PREPARED BY : DATE	SHARP	SPEC No. LD-12607A
APPROVED BY : DATE	TFT Liquid Crystal Display Group SHARP CORPORATION	FILE No. ISSUE : Sep. 25 2000 PAGE : 17 pages
	SPECIFICATION	APPLICABLE GROUP TFT Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ133X1TS70

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

BY Makoto Takeda

M. TAKEDA

Department General Manager

Development Engineering Department 2

TFT Division 2

TFT LIQUID CRYSTAL DISPLAY GROUP

SHARP CORPORATION

RECORDS OF REVISION

LQ133X1TS70

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-12607	Jun.28 2000	-	-	-	1st Issue
LD12607A	Sep.26.2000	1	4	4-2. Interface block diagram	
				Using receiver : SiI141 => SiI151	
			6	6-1. TFT-LCD panel driving	
				Current dissipation Typ:445=>640	
				Max:620=>890	
			7	6-2. Backlight driving	
				Lamp voltage Typ:610=>600	
				Lamp power consumption	
				Typ:3.66=>3.60	
				Kick-off voltage	
				Max:900=>1140 on Ta=25℃	
			12	9. Optical Characteristics	
				Chromaticity of red	
				Y: 0.353+/-0.03=>0.324+/-0.03	
				Chromaticity of green	
				Y: 0.513+/-0.03=>0.547+/-0.03	
				Chromaticity of blue	
				Y: 0.516+/-0.03=>0.125+/-0.03	
			15	13-1. Lot No. and indication Label	
				Add "S" for administration No.	
			16	Fig.1 Outline dimension	
				A shape of backside	
				(position of PWB etc)	
				CCFT cable length:190=>90	

The device listed in these specification sheets was designed and manufactured for use in OA equipment.

In case of using the device for applications such as control and safety equipment for transportation(aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment(trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets.

Contact and consult with a SHARP sales representative for any questions about this device.

1. Application

This specification applies to a color TFT-LCD module, LQ133X1TS70.

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 1024×3×768 dots panel with 262,144 colors by using TMDS (Transition Minimized Differential Signaling) to interface and supplying +3.3V DC supply voltage 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
Display size	34 (13.3") Diagonal	cm
Active area	270.3 (H)×202. 8 (V)	mm
Pixel format	1024 (H)×768 (V)	pixel
	(1 pixel=R+G+B dots)	
Pixel pitch	0.264 (H)×0.264 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	304 (W)×240.6 (H)×8(D)	mm
Mass	750±30	g
Surface treatment	Anti-glare and low reflection(~1.7%) hard-coating 2H	

*1.Note: excluding backlight cables.

Outline dimensions is shown in Fig.1

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (TMDS signals and +3.3V DC power supply)

Using connector : DF14A-20P-1.25H (Hirose)

Corresponding connector : DF14-20S-1.25C(Hirose)

端 子	記号	機 能	備考
1	GND		
2	GND		
3	RX2+	Receiver signal (+)	TMDS
4	RX2-	Receiver signal (-)	TMDS
5	RX2GND		
6	RX1+	Receiver signal (+)	TMDS
7	RX1-	Receiver signal (-)	TMDS
8	RX1GND		
9	RX0+	Receiver signal (+)	TMDS
1 0	RX0-	Receiver signal (-)	TMDS
1 1	RX0GND		
1 2	RXC+	Clock signal (+)	TMDS
1 3	RXC-	Clock signal (-)	TMDS
1 4	RXCGND		
1 5	+3. 3V	+3.3V power supply	
1 6	+3. 3V	+3.3V power supply	
1 7	GND		
1 8	GND		
1 9	GND		
2 0	GND		

【Note 1】 Relation between TMDS signals and actual data shows below section (4-2).

【Note 2】 The impedance of the connecting cable must be 50 ohm.

【Note 3】 The shielding case is connected with signal GND.

4-2 Interface block diagram

Corresponding Transmitter : Sil150, Sil154, Sil140 (Silicon Image)

Using receiver : Sil151 (Silicon Image)

[Example]Useing Sil154. (Single pixel/clock, 18bpp)

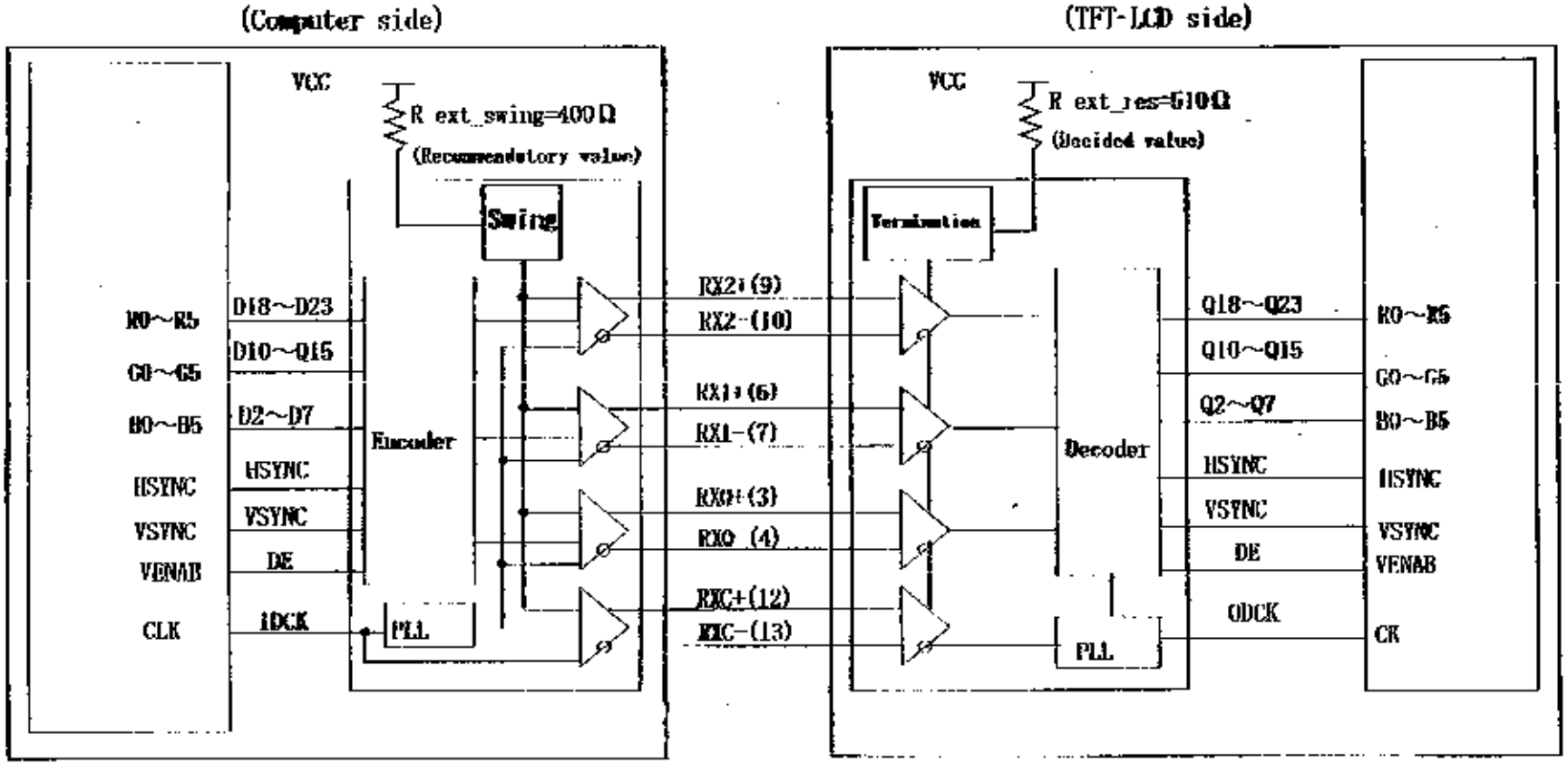


FIG. 2 TMDS Interface block diagram

4-3. Backlight driving

CN2,CN3 Using conncter: BHR-03VS-1(JST)

Mating connector : SM02(8.0)B-BHS-1(JST)

Pin no.	symbol	Function
1	V_{HIGH}	Power supply for lamp (High voltage side)
2	NC	
3	V_{LOW}	Power supply for lamp (Low voltage side)

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25℃	−0.3 ～ Vcc+0.3	V	
+3.3V supply voltage	Vcc	Ta=25℃	0 ～ +4.0	V	
Storage temperature	Tstg	−	−25 ～ +60	℃	【Note1】
Operating temperature (Ambient)	Topa	−	0 ～ +50	℃	

【Note1】 Humidity : 95%RH Max. at Ta≦40℃.

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

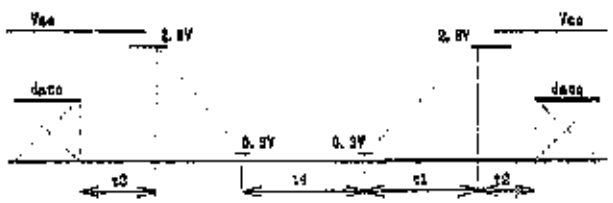
No condensation.

6. Electrical Characteristics

6-1.TFT-LCD panel driving Ta=25℃

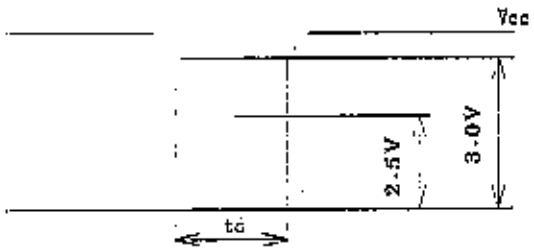
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc	Supply voltage	Vcc	+3.0	+3.3	+3.6	V	[Note1]
	Current dissipation	Icc	—	640	890	mA	[Note2]
Permissive input ripple voltage		V_{RP}	—	—	100	mVp-p	Vcc=+3.3V
Differential input voltage Single ended amplitude		V_{ID}	75	—	1000	mV	
Input leakage Current		I_L	-10		+10	μA	Vcc=+3.3V

[Note1]
On-off conditions for supply voltage



0<t1≦10ms
0<t2≦60ms
0<t3≦1s
t4>200ms

Vcc-dip conditions



1) 2.5V≦Vcc<3.0V
td≦10ms
2) Vcc<2.5V
Vcc-dip conditions should also follow the
On-off conditions for supply voltage

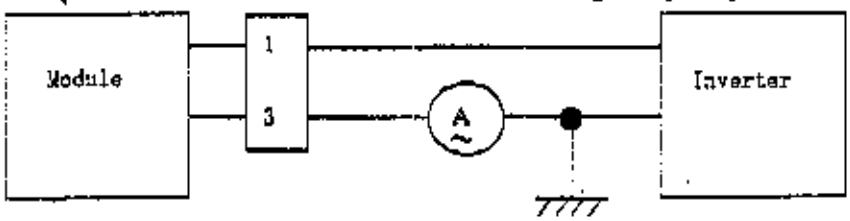
[Note2] Typical current situation : 16-gray-bar pattern.
Vcc=+3.3V

6-2. Backlight driving

The backlight system is an edge-lighting type with a couple of CCFT (Cold Cathode Fluorescent Tube).
The characterisdcs of the only lamp are shown in the following table. △1

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	3.0	6.0	6.5	mArms	【Note1】
Lamp voltage	V_L	—	600	—	Vrms	
Lamp power consumption	P_L	—	3.60	—	W	【Note2】
Lamp frequency	F_L	30	60	70	KHz	【Note3】
Kick-off voltage	V_S	—	—	1140	Vrms	Ta=25℃
		—	—	1400	Vrms	Ta=0℃ 【Note4】
Lamp life time	L_L	25000	—	—	Hour	【Note5】

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



＊3pin is V_{Low}

【Note2】 Calculated value for reference ($I_L \times V_L$)

【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】 Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of Ta=25℃ and I_L=6.0mArms.

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

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

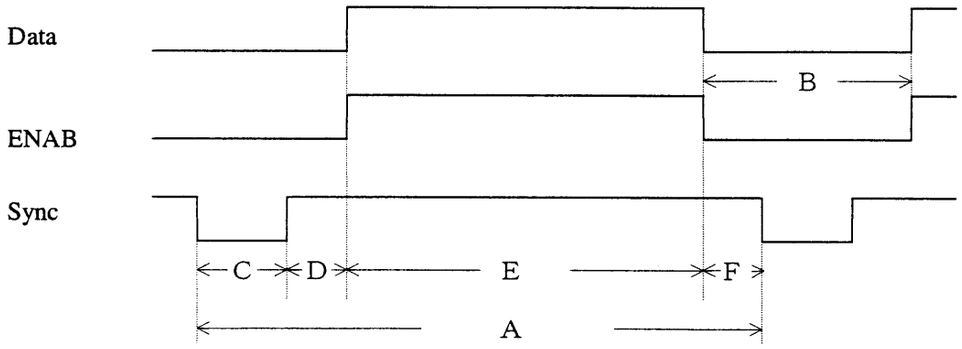
Note) The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting,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

Use the lamp inverter power source incorporating such safeguard as overvoltage/overcurrent protective circuit or lamp voltage waveform detection circuit, which should have individual control of each lamp.In case one circuit without such individual control is connected to more than two lamps, excessive current may flow into one lamp when the other one is not in operation.

7. Timing characteristics of input signals

7-1. Timing characteristics

7-1-1. Digital outputs of TMDS driver



(Vertical)

Item (symbol)	Min.	Typ.	Max.	Unit	備考
Vsync cycle (T_{VA})	—	16.667	—	ms	Negative
	803	806		line	
Blanking period(T_{VB})	35	38	—	line	
Sync pulse width (T_{VC})	4	6	—	line	
Back porch (T_{VD})	0	29		line	
Sync pulse width+Back porch (T_{VC}+T_{VD})	35	35	35	line	
Active display area (T_{VE})	768	768	768	line	
Front porch (T_{VF})	0	3	—	line	

(Horizontal)

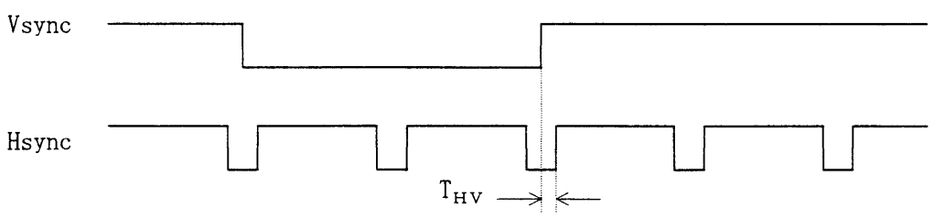
Item (symbol)	Min.	Typ.	Max.	Unit	Remark
Hsync cycle (T_{HA})	19.4	20.677	—	μs	Negative
	1260	1344	1408	clock	
Blanking period (T_{HB})	236	320	—	clock	
Sync pulse width (T_{HC})	8	136	—	clock	
Sync pulse width + Back porch (T_{HC} + T_{HD})	1500-T_{HA}	296	T_{HA}-1024	clock	
Active display area (T_{HE})	1024	1024	1024	clock	
Front porch (T_{HF})	0	24	—	clock	

(Clock)

Item	Min.	Typ.	Max.	Unit	Remark
Frequency	50.0	65.0	65.3	MH_z	【Note1】

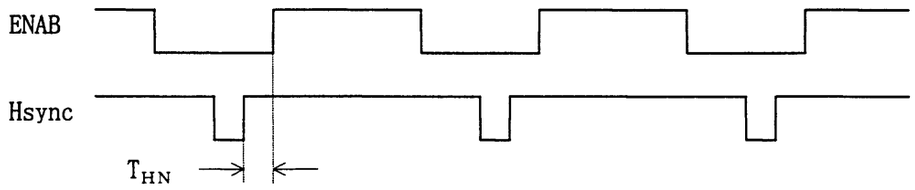
Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

(Hsync-Vsync Phase difference)



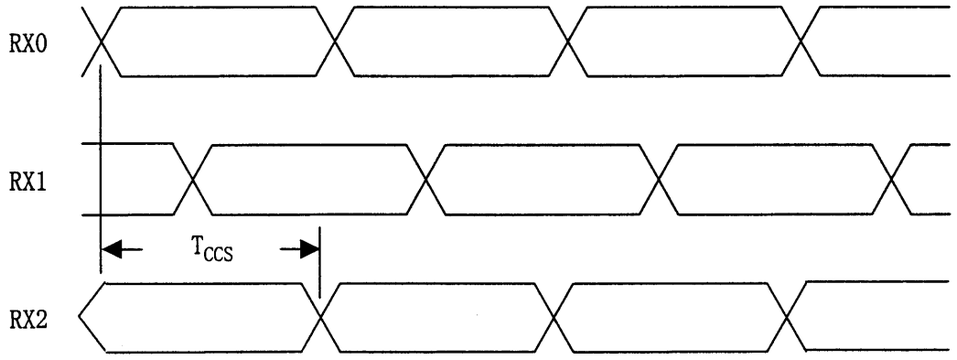
Item(symbol)	Min.	Typ.	Max.	Unit	Remark
Hsync-Vsync Phase difference(T_{HV})	1	—	$T_{HA}-T_{HC}$	clock	

(Hsync-ENAB Phase difference)



Item	Min.	Typ.	Max.	Unit	Remark
(T_{HN})	0	—	312	clock	

7-1-2. TMDS inputs



Item(symbol)	Conditions	Min.	Typ.	Max.	Unit	Remark
Channel to Channel Differetial Input Skew(T_{CCS})	65MHz 1 pixel / clock	—	—	7	ns	
Intra-Pair(+ to -) Differential Input Skew(T_{DPS})		—	—	470	ps	
Worst Case Differencial Input Jitter tolerance		—	—	465	ps	【Note1】

【Note1】 Jitter defined as per DVI 1.0 Specification, Section 4.6 *Jitter Specification.*

7-2 Display position

Item	Standards	Beginning	Ending	Unit	Remark
Horizontal	rising edge of ENAB	0	1024	clock	
Vertical	rising edge of Vsync	35	803	clock	

[Note]

(Horizontal display direction)

Don't keep ENAB "Low" during operation.

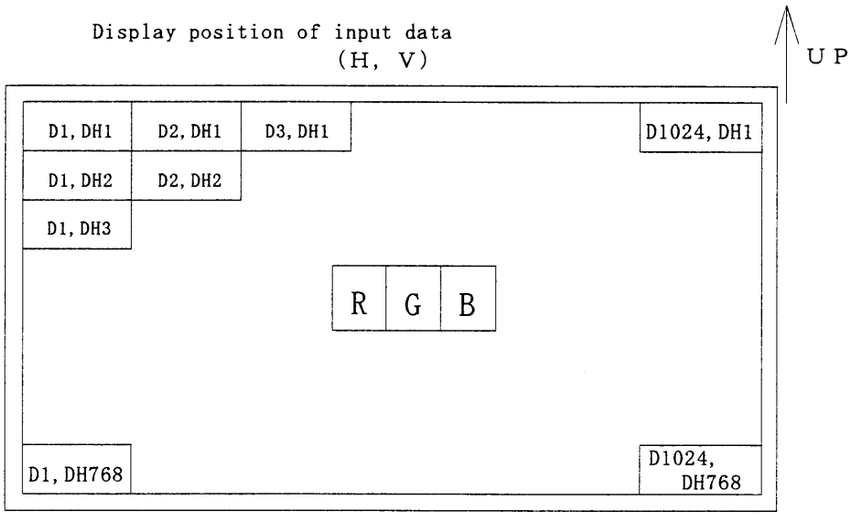
(Vertical display direction)

35 lines are counted from Vsync negative edge and data from next line are available.

(Note of ENAB signal)

ENAB could not be used for the purpose of the vertical display start timing.

7-3. Input Data Signals and Display Position on the screen



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

	Colors & Gray scale	Data signal																	
		GrayScale	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 Characteristics

Ta=25℃, Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21, θ 22	CR≧10	45	50	—	Deg.	[Note1,4]
	Vertical	θ 11		10	20	—	Deg.	
		θ 12		30	45	—	Deg.	
Contrast ratio		CRn	θ =0°	150	—	—		[Note2,4]
		CRo	Optimum viewing angle	—	300	—		
Response time	Rise	τr	θ =0°	—	10	—	ms	[Note3,4]
	Decay	τd		—	30	—	ms	
Chromaticity of white		x		0.283	0.313	0.343		[Note4]
		y		0.299	0.329	0.359		
Chromaticity of red		x		0.545	0.575	0.605		
		y		0.294	0.324	0.354		
Chromaticity of green		x		0.280	0.310	0.340		⚠1
		y		0.517	0.547	0.577		
Chromaticity of blue		x		0.130	0.160	0.190		
		y		0.095	0.125	0.155		
Luminance of white		Y_L		170	210	—	cd/m²	I_L=6.0mArms [Note4]
White Uniformity		δ w		—	—	1.35		[Note5]

※The measurement shall be executed 30 minutes after lighting at rating. (typical condition:I_L=6.0mArms)

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

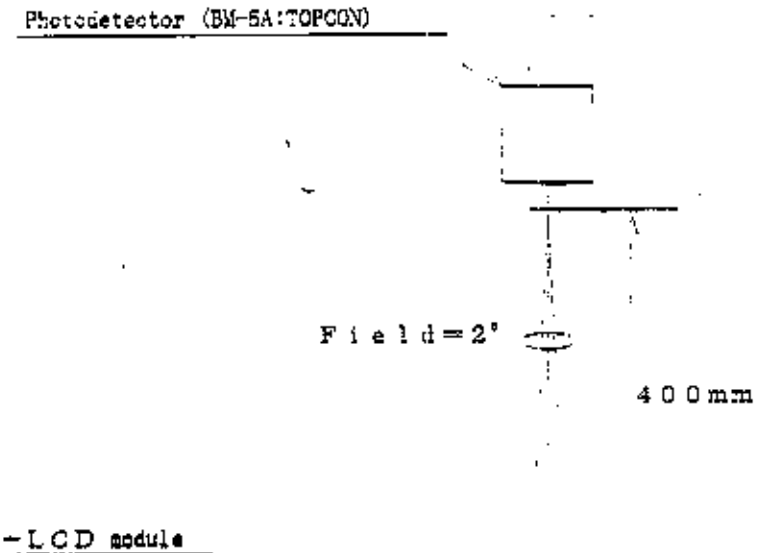
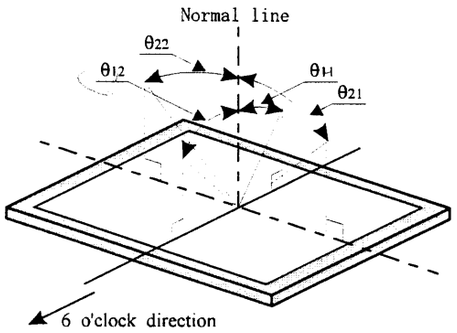


Fig. 3 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



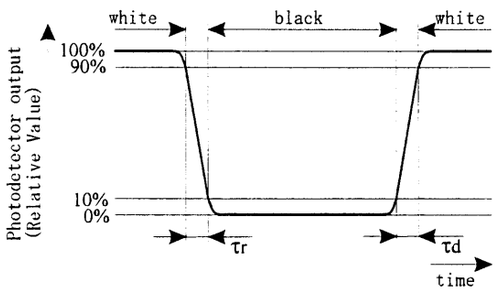
【Note2】 Definition of contrast ratio:

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:

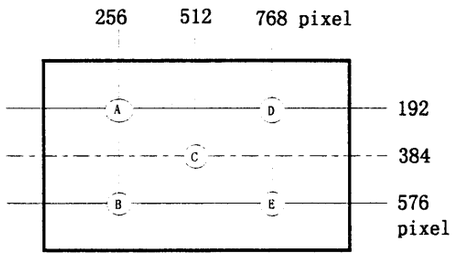
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



【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) .



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

10. 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 polarize is easily damaged, pay attention not to scratch it .

d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately .

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 take the human earth into consideration when handling .

h) Make sure the four mounting holes of the module are grounded sufficiently. Take electro-magnetic interference (EMI) into consideration.

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

j) Observe all other precautionary requirements in handling components .

k) When some pressure is added onto the module from rear side constantly , it causes display non-uniformity issue , functional defect , etc . So , please avoid such design .

11. Packing form

a) Piling number of cartons : MAX. 5

b) Package quantity in one carton : 5pcs

c) Carton size : 340mm(W) × 420mm(H) × 180mm(D)

d) Total mass of one carton filled with full modules : 5500g

Packing form is shown in Fig.4.

12. Reliability test items

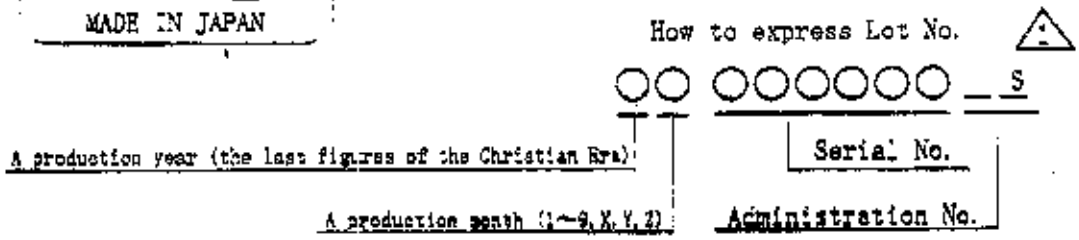
No.	Test item	Conditions
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-25℃ 240h
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50℃ 240h (The panel temp. must be less than 60℃)
5	Low temperature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

【 valuation method 】

Module test is done in standard condition, under the inspection standard of the shipment inspection standard book. We consider which there is the change that becomes an obstruction on practical use or not.

13. Others

1) Lot No. and indication 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) The chemical compound which causes the destruction of ozone layer is not being used.

6) When any question or issue occurs , it shall be solved by mutual discussion .

LD-12607-16

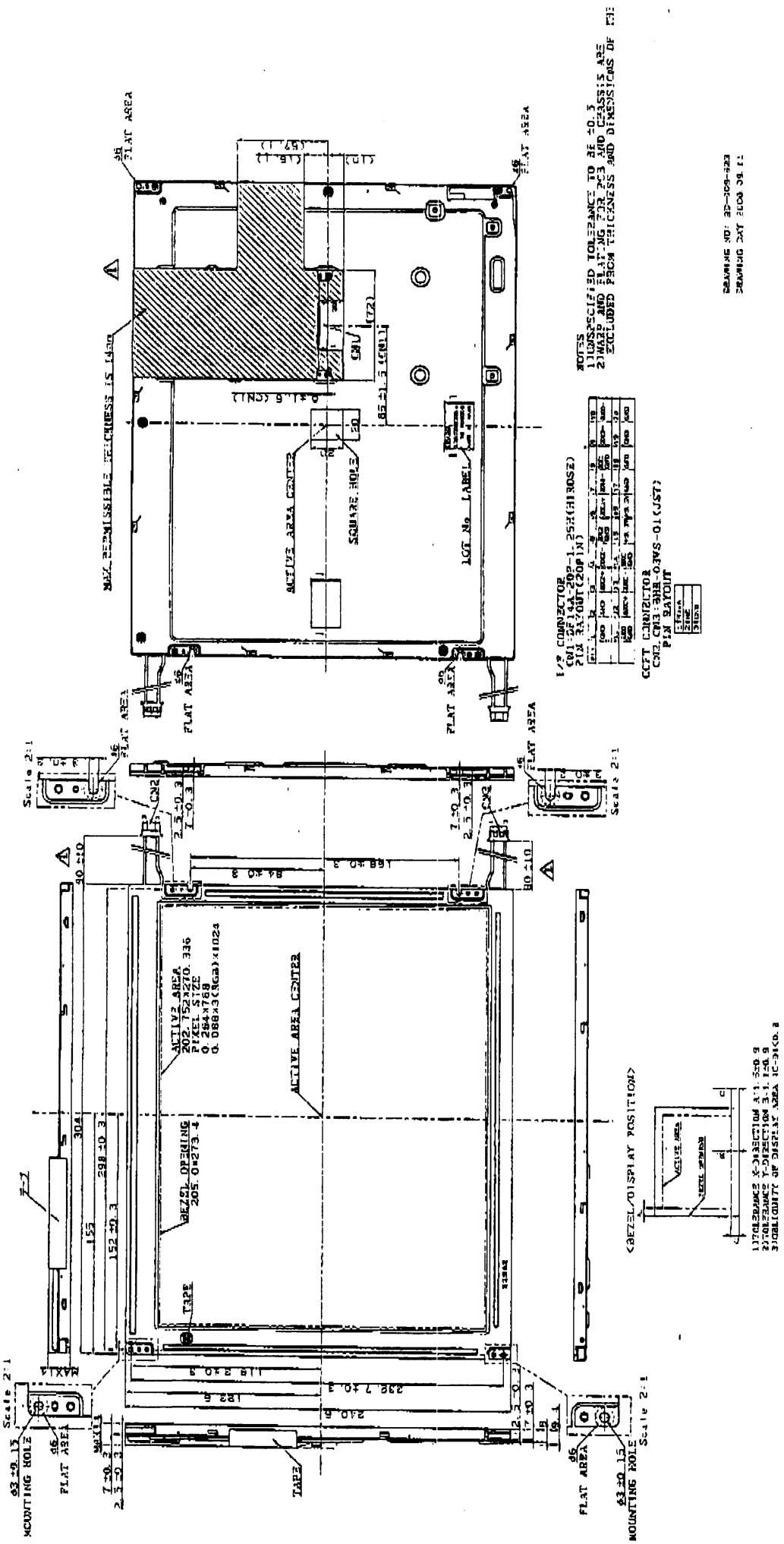
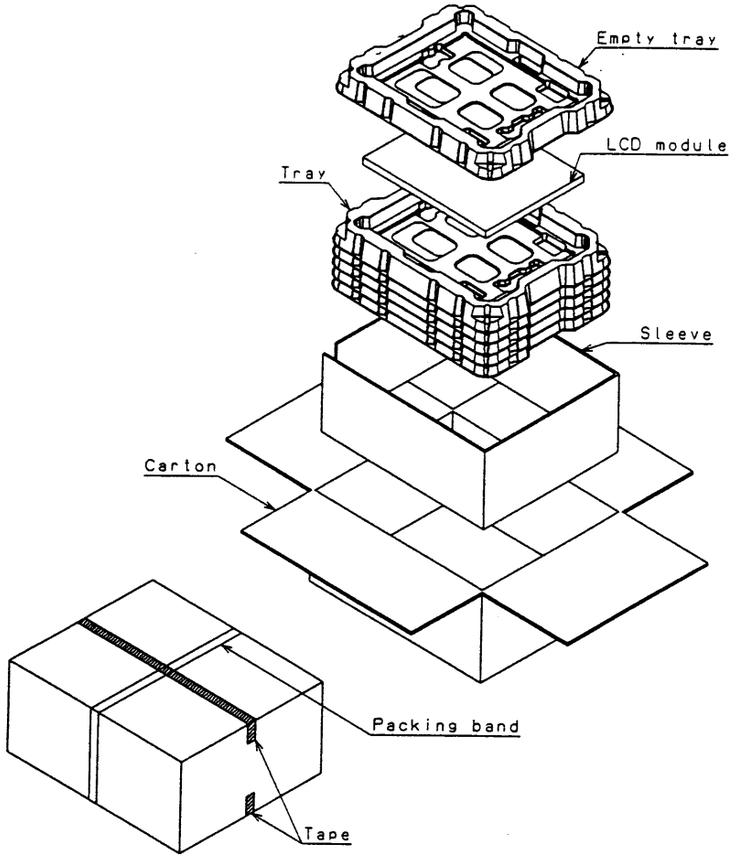
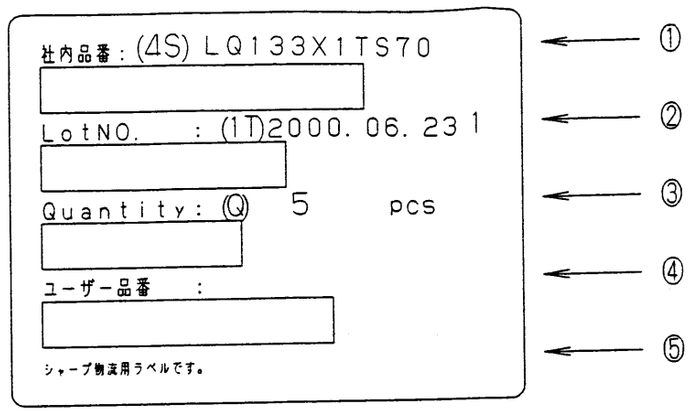


Fig. 1 LQ133X1TS70 OUTLINE DIMENSIONS



-Packing barcode label-



①Model No.

②Lot No. (Date)

③Quantity

④User model No.

⑤Sharp model No.

FIG.4 PACKING FORM