.C.	No Connect	
40	Vcc	+3.3V power supply	

【Note 1】 Refer to the one that the size of FFC/FPC was recommended it of input connector.
The terminal of FFC/FPC of input connector recommend gold or gold plating specification.
Because point of contact with its is gold plating specification.

【Note 2】 A frame ground of the 34pin is connected to front and back bezel electrically,
but other grand terminals(2pin,4pin,・・・,32pin) are not connected to it.

【Note 3】 The horizontal display location is designated and controlled by rising timing of ENAB signal. However if ENAB signal is fixed to "Low", display location is designated by the default setting in the module. (Don't use the module by fixing ENAB to "High") .....See: Chapter 7-2

4.2 Backlight section

CN2 Employed connector: BHR-02(8.0)VS-1N (JST), Adapted connector: SM02(8.0)B-BHS-1N-TB (JST)

Pin no.	Symbol	Function	Collar of FL cable
1	V_{HIGH}	input terminal (Hi Voltage Side)	Pink
2	V_{LOW}	input terminal (Low Voltage Side)	White

【Note】

Please connect Low Voltage Side of a lamp input terminal (V_{LOW}) to input GND of a DC/AC inverter circuit, in the case of use in GND electrical potential.

5 Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25°C	-0.3 ~ + Vcc+0.3	V	【Note 1】
Supply voltage	Vcc	Ta=25°C	0 ~ +4.6	V	-
Storage temperature	Tstg	-	- 25 ~ +75	°C	【Note 2】
Operating temperature (Panel surface)	Topp	-	0 ~ +75	°C	

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

【Note 2】 No condensation.

It may stop acting normally, when it operates it for a long time with having condensed.

6 Electrical characteristics

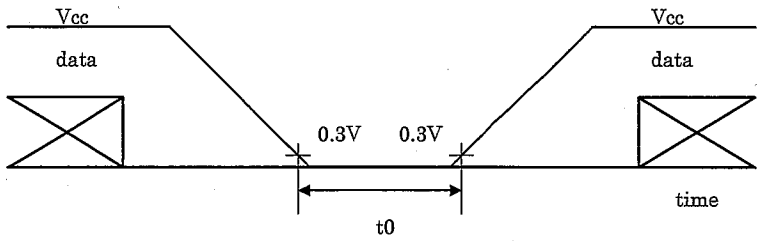
6.1 TFT-LCD Panel driving section

Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	Vcc	+3.0	+3.3	+3.6	V	[Note1]
Current dissipation	Icc	-	300	400	mA	Vcc=3.3V [Note2]
Permission input ripple voltage	V_{RL}	-	-	100	mVp-p	
Input voltage ("Low" state)	V_{IL}	0	-	0.2*Vcc	V	[Note3]
Input voltage ("High" state)	V_{IH}	0.8*Vcc	-	Vcc	V	
Input leakage current(low)	$\|I_{OL1}\|$	-	-	4.0	μA	Vcc=0V [Note4]
Input leakage current(High)	$\|I_{OH1}\|$	-	-	4.0	μA	Vcc=3.3V [Note4]

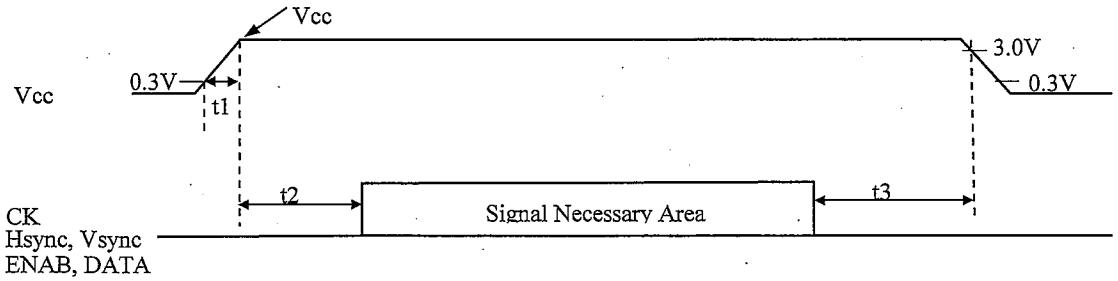
[Note1]
Vcc turn-on/off conditions

1s < t0



[Note2] Current dissipation : When Black pattern is displayed.
[Note3] CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB
[Note4] R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB

6.2 Vcc turn-on/off conditions



◎ Every Signal is CMOS Input, Hi-Z is prohibited when VCC is on level.
◎ Input CK, Hsync, Vsync, ENAB, and DATA after it becomes regular amplitude and a frequency.

	Min.	Typ.	Max.	Unit
t1	0	-	10	ms
t2	50	-	-	ms
t3	0	-	-	ms

6.3 Backlight driving Section Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Lamp voltage	VL	-	960	-	Vrms	IL=5.0mArms
Lamp current	IL	4.0	5.0	6.0	mArms	steady state [Note6-1]
Lamp frequency	fL	35	55	80	kHz	
Kick off voltage [Note6-2]	VS	-	-	1660	Vrms	Ta=25°C
		-	-	2325		Ta=0°C
Lamp life time Ta=25℃		25,000	-	-	hour	Continuation [Note6-3] [Note6-4]

(Inverter: HARISON TOSHIBA LIGHTING CORPORATION Type HIU-766(13.5pF, 52kHz) is used.)

Caution: 1) 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.

2) Use the inverter providing symmetrical sine-wave in positive/negative polarity with no spike.

[Note6-1] Lamp current is a value at the time of stability after 30 minutes since backlight turns on.

[Note6-2] The data for lamp is for your reference, because lamp is consumable component.

When you design or order the inverter, please make sure that leak current and backlight turns on voltage of inverter circuit. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Also, Method of voltage impress is slide up.

The open output voltage of the inverter shall be maintained for more than 1s.

[Note6-3] a) Lamp life time is defined by either ①or ② below.(Continuous turning on at Ta=25℃, IL=5mArms)

①When a brightness of lamp surface became 50% of the initial value under the standard condition.

②When it became the condition which a lamp impossible to illumination.

b) 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.)

[Note6-4] Please make sure that average lamp life time becomes short, although brightness goes up when lamp current is increased. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

(Recommendation lamp current 4.0～6.5 mArms)

This life is reference value when a module was put horizontally.

There is the case that luminance deteriorates in a shorter term than above specifications,

When a module was put in the state that put up a lamp (the state that made harness up or down).

7 Timing Characteristics of Input Signals

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

7.1 Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	31.95	33.26	34.6	MHz	
	"High" time	Tch	12	-	-	ns	
	"Low" time	Tcl	13	-	-	ns	
Data	Setup time	Tds	5	-	-	ns	
	Hold time	Tdh	5	-	-	ns	
Hsync	Period	TH	31.45	31.75	32.05	μs	
			1024	1056	1088	clock	
	Pulse width	THp	5	128	186	clock	
Vsync	Period	TV	520	525	530	line	60Hz
	Pulse width	TVp	2	-	TV-515	line	
Horizontal display period		THd	-	800	-	clock	
Phase difference between Hsync and clock		THc	8	-	Tc-10	ns	
Phase difference between Hsync and Vsync		TVh	0	-	50	clock	
Vertical back porch		TVs		35(fixed)	-	line	
Vertical front porch		TVf	3	-	-	line	
Vertical display period		TVd	-	480	-	line	

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

7.2 Display Position in horizontal direction

Display position in horizontal direction is designated by rising timing of ENAB signal.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
ENAB signal	Setup time	Tes	5	-	Tc-10	ns	
	Pulse width	Tep	-	800	-	clock	
Phase difference between Hsync and ENAB signal		THe	88	-	216	clock	

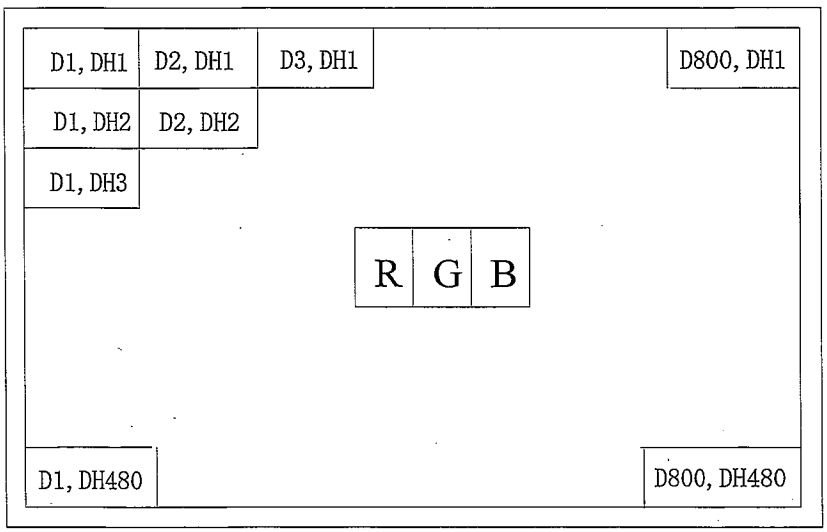
When ENAB is fixed to "Low", the horizontal display will starts from the clock C216 (clock) as shown in Fig.2.

[Note] In the case that ENAB signal is used with active, ENAB signal is fixed "LOW" or continuation input of the ENAB signal similar to the TVd period on Vertical invalid data period.

7.3 Display position in vertical direction.

↑ UP

Display position of input data (H,V)



8 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	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 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.

9 Optical Specification

Ta=25°C, Vcc=3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle Range	Horizontal	θ21,θ22	CR≥10	50	55	-	° (Deg.)	[Note9-1,4]
	Vertical	θ11		30	40	-	° (Deg.)	
		θ12		50	60	-	° (Deg.)	
Contrast ratio		CR max	Best viewing angle	-	250	-	-	[Note9-2]
Response time	Rise	Tr	θ = 0°	-	8	-	ms	[Note9-3]
	Fall	Td		-	21	-	ms	
Chromaticity of white		x	θ = 0°	0.25	0.30	0.35	-	[Note9-4]
		y		0.27	0.32	0.37	-	
Luminance of white		L		200	260	-	cd/m²	IL=5.0mArms

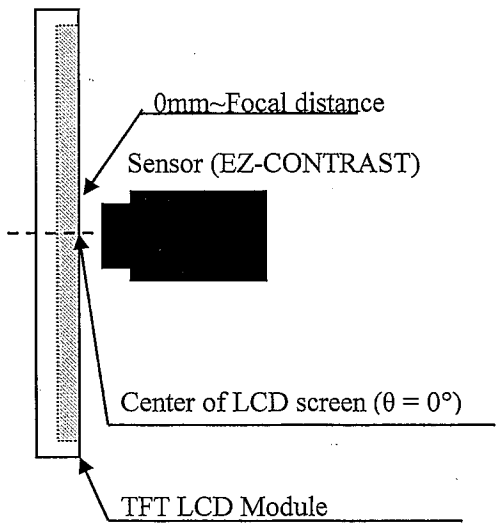


Fig.9-1 Measuring setup for Viewing angle and Contrast ratio

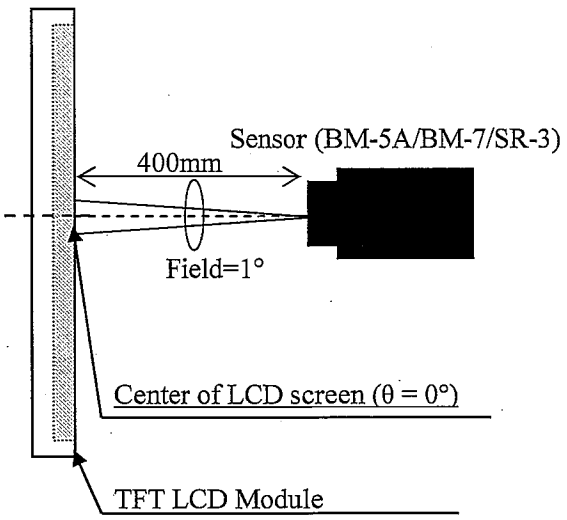
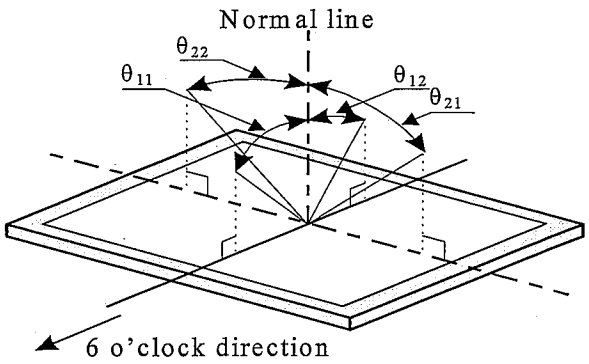


Fig.9-2 Measuring setup for Luminance, Chromaticity and Response time (BM-5A/7 is used for Luminance, SR-3 is for chromaticity)

[Note9-1] Definitions of viewing angle range:



The best viewing angle of this module (θmax) is slightly leaned to 12 o'clock from normal line.
Where $\theta_{12} > \theta_{max}$, gray scale is reversed partially.
Where $\theta_{12} < \theta_{max}$, or 6 o'clock direction , gray scale isn't reversed.

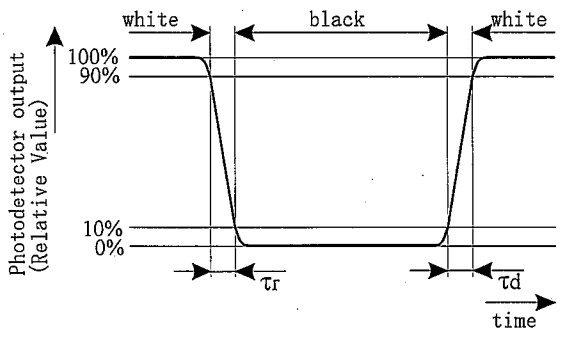
[Note9-2] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note9-3] Definition of response time:

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



[Note9-4] This parameter should be measured at the center of the screen and 30 minutes after turn-on.
The characteristics are measured when the driver circuit is not powered.

10 Display Qualities

Please refer to the Outgoing Inspection Standard.

11 Handling Instruction

11.1 Assembling the module

①Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

②Be sure to turn off the power supply and signals when inserting or disconnecting the cable.

11.2 Precautions in mounting

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

b) Method of removing dust from polarizer.

- Blow off dust with N2 blower for which static electricity preventive measure has been taken.
- Since the polarizer is easily damaged, wiping should be avoided. If the panel has stain or finger grease, we recommend to use adhesive tape to softly remove them from the panel. Inevitable, wipe off by cleaning cloth for a lens with carefully, breathing on it.

c) 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.

d) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface handle with care. Since CMOS LSIs are incorporated in this module, take care of electrostatic and earth human body while handling.

11.3 Caution in product design

The notes and cautions below should be followed when product is designed with this module.

The module should be protected with cover to prevent salt content and/or water droplet.

Take enough shielding countermeasure not to interfere to peripheral electronic device.

11.4 Others

The LCD has the nature that its performance is degradation by ultra-violet light. Don't leave the LCD module in direct sunlight or strong ultra violet ray.

If stored at the temperatures lower than the rated storage temperature, the LC may freeze and it may cause LCD panel damage. If storage temperature exceeds the specified rating, the molecular orientation of the LC may change to that of a liquid, and they may not revert to their original state. Store the module in normal room temperature.

The inductive loss caused by routing of lamp lead wire, which is closed to conductive section, may require the kick-off voltage greater than specified kick-off voltage.

The liquid crystal may leak out when the LCD is broken. If the liquid crystal drip into the eyes or mouth washes it out immediately.

The caution to other ordinal electronic component should be followed also.

12 Packing Form

12.1 Fig.3 shows packaging form.

12.2 Carton stock conditions

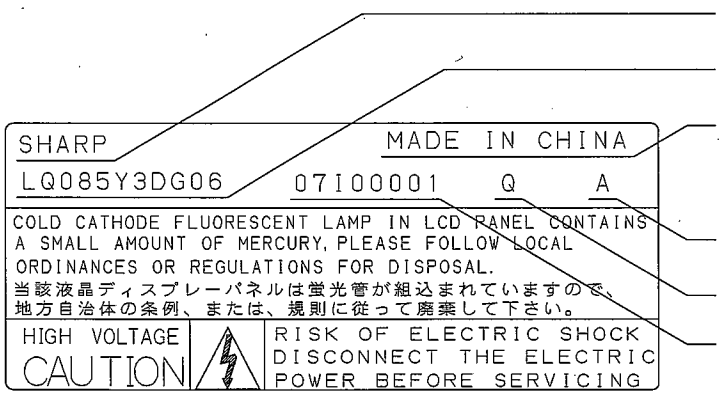
a) Maximum number of Carton being stuck: Max. 6 cartons
b) Maximum number of product contained: 20 Unit
c) Carton size: 571mm(W) × 241mm(H) × 356mm(D)
d) Total mass (for 20Unit): Approximately 10 kg
e) Carton stock environment:

1) Temperature:	0 ~ 40°C
2) Humidity:	Up to 60%RH
3) Ambiance:	No gases bite into electronic components and wiring materials
4) Period:	Approximately 3month
5) Unpacking:	To prevent LCD module from damaging by ESD, unpack the module with effective measure after controlling humidity 50%RH or more.

13 Marking of product name

13.1. Serial No. indication

Serial No. is indicated by labeling. The location is given in Fig.1 Outline dimension.



SHARP product

Model name

Country of origin

Revision marks (A, B, C, …)

Product factory (Q, L, etc.)

Serial No. contents

Production year (ex. 2007 → "07")

Production month (1:A, 2:B,..., 12:L)

Serial number (00001 ~)

14 Others

a) Don't disassemble this module, it may cause malfunction

b) Image retention may occur when the fixed image is display for long time.

15 Reliability Test Items

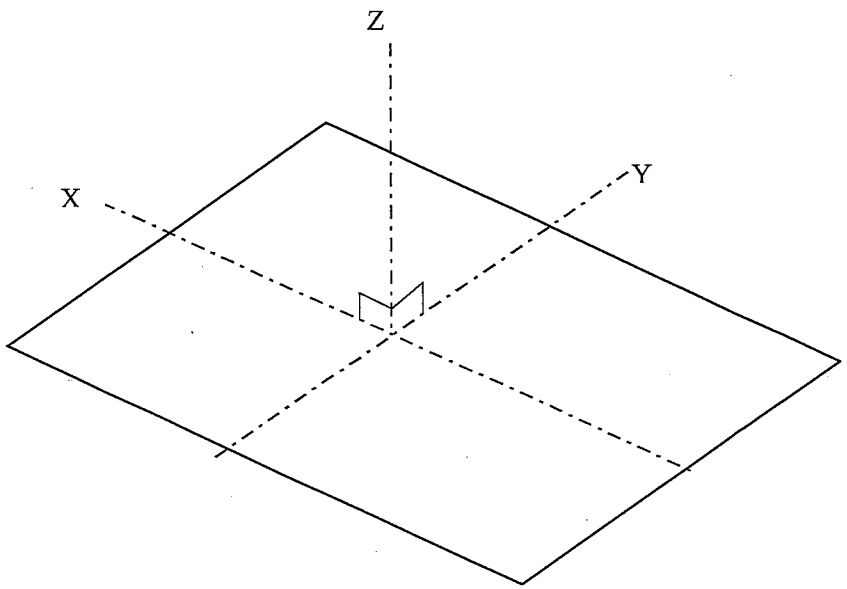
[Note] Temperature condition is based on operating temperature condition of Absolute Maximum Ratings.

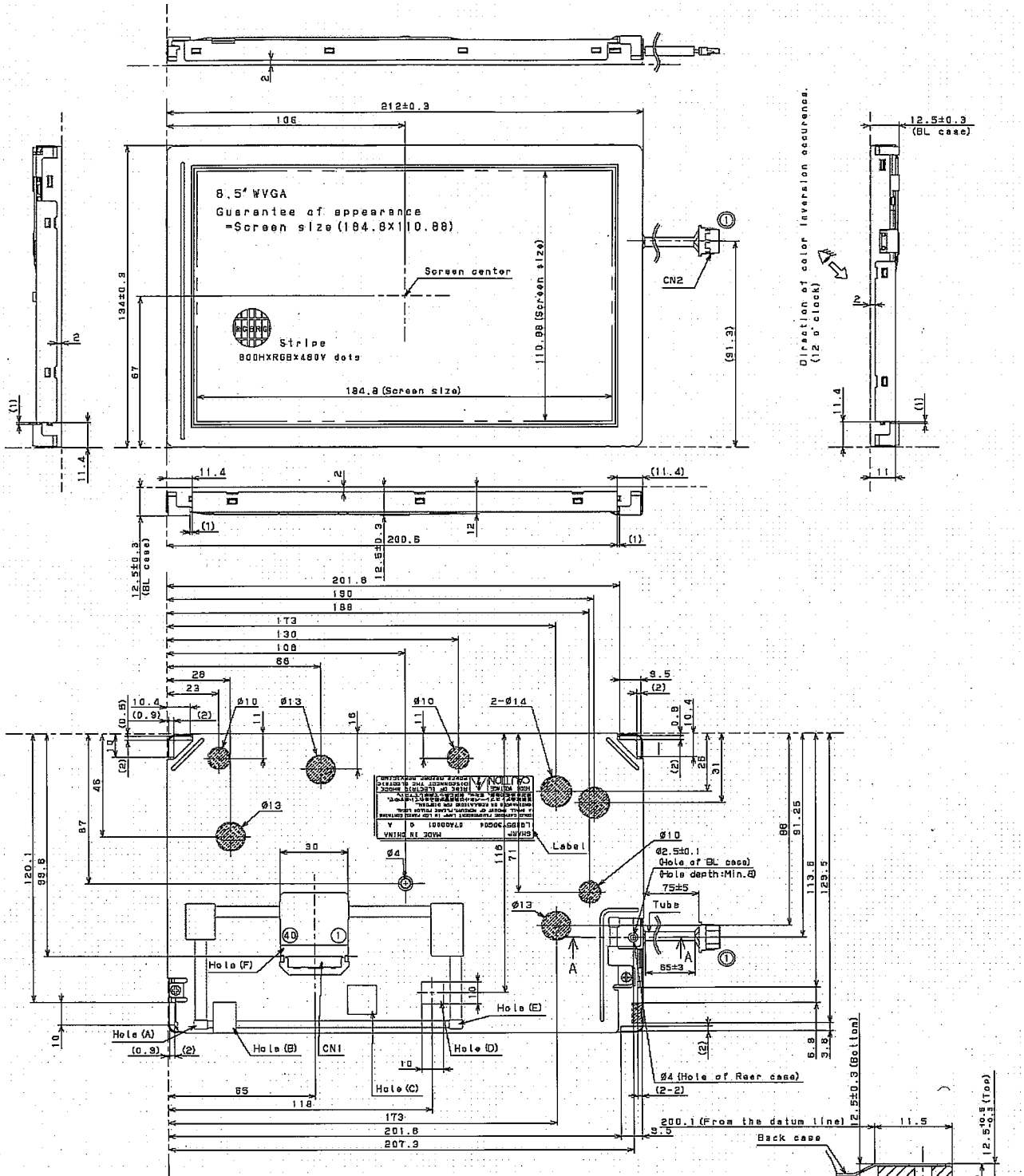
No.	Test parameter	Conditions
1	High temperature storage test	Leaves the module at Ta=75°C for 240h
2	Low temperature storage test	Leaves the module at Ta=-25°C for 240h
3	High temperature & high humidity operation test	Operates the module at Ta=40°C; 90~95%RH for 240h (No condensation)
4	High temperature operation test	Operates the module with +75°C at panel surface for 240h
5	Low temperature operation test	Operates the module at Ta=0°C for 240h (Exclude lamp life time)
6	Strength against ESD	±200V·200pF [0Ω] one time for each terminal
7	Shock test (non- operating)	Max. acceleration : 490m/s^2 Pulse width : 11ms, half sine wave Direction : ±X,±Y,±Z once for each direction.
8	Vibration test (non- operating)	Frequency : 10~57Hz/Vibration width (one side):0.075mm : 57~500Hz/ acceleration:9.8m/s^2 Sweep time : 11 minutes Test period :1 hour for each direction of X,Y,Z (total 3 hours)
9	Thermal shock test	-25°C ~ +75°C /50 cycle [0.5h] [0.5h]

[Result Evaluation Criteria]

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

[Note] The directions of X, Y, Z are defined as below:

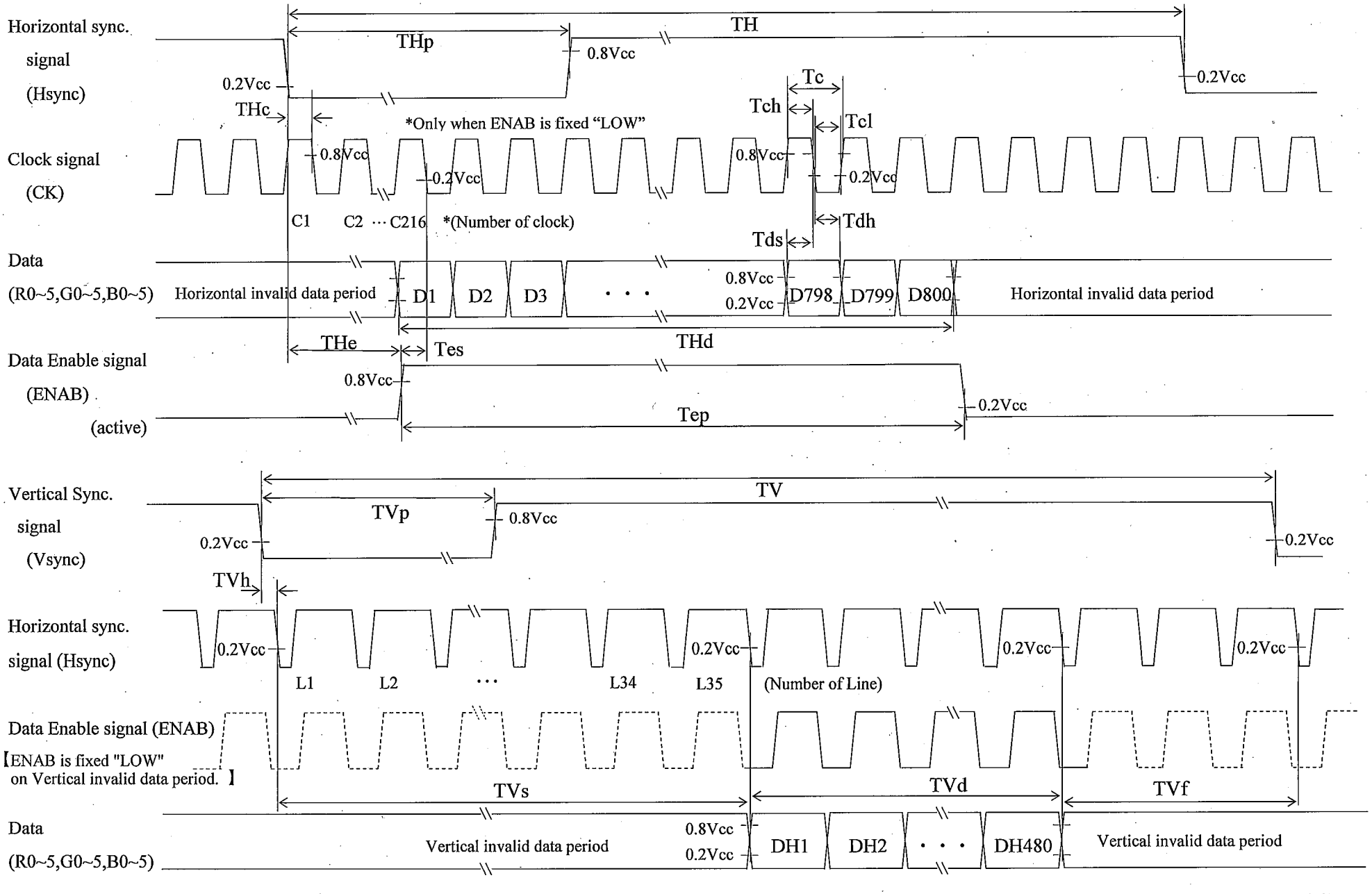




CN1:FH12-40S-0.5SH(55) (HIROSE)
(CN1 Specification:Pitch0.5mm, 40Pin, Tin plating, Bottom side contact)
CN2:BHR-02(8.0) VS-1N(JST)

note1) General tolerance is ±0.5mm.
note2) Take care in set design to hide the scratches and bubbles appared on the polarizer or other flame area whitch is located outside of active area.
note3) ① shows the HOT side of the lamp harness.
note4) Please fix the module on the same plane, taking care not to wrap or twist the module.
note5) ▨ :Maximum thickness is 9.5mm.
note6) Please avoid to have static electricity at hole(A~F) of back panel where PWB and FPC are not covered.
note7) Please avoid to press back panel by sharp edged item. And please confirm area pressed or contacted has no scratch/damage after vibration/shock test.
note8) The tube hasn't been contracted by heat, and the position is not fixed.

Fig.1 Outline Dimensions



※ Vcc=3.3V

Fig 2. Input signal waveforms

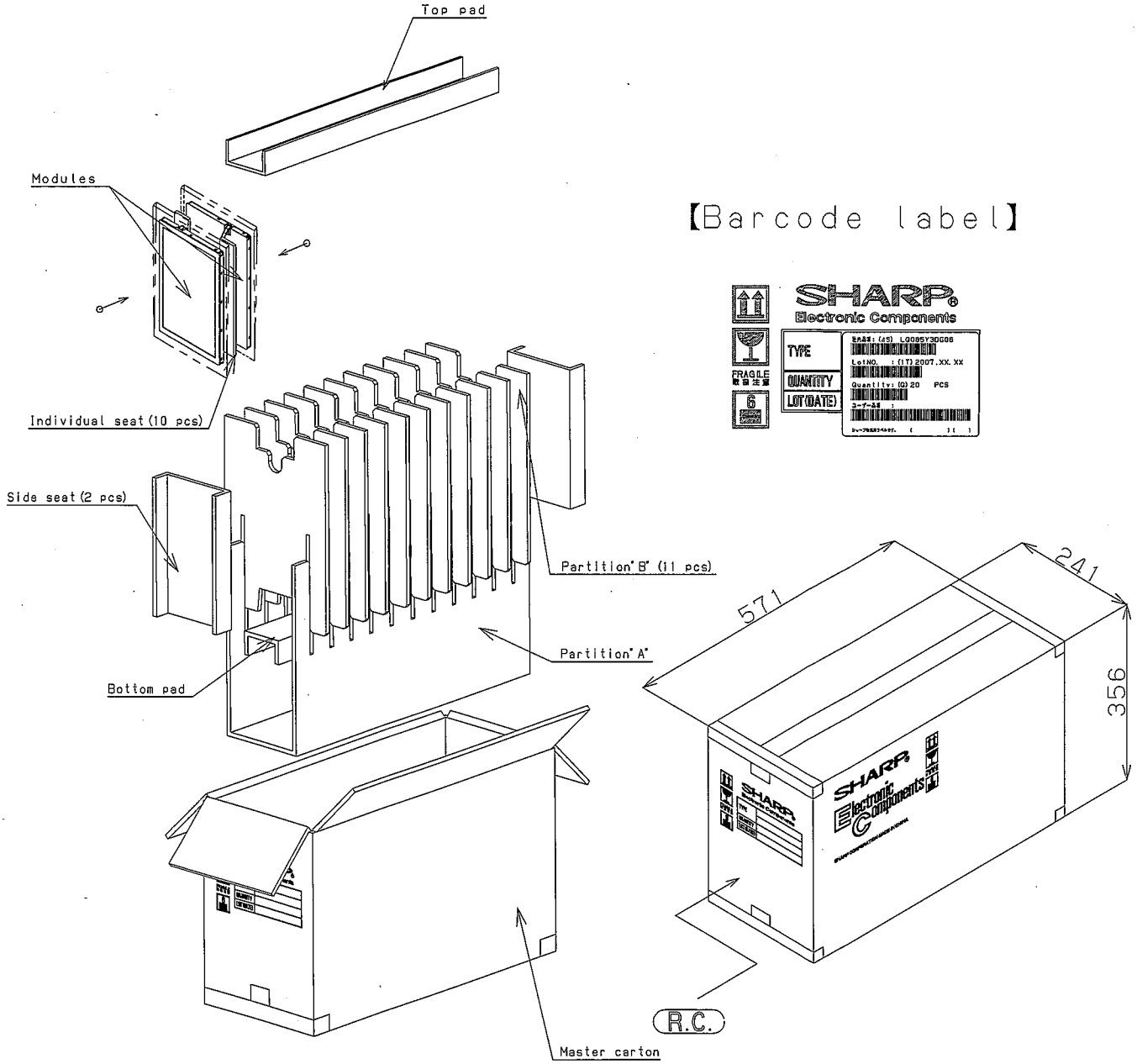


Fig.3 Packing form chart