

REPAIRED BY : DATE	<h1 style="margin: 0;">SHARP</h1> <p style="margin: 0;">TENRI LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION</p> <h2 style="margin: 0;">SPECIFICATION</h2>	SPEC No. LD-8203
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		APPLICABLE GROUP Tenri Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD Module


MODEL No.

LQ14X01

CUSTOMER' S APROVAL

DATE _____

BY _____

PRESENTED BY 

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 SHARP CORPORATION

1. Application

This specification applies to color TFT-LCD module, LQ14X01.

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 (including a DC/AC inverter). 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), +5V DC supply voltage for TFT-LCD panel driving and supply voltage for a backlight-driving DC/AC inverter.

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. 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) X 209,7 (V)	mm
Pixel format	1024 (H) X 768 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.273 (H) X 0.273 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions • 1	330 (W) X 242 (H) X 16 (D)	mm
Mass	1150 ± 20	g
Surface treatment	Anti-glare and hard-coating 2H (Haze value = 25)	

*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	BBO	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 Signal1(GND)	
45	GND		

46	Vsync	Vertical Sync Signal (Negative True)	
47	Hsync	Horizontal Sync Signal (positive 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		
ND			
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")

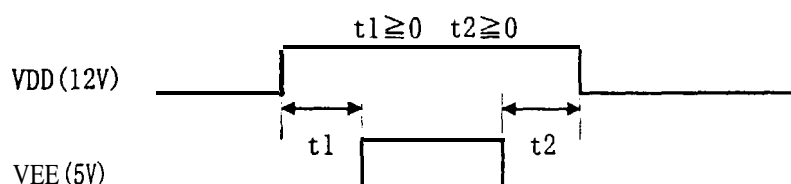
4-2, Backlight driving

CN2 Used connector : S5E-PH-SM (JST) or S5E-PH-SM3 (JST)
Corresponding connector: PHR-5 (JST)

Pin no.	Symbol	I/o	Function	Remark
1	V _{DD}	I	+12V Supply Voltage	[Note 1]
2	GND			
3	V _{CON}	I	Luminance Control Voltage	
4	V _{ST}	O	LampStatusSignal	[Note 2]
5	V _{EE}	I	+5V Supply Voltage	【 Note 1 】

【Note 1】 The time of V_{EE} is at the same time or later than that of V_{DD}.

PowerSequence of inverter



There is no relation between above and Vcon timing.

【Note 2】 5V:lit on or normally, 0V:lit off or abnormally

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Signal Input voltage	v^*	$T_a=25^\circ\text{C}$	$-0.3 \sim V_{CC}+0.3$	V	【Note1】
+5V supply voltage	V_{CC}	$T_a=25^\circ\text{C}$	$0 \sim +6$	V	
+5V supply voltage	V_{EE}	$T_a=25^\circ\text{C}$	$0 \sim +7$	V	
+12V supply voltage	V_{DD}	$T_a=25^\circ\text{C}$	$0 \sim +20$	V	
Luminance Control Voltage	V_{CON}	$T_a=25^\circ\text{C}$	$0 \sim +7$	V	
Storage temperature	T_{stg}	-	$-25 \sim +60$	$^\circ\text{C}$	【Note2】
Operating temperature (Ambient)	T_{opa}	-	$0 \sim +50$	$^\circ\text{C}$	

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

【Note2】 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.

6. Electrical Characteristics

6-1. TFT-LCD panel driving

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
+5V	Supply voltage	+4.5	+5.0	+5.5	V	【Note1】
	Current dissipation	I_{CC}	-	370	600	mA
Permissible input ripple voltage	V_{RF}	-	-	100	mVp-p	$V_{CC}=+5V$
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	$V_I=V_{CC}$ 【Note3】
	I_{OH2}	-	-	260	μA	$V_I=V_{CC}$ 【Note4】

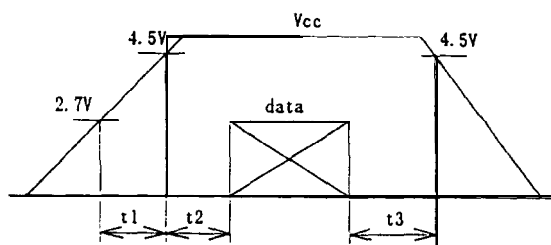
【Note1】

V_{CC}-turn-on conditions

$$0 < t_1 \leq 10\text{ms}$$

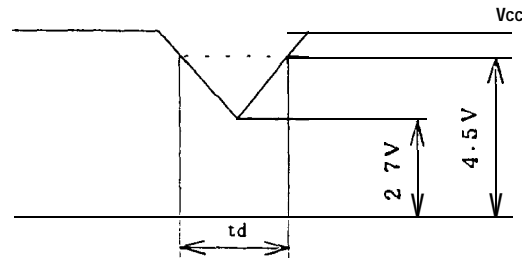
$$0 < t_2 \leq 10\text{ms}$$

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



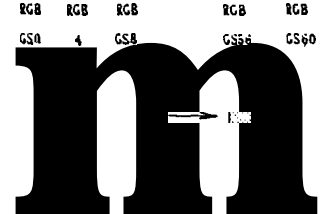
Vcc-dip conditions

- 1) $2.7V \leq V_{cc} < 4.5V$
 $t_d \leq 10ms$
- 2) $V_{cc} < 2.7V$



[Note2] Typical current situation: 16-gray-bar pattern.

$V_{cc}=+5.0V$



[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 lamps are shown in the following table.

$T_a=25^\circ$

Parameter	Symbol	Min.	Typ.	Max.	unit	Remark	
+12V Supply Voltage	V_{DD}	10.8	12.0	13.2	v		
+12V Supply Current	I_{DD}	-	700	900	mA	$V_{DD} = 12.0V$	
+5 V Supply Voltage	V_{EE}	4.75	5.0	5.25	V		
+5V Supply Current	I_{EE}	-	3.3	5.0	mA		
Bright Control Voltage	V_{CON}	0	-	3.5	V	[Note1]	
Lamp OFF Voltage	V_{CON}	4.5	-	5.0	v		
Bright Control Current	I_{CON}	-	-	1.0	mA		
Lamp Status Voltage (Lamp ON)	V_{ST}	$V_{EE} - 0.5$	V_{EE}	-	v	[Note2]	
Lamp Status Voltage (Lamp OFF)	V_{ST}	0	-	0.5	v		
Lamp life time	L_L	10000	-	-	H	[Note3]	
Permissible input ripple voltage	V_{DD}	$V_{R(DD)}$	-	-	150	mVp-p	[Note4]
	V_{EE}	$V_{R(EE)}$	-	-	100	mVp-p	
	V_{con}	$V_{R(con)}$	-	-	100	mVp-p	

[Note1] $V_{CON} = 0V$: Luminance Max.
 $V_{CON} = 3.5V$: Luminance Min.

[Note2] In case of V_{DD}, V_{EE}, V_{COM} are out of recommended operating conditions, this Status may not properly indicate,
 When pal-up V_{st} , the pull-up resistor value is recommended 3.3K to 8.1 K Ω .

[Note3] Lamp life time is defined that it applied either ① or ② under this condition
 (Continuous turning on at $T_a=25^\circ C, V_{CON}=0V$)

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

② Lamps can't normally turn on at $T_a=0^\circ C$.

[Note4] These values are specified as the ripple voltage of user's power supply which input the power to the backlight inverter. These do not include the returned ripple voltage from backlight inverter.

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	$1/T_c$	25	32.5	37.5	MHz
	High time	T_{ch}	9	“	—	ns
	Low time	T_{cl}	9	—	—	ns
Data	Setup time	T_{ds}	5	—	—	ns
	Hold time	T_{dh}	10	—	—	ns
Horizontal sync. signal	Cycle	m	19.2	20.7	—	μs
			630	672		clock
	Pulse width	TH_p	4	68	-	clock
Horizontal data start		TH_d	148	148	148	clock
Hsync-Clock phase difference		TF_c	5			ns
Vertical sync. signal	Cycle	TV	-	16.7	-	line
			803	806	-	line
	Pulse width	TV_p	4	6	-	line
Vertical data start		TV_d	35	35	35	line
Hsync-Vsync phase difference		TV_h	1	—	$TH-TH_p$	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	rts	
	Pulse width	Tep	5	512	512	clock	
Hsync-DE phase difference		THE	16	148	186	clock	

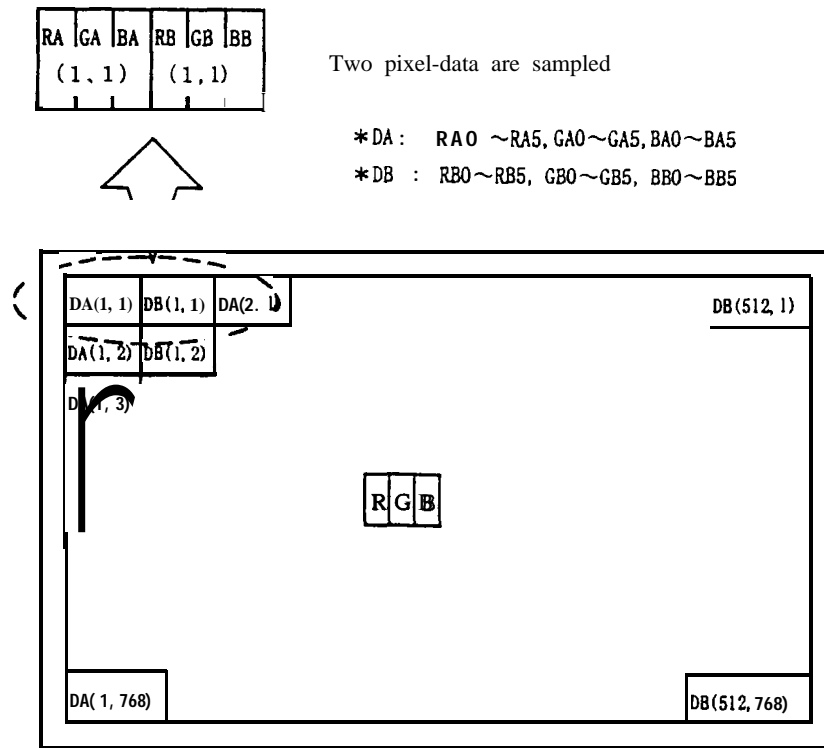
Note) When DE is fixed "Low", the display starts from the data of C148(clock) as shown in Fig.2.

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 1024x 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		Data signal																	
and	DA	RA0	RA1	RA2	RA3	RA4	RA5	GA0	GA1	GA2	GA3	GA4	GA5	BA0	BA1	BA2	BA3	BA4	BA5
color	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	$\theta 21, \theta 22$	CR>10	45	-	-	Deg.	[Note 1,4]
	Vertical	$\theta 11$		10	-	-	Deg.	
		$\theta 12$		30	-	-	Deg.	
Contrast ratio		CR	$\theta = 0^\circ$	150	-	-		[Note 2,4]
			Optimum Viewing Angle		300	-		
Response time	Rise	τr	$\theta = 0^\circ$	-	30	-	ms	[Note 3,4]
	Decay	τd		-	50	-	ms	
Chromaticity of white		X	$\theta = 0^\circ$	-	0,313	-		[Note4]
		Y		-	0,329	-		
Luminance of white		Y_L		160	200	-	cd/m ²	[Note 4,6]
White Uniformity		δ_w		-	-	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.

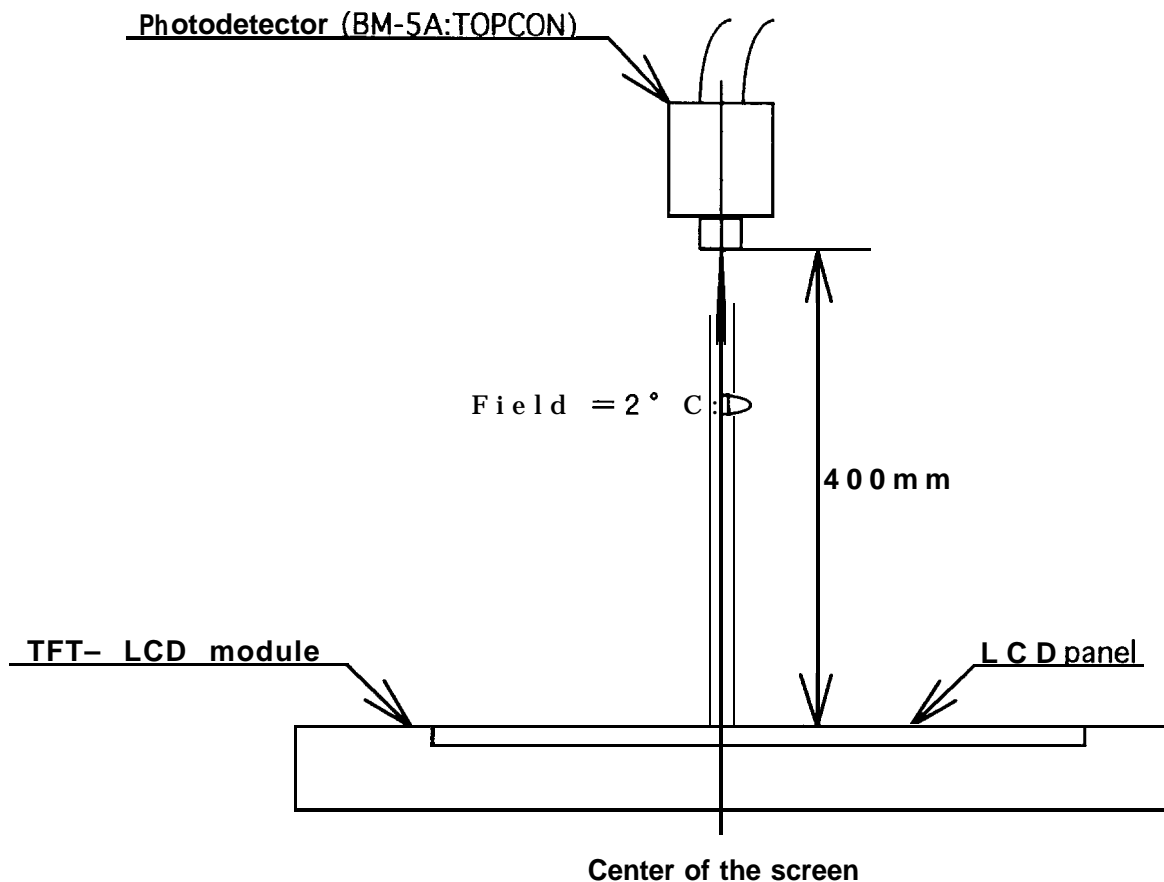
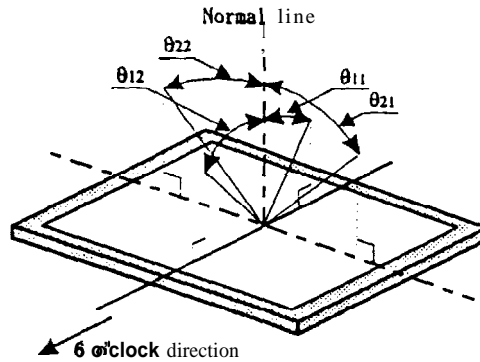


Fig.3 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



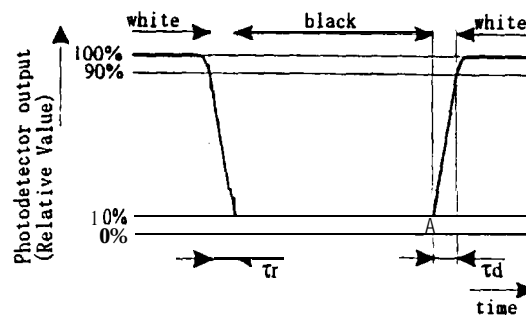
【Note2】 Definition of contrast ratio:

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:

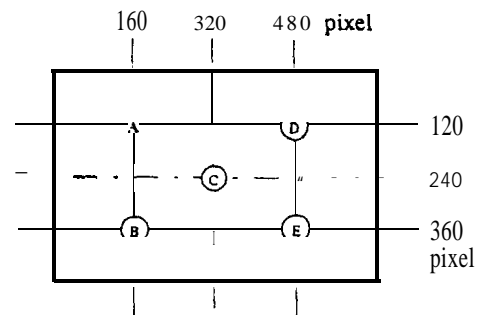
The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white” .



【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 Quantity

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 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 touch the ground through yourself 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.

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**

Packing form is shown in **Fig.4**

13. Reliability test items

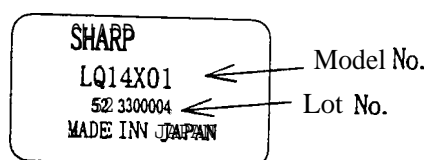
No.	Test item	Conditions
1	High temperature storage test	Ta=60°C 240h
2	Low temperature storage test	Ta= -25°C 240h
3	High temperature & high humidity operation test	Ta= 40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50°C 240h
5	Low temperature operation test	Ta=0°C 240h
6	Vibration 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 :1 lms, half sine wave Direction : ±X, ±Y, ±Z once for each direction.

[Result Evaluation Criteria]

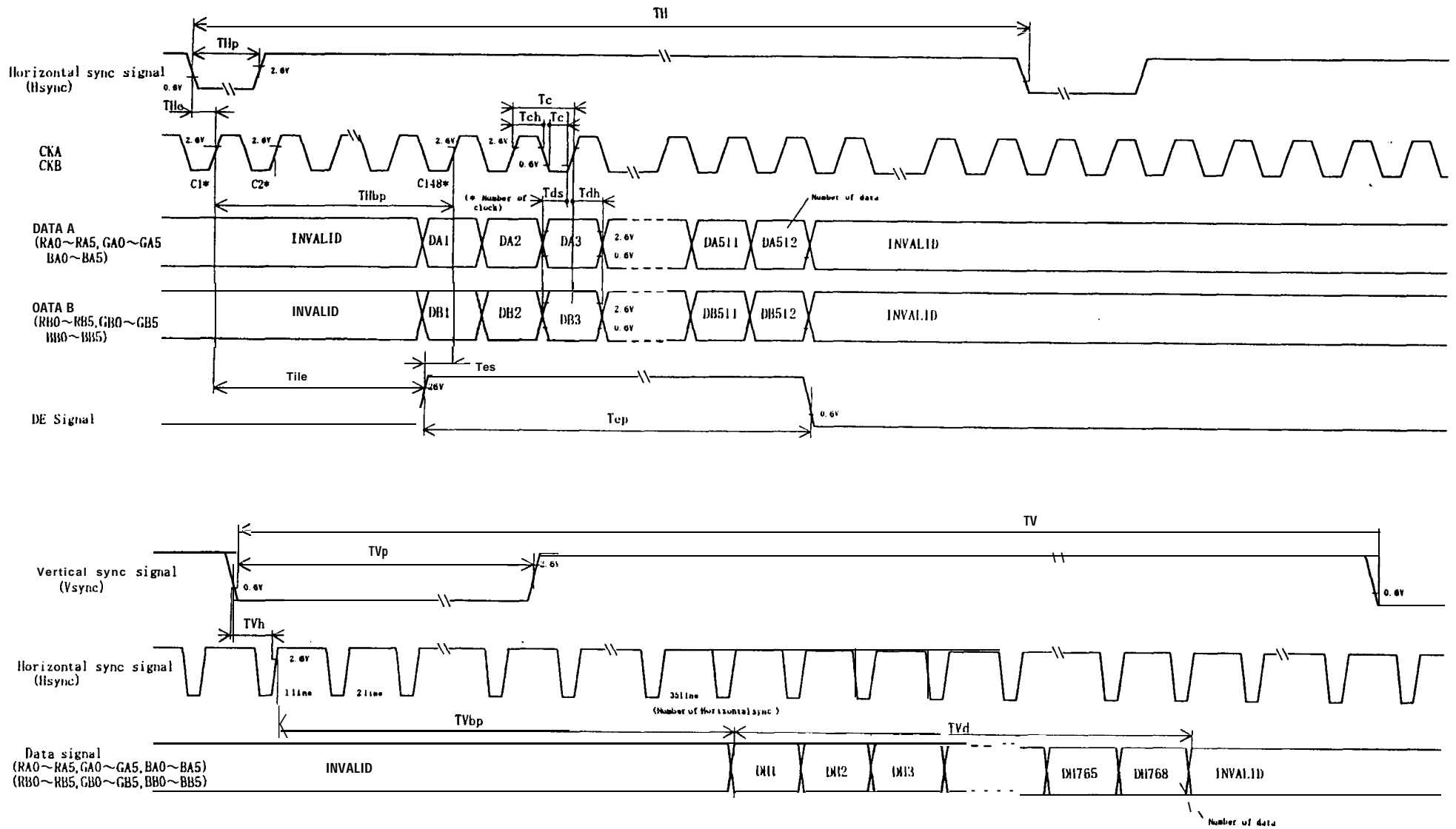
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

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.



F g. 2 I n p u t S i g n a l W a v e f o r m s

