SHARP

REIN Components GmbH
Lötscher Weg 66 · D-41334 Nettetal
Telefon +49 (0)2153-733 91 · Telefax +49 (0)2153-733 575
email rein@rnc.memec.com · http://www.rein.memec.com
Hotline +49 (0)2153-733 112

A Specialist within the Memec International Components Group raab karcher electronics

REIN Components

No.	LD - 8 6 09B
DATE	Nov. 8 . 1996

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ14X03 +E.

The technical literature is subject to change without notice. So, please contact Sharp or its representative before designing your product based on this literature.

SHARP CORPORATION

TENRI LCD DEVEROPMENT GROUP

LCD PRODUCTS DEVELOPMENT CENTER

RECORDS OF REVISION

MODEL No: LQ14X03

SPEC No : LD-8609

DATE	REVISED No.	PAGE	SUMMARY	NOTE
1996. 7.31	-	-	-	1 st Issue
1996.10.17	A	3	Revision:Hsync(Positive→Negative)	2 nd Issue
		6	Addition:a),b)	
		9	Change :θ11(min.55→35deg, typ.70→40deg)	
			Change :θ12(min.35→55deg, typ.40→70deg)	
		10	Revision:Note5 measurement point	
		11	Addition:k),l),m) of 11	
		13	Addition:Input signal waveforms	
		14	Addition:Outline dimensions	
		15	Addition:Outline dimensions	
1996.11. 8	B	3	Revision:Connector	3 rd Issue
		4	Revision:deletion(VEE,VDD,VCON)	
		14	Revision:deletion(Inverter)	
		15	Revision:deletion(Inverter)	

1. Application

This specification applies to color TFT-LCD module, LQ14X03.

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. Graphics and texts can be displayed on a 1024x3x768 dots panel with 256K colors by supplying 36 bit data signal (18bit/pixel [6bit/color x 3] x 2 pixel) and +5V DC supply voltage for TFT-LCD panel driving.

The TFT-LCD panel used for this module is a low-reflection and higher-color-saturation type. Therefore, this module is suitable for the computer display and the multimedia use.

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

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	35 (13.8") Diagonal	cm
Active area	279.6 (H) × 209.7 (V)	mm
Pixel format	1024 (H) × 768 (V)	pixel
	(1 pixel=R+G+B dots)	
Pixel pitch	0.273 (H)×0.273 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	330 (W)×242 (H)×16 (D)	mm
Mass	1125±20	g
Surface treatment	Anti-glare and hard-coating 3H (Haze value = 28)	

*1. Note: excluding backlight cables.

Outline dimensions is shown in Fig.1-1,1-2

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 Used connector: FX8-60S-SV (HIROSE)
Corresponding connector: FX8-60P-SV (HIROSE)

Pin No.	Symbol	Function	Remark
1	GND		
2	RB0	RED Data Signal of Even Pixels (LSB)	
3	RB1	RED Data Signal of Even Pixels	
4	RB2	RED Data Signal of Even Pixels	
5	RB3	RED Data Signal of Even Pixels	
6	RB4	RED Data Signal of Even Pixels	
7	RB5	RED Data Signal of Even Pixels (MSB)	
8	GND		
9	GB0	GREEN Data Signal of Even Pixels (LSB)	
10	GB1	GREEN Data Signal of Even Pixels	
11	GB2	GREEN Data Signal of Even Pixels	
12	GB3	GREEN Data Signal of Even Pixels	
13	GB4	GREEN Data Signal of Even Pixels	
14	GB5	GREEN Data Signal of Even Pixels (MSB)	
15	GND		
16	BB0	BLUE Data Signal of Even Pixels (LSB)	
17	BB1	BLUE Data Signal of Even Pixels	
18	BB2	BLUE Data Signal of Even Pixels	
19	BB3	BLUE Data Signal of Even Pixels	
20	BB4	BLUE Data Signal of Even Pixels	
21	BB5	BLUE Data Signal of Even Pixels (MSB)	
22	GND		
23	RA0	RED Data Signal of Odd Pixels (LSB)	
24	RA1	RED Data Signal of Odd Pixels	
25	RA2	RED Data Signal of Odd Pixels	
26	RA3	RED Data Signal of Odd Pixels	
27	RA4	RED Data Signal of Odd Pixels	
28	RA5	RED Data Signal of Odd Pixels (MSB)	
29	GND		
30	GA0	GREEN Data Signal of Odd Pixels (LSB)	
31	GA1	GREEN Data Signal of Odd Pixels	
32	GA2	GREEN Data Signal of Odd Pixels	
33	GA3	GREEN Data Signal of Odd Pixels	
34	GA4	GREEN Data Signal of Odd Pixels	
35	GA5	GREEN Data Signal of Odd Pixels (MSB)	
36	GND		
37	BA0	BLUE Data Signal of Odd Pixels (LSB)	
38	BA1	BLUE Data Signal of Odd Pixels	
39	BA2	BLUE Data Signal of Odd Pixels	
40	BA3	BLUE Data Signal of Odd Pixels	
41	BA4	BLUE Data Signal of Odd Pixels	
42	BA5	BLUE Data Signal of Odd Pixels (MSB)	
43	GND		
44	REV1	Reserve Signal 1 (GND)	
45	GND		

46	Vsync	Vertical Sync Signal (Negative True)	
47	Hsync	Horizontal Sync Signal (Negative True)	
48	DE	Data Enable Signal	
49	GND		
50	GND		
51	CKB	Clock signal for sampling B Data signals	
52	CKA	Clock signal for sampling A Data signals	
53	GND		
54	GND		
55	REV2	Reserve Signal 2 (GND)	
56	REV3	Reserve Signal 3 (GND)	
57	Vcc	+5V Power Supply	
58	Vcc	+5V Power Supply	
59	Vcc	+5V Power Supply	
60	Vcc	+5V Power Supply	

※The shielding case is connected with signal GND.

【Note1】 The horizontal display start position is settled in accordance with a rising edge of DE signal. In case DE is fixed "Low", the horizontal start position is determined as described in 7-2. (DE signal should not be fixed "High".)

4-2. Backlight driving

CN2,CN3 Used connector : BHR-03VS-1 (JST)

Corresponding connector : SM02(8.0)B-BHS (JST)

Pin no.	Symbol	I/O	Function	Remark
1	V_{HIGH}	I	Power supply for lamp (High voltage side)	
2	NC		This is electrically opened	
3	V_{LOW}	I	Power supply for lamp (High voltage side)	

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Signal Input voltage	V_I	Ta=25℃	−0.3 ～ Vcc+0.3	V	【Note1】
+5V supply voltage	Vcc	Ta=25℃	0 ～ + 6	V	
Storage temperature	Tstg	−	−25 ～ +60	℃	【Note2】
Operating temperature (Ambient)	Topa	−	0 ～ +50	℃	

【Note1】 CKA, CKB, RA0～RA5, GA0～GA5, BA0～BA5, RB0～RB5, GB0～GB5, BB0～BB5 Hsync, Vsync, DE

【Note2】 Humidity：95%RH Max. at Ta≦40℃.

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

No condensation.

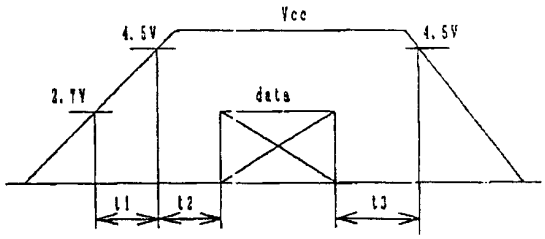
6. Electrical Characteristics

6-1. TFT-LCD panel driving　　Ta＝25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+5V	Supply voltage	Vcc	+4.5	+5.0	+5.5	V	【Note1】
	Current dissipation	Icc	−	370	600	mA	【Note2】
Permissive input ripple voltage		V_{RF}	−	−	100	mVp-p	Vcc=+5V
Input voltage (Low)		V_{IL}	−	−	0.6	V	
Input voltage (High)		V_{IH}	2.6	−	−	V	
Input current (low)		I_{OL}	−	−	15	μA	V_I=0V 【Note3,4】
Input current (High)		I_{OH1}	−	−	10	μA	V_I=Vcc 【Note3】
		I_{OH2}	−	−	260	μA	V_I=Vcc 【Note4】

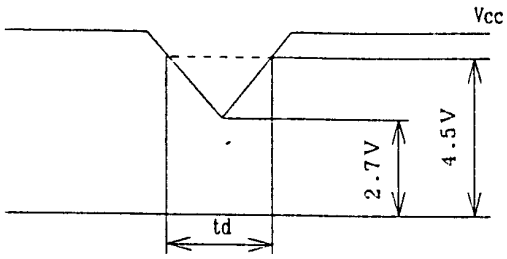
【Note1】
Vcc-turn-on conditions

0 < t1 ≦ 10ms
0 < t2 ≦ 10ms
0 < t3 ≦ 1s

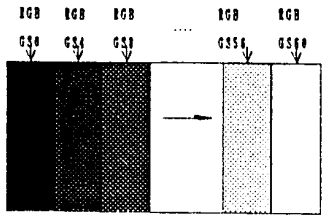


Vcc-dip conditions

1) 2.7V ≦ Vcc < 4.5V
   td≦10ms
2) Vcc < 2.7V



【Note2】 Typical current situation : 16-gray-bar pattern.
Vcc=+5.0V



【Note3】 CKA, CKB, RA0～RA5, GA0～GA5, BA0～BA5, RB0～RB5, GB0～GB5, BB0～BB5, Hsync, Vsync

【Note4】 DE

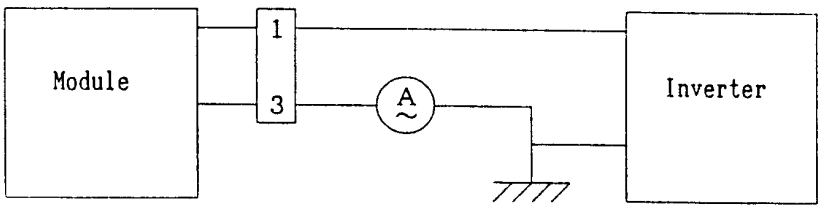
6-2. Backlight driving

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

Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current	I_L	2.0	5.5	6.0	mArms	【Note1】
Lamp power consumption	P_L	—	3.6	—	W	【Note2】
Lamp frequency	F_L	20	35	60	KHz	【Note3】
Kick-off voltage	Vs	—	—	1250	Vrms	Ta=25℃
		—	—	1400	Vrms	Ta=0℃ 【Note4】
Lamp life time	L_L	10000	—	—	h	【Note5】

【Note1】 Lamp current is measured with current meter for high frequency as shown below.



* 3pin is V_{LOW}

【Note2】 At the condition of Y_L = 200 cd/m^2

【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 open output voltage of the inverter shall be maintained for more than 1sec; otherwise the lamp may not be turned on.

【Note5】 a)Since lamp is consumables,the life time written above is referencial value and it is not guaranteed in this specification sheet by SHARP.

Lamp life time is defined that it applied either ① or ② under this condition (Continuous turning on at Ta=25℃, IL=6.0mArms)

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

② Kick-off voltage at Ta=0℃ exceeds maximum value,1400 Vrms.

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.)

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

Note) 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.

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
Clock	Frequency	1/Tc	25	32.5	37.5	MHz
	High time	Tch	9	—	—	ns
	Low time	Tcl	9	—	—	ns
Data	Setup time	Tds	5	—	—	ns
	Hold time	Tdh	10	—	—	ns
Horizontal sync. signal	Cycle	TH	19.2	20.7	—	μs
			630	672	—	clock
	Pulse width	THp	4	68	—	clock
Horizontal data start		THbp	148	148	148	clock
Hsync-Clock phase difference		TFc	5	—	—	ns
Vertical sync. signal	Cycle	TV	—	16.7	—	ms
			803	806	—	line
	Pulse width	TVp	4	6	—	line
Vertical data start		TVbp	35	35	35	line
Hsync-Vsync phase difference		TVh	1	—	TH-THp	clock

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 DE signal and the input data corresponding to the rising edge of DE signal is displayed at the left end of the active area.

Parameter		symbol	Min.	Typ.	Max.	Unit	Remark
DE signal	Setup time	Tes	5	–	Tc-10	ns	
	Pulse width	Tep	5	512	512	clock	
Hsync-DE phase difference		THe	16	148	186	clock	

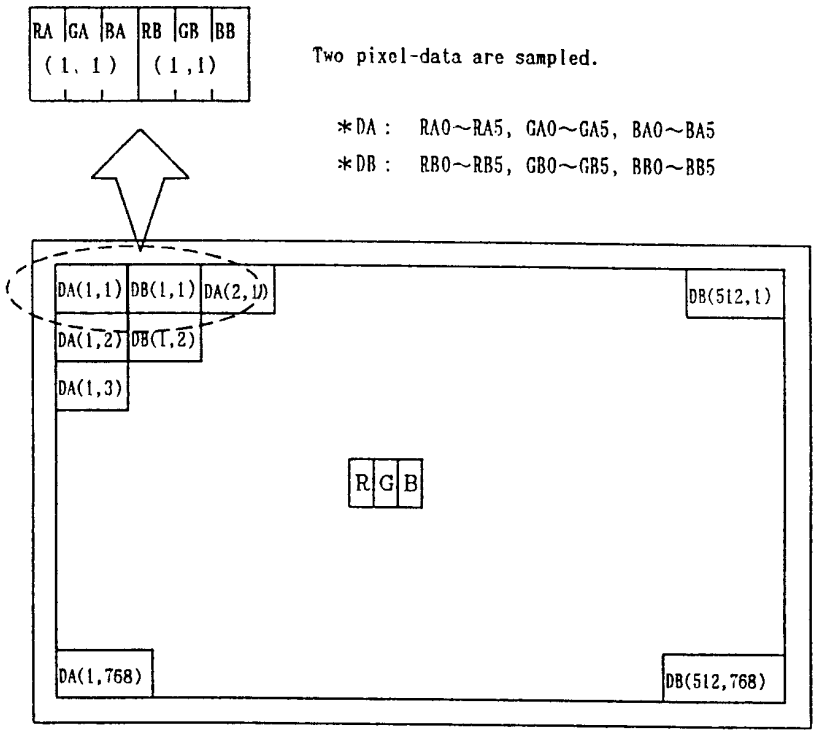
Note) When DE is fixed "Low", the display starts from the data of C148(clock) as shown in Fig.2.

7-3. Vertical display position

The vertical display start position is the 36th line from the falling edge of Vsync.

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

Graphics and texts can be displayed on a 1024 x 3 x 768 dots panel with 256K colors by supplying 36 bit data signal (6bit/color [64 gray scale] x 3 x 2 pixels).



Display position of input data (H,V)

8 . Input signals, Basic display colors and Gray scale of each color

gray scale and color	DA / DB	Data signal																	
	DA	RA0	RA1	RA2	RA3	RA4	RA5	GA0	GA1	GA2	GA3	GA4	GA5	BA0	BA1	BA2	BA3	BA4	BA5
	DB	RB0	RB1	RB2	RB3	RB4	RB5	GB0	GB1	GB2	GB3	GB4	GB5	BB0	BB1	BB2	BB3	BB4	BB5
Basic color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Purple	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	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	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				↑			0	0	0	0	0	0	0	0	0	0	0	0
	↓				↓			0	0	0	0	0	0	0	0	0	0	0	0
	Bright	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	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	0	0	0	0	0
	↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0				↑			0	0	0	0	0	0
	↓	0	0	0	0	0	0				↓			0	0	0	0	0	0
	Bright	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	↓	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	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	0	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0				↑		
	↓	0	0	0	0	0	0	0	0	0	0	0	0				↓		
	Bright	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	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 color is displayed in 64 gray scales from 6 bit data signal input

According to the combination of total 18 bit data , 262,144 colors are displayed.

9. Optical Characteristics

Ta=25°C, Vcc=+5V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21, θ22	CR≧5	60	70	—	Deg.	【Note 1,4】
	Vertical	θ11		35	40	—	Deg.	
		θ12		55	70	—	Deg.	
Contrast ratio		CR	θ=0°	150	—	—		【Note 2,4】
			Optimum Viewing Angle		300	—		
Response time	Rise	τr	θ=0°	—	30	—	ms	【Note 3,4】
	Decay	τd		—	50	—	ms	
Chromaticity of white		x		—	0.313	—		【Note4】
		y		—	0.329	—		
Luminance of white		Y_L		150	200	—	cd/m²	【Note 4,6】
White Uniformity		δw		—	—	1.45		【Note5】

※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.

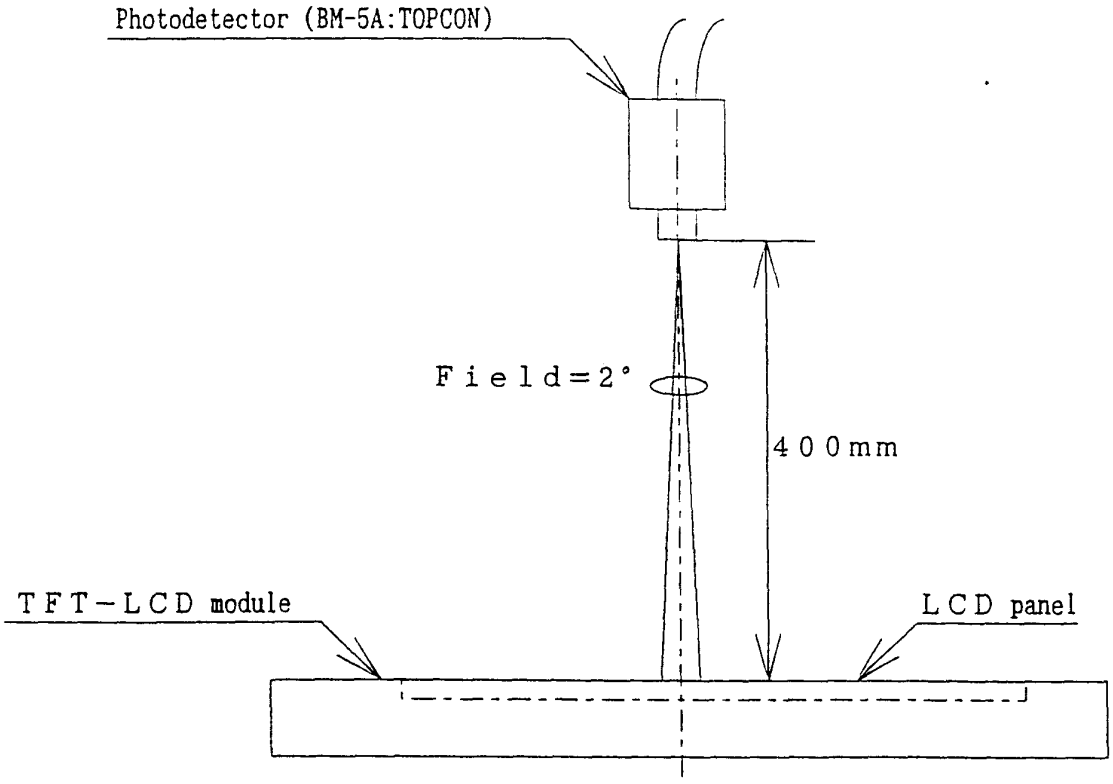
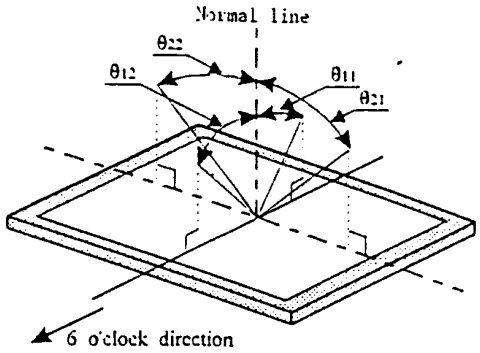


Fig.3 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



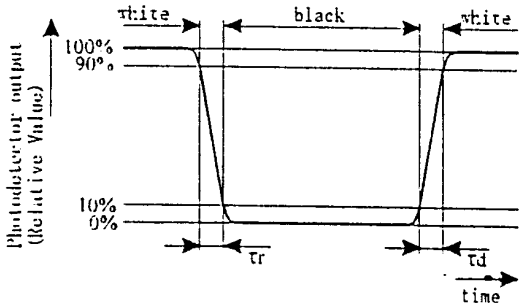
【Note2】 Definition of contrast ratio:

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:

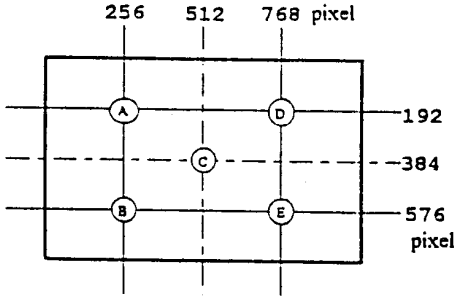
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



【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).



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

【Note6】 Maximum Luminance

10. Display Quality

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

11. 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 to avoid rubbing with something hard or sharp.

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 and refined wires and components, it may break,crack or internal wire breaking 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.

h) Observe all other precautionary requirements in handling components.

i) This module has its circuitry PCBs on the rear side and should be carefully handled in order not to be stressed.

j) Laminated 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. Ionized air shall be blown over during the action. Blow off 'dust' on the polarizer by using an ionized nitrogen gun, etc.

k)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 interference fringe etc.
Which degrades display quality.

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 tail.

12. Packing form

a) Piling number of cartons : MAX.6

b) Package quantity in one carton : 10pcs

c) Carton size : 370(W)×470(H)×590(D)mm

d) Total mass of 1 carton filled with full modules : 15.5kg

13. Reliability test items

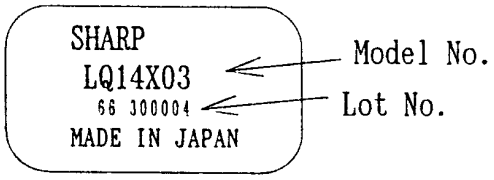
No.	Test item	Conditions
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta= -25℃ 240h
3	High temperature & high humidity operation test	Ta= 40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50℃ 240h
5	Low temperature operation test	Ta=0℃ 240h
6	Vibration test (non- operating)	Frequency : 10～57Hz/Vibration width (one side):0.075mm : 58～500Hz/Gravity:9.8m/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.

【Result Evaluation Criteria】

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

14. Others

1) Lot No. Label:



2) 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.

3) Disassembling the module can cause permanent damage and should be strictly avoided.

4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

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

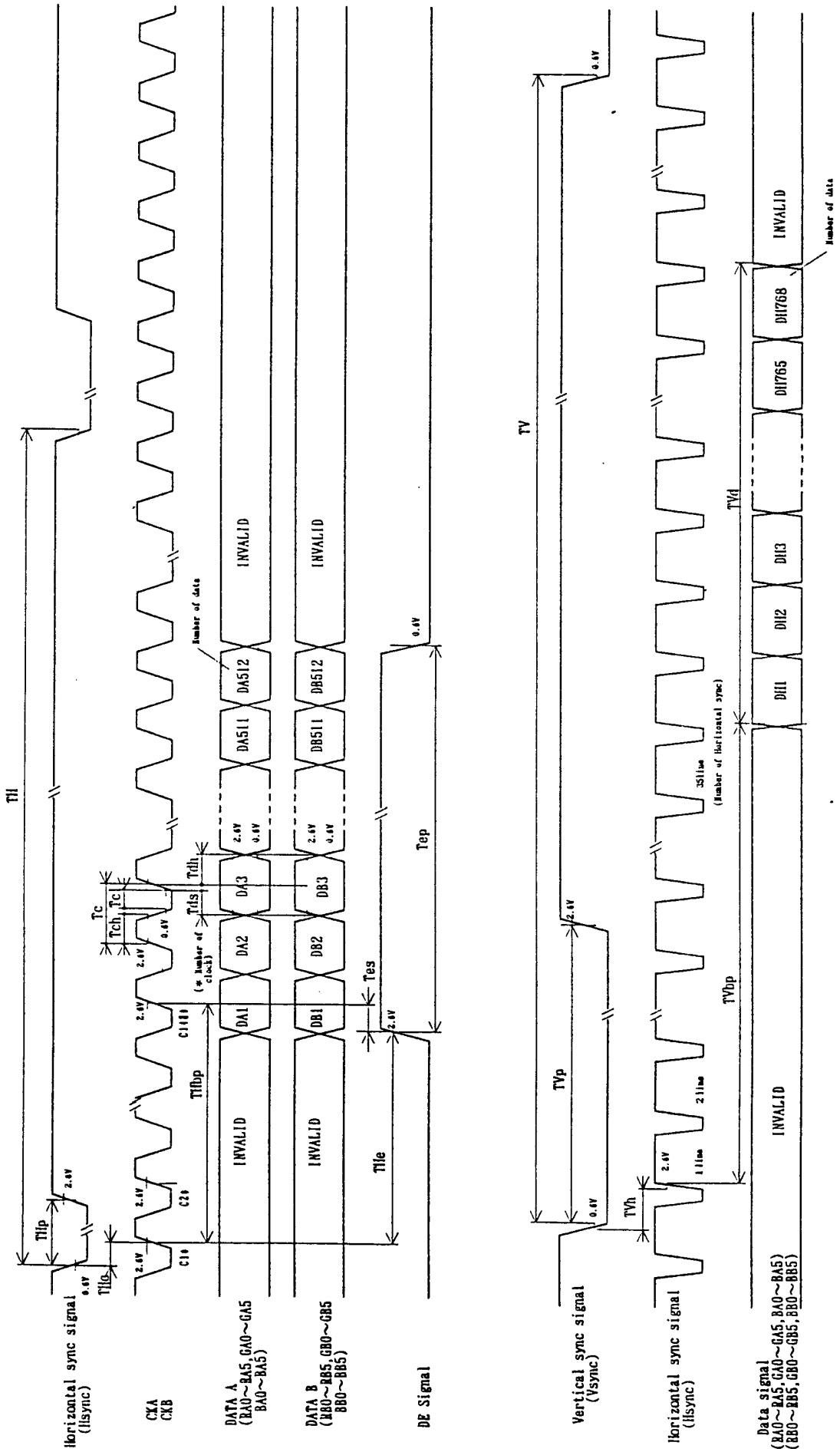


Fig. 2 Input Signal Waveforms

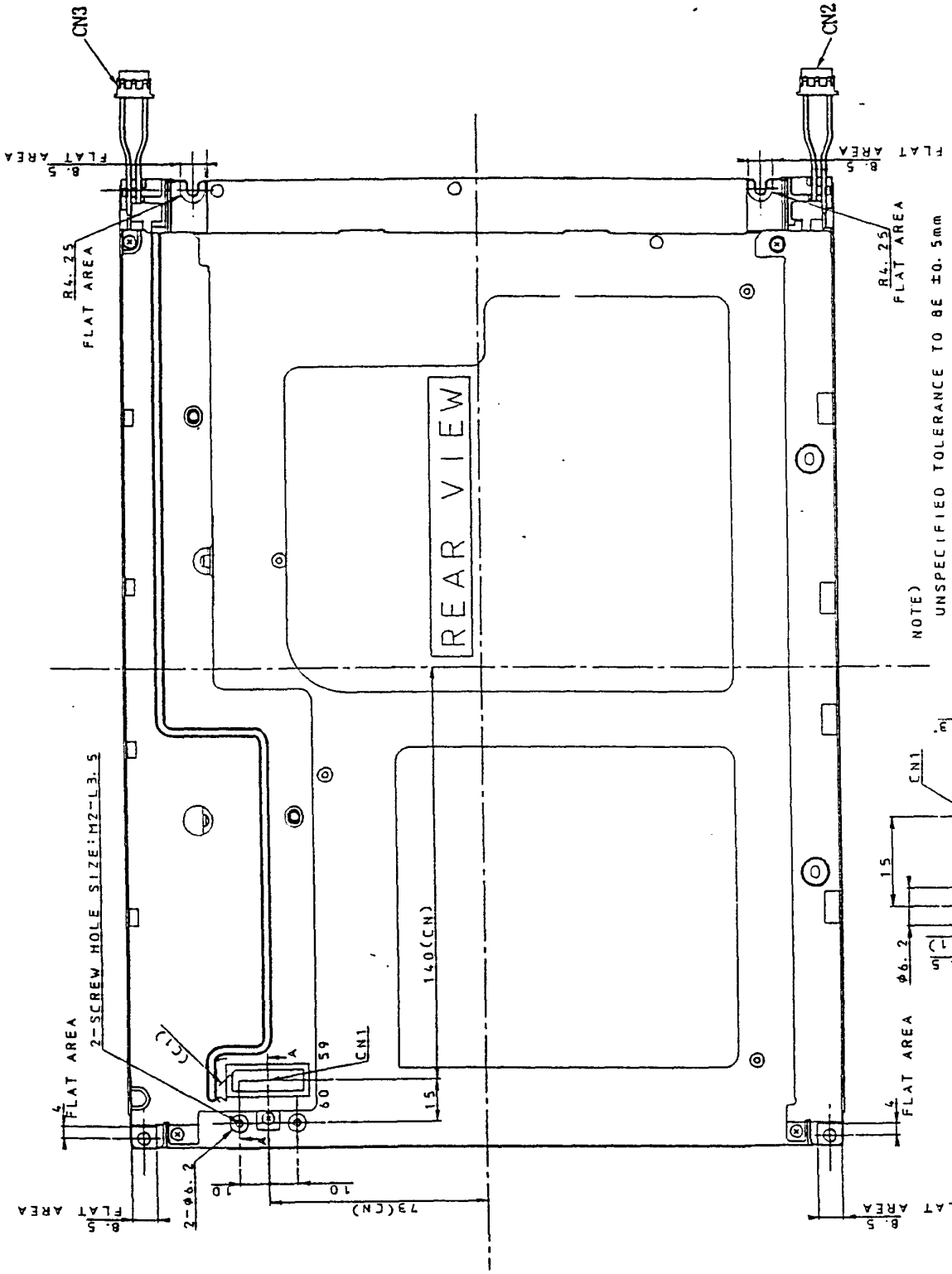
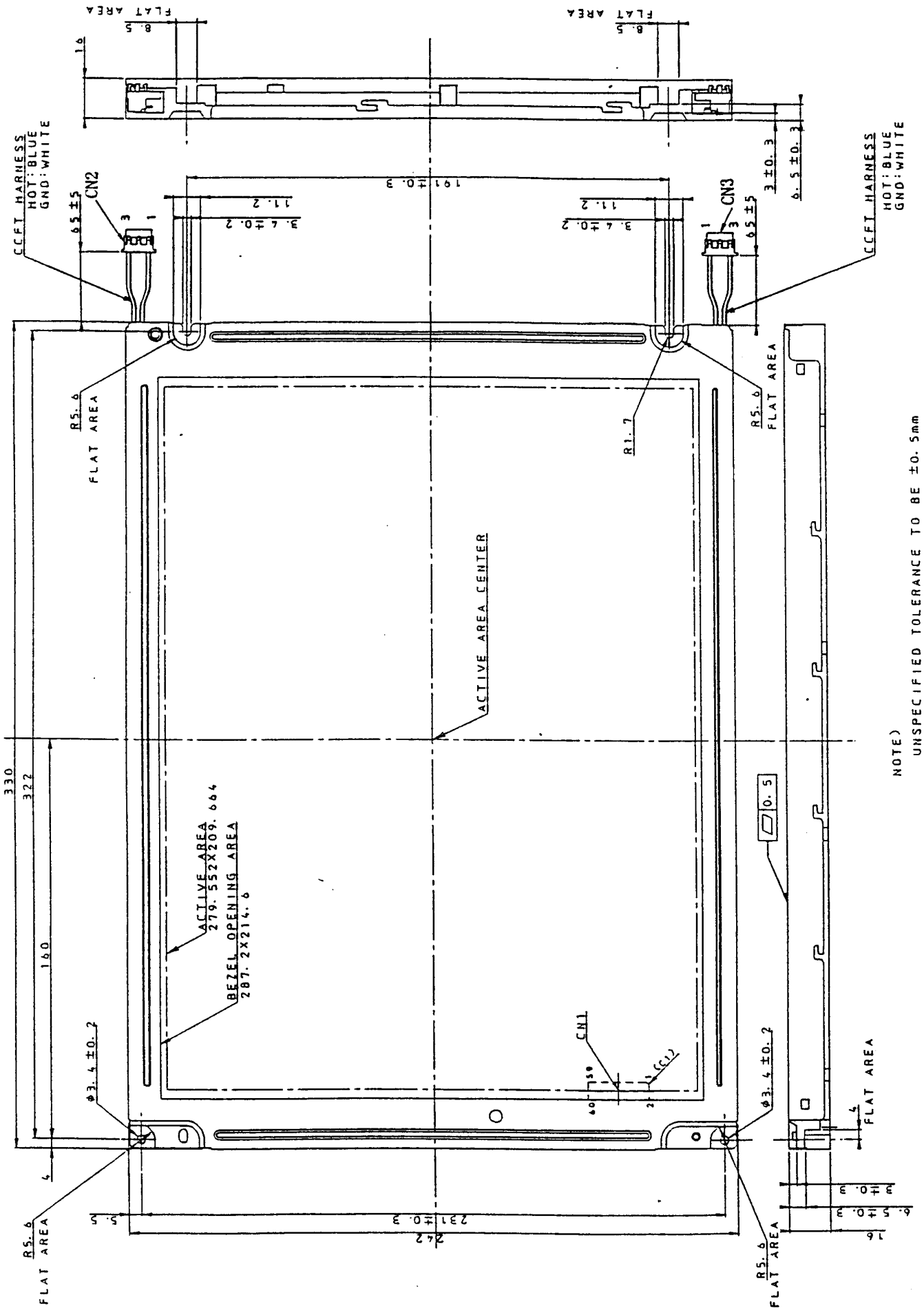


Fig. 1-2 OUTLINE DIMENSIONS



NOTE)
UNSPECIFIED TOLERANCE TO BE ±0.5mm

Fig. 1-1 OUTLINE DIMENSIONS

CN1 FX8-60S-SV(HIROSE)
CN2,CN3 BBR-03VS-1(JST)