SHARP

No.	**LD –12Y60A**
DATE	Nov. 16 . 2000

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ150U1LH21

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DEVELOPMENT ENGINEERING DEPT. 2
TFT DIVISION 2
TFT LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

LQ150U1LH21

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-12Y60	Nov.16.2000				1st Issue
LD-12Y60A	Jan.10.2001	A	15	B/L cables length 60±5mm → 100±5mm	2nd Issue

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1. Application

This technical literature applies to a color TFT-LCD module,LQ150U1LH21

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). This module is based on the standards of SPWG(Standard Panels Working Group).

It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, and a backlight unit. Graphics and texts can be displayed on a 1600×3×1200 dots panel with 262,144 colors by using LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module has very high aperture ratio. A low-reflection and higher-color-saturation type color filter is also used for this panel. Therefore, high-brightness and high-contrast image, which is suitable for the multimedia use, can be obtained by using this module.

Optimum viewing direction is 6 o'clock.

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

[Features]

1) High aperture panel; high-brightness or low power consumption.
2) Brilliant and high contrast image.
3) Small footprint and thin shape.
4) Light weight.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	38 (15.0") Diagonal	cm
Active area	304.0 (H)×228.0 (V)	mm
Pixel format	1600 (H)×1200 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.190(H)×0.190 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	317.3(W)×242.0 (H)×7.0max.(D)	mm
Mass	(650)	g
Surface treatment	Anti-glare and hard-coating 2H Haze Value = 25	

*1.Note : excluding backlight cables.

Outline dimensions is shown in Fig.1

4. Input Terminals

4-1. TFT-LCD panel driving

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

Using connector : FI-XB30S-HF10 (JAE)

Corresponding connector : FI-X30M, or FI-X30H (JAE)

Pin No.	Symbol	Function	Remark
1	GND		
2	Vcc	+3.3V power supply	
3	Vcc	+3.3V power supply	
4	Vedid	DCC +3.3V power supply	
5	NC	Reserved	
6	CLKedid	DDC Clock	
7	DATAedid	DDC Data	
8	R1IN0-	Receiver signal of A side pixels (-)	LVDS
9	R1IN0+	Receiver signal of A side pixels (+)	LVDS
10	GND		
11	R1IN1-	Receiver signal of A side pixels (-)	LVDS
12	R1IN1+	Receiver signal of A side pixels (+)	LVDS
13	GND		
14	R1IN2-	Receiver signal of A side pixels (-)	LVDS
15	R1IN2+	Receiver signal of A side pixels (+)	LVDS
16	GND		
17	CK1IN-	Clock signal of A side pixels (-)	LVDS
18	CK1IN+	Clock signal of A side pixels (+)	LVDS
19	GND		
20	R2IN0-	Receiver signal of B side pixels (-)	LVDS
21	R2IN0+	Receiver signal of B side pixels (+)	LVDS
22	GND		
23	R2IN1-	Receiver signal of B side pixels (-)	LVDS
24	R2IN1+	Receiver signal of B side pixels (+)	LVDS
25	GND		
26	R2IN2-	Receiver signal of B side pixels (-)	LVDS
27	R2IN2+	Receiver signal of B side pixels (+)	LVDS
28	GND		
29	CK2IN-	Clock signal of B side pixels (-)	LVDS
30	CK2IN+	Clock signal of B side pixels (+)	LVDS

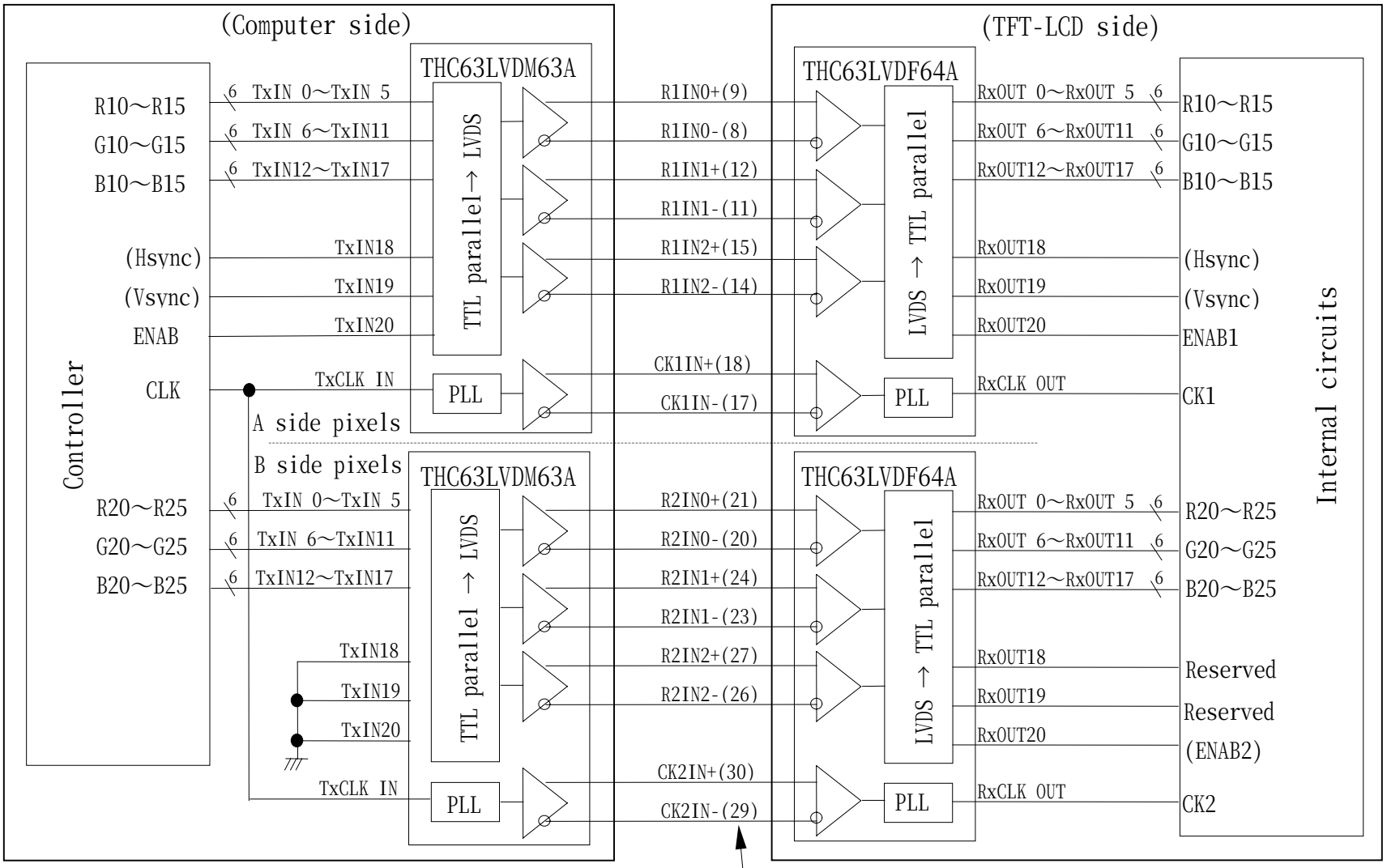
【Note 1】Relation between LVDS signals and actual data shows below section (4-2).

【Note 2】The shielding case is connected with signal GND.

.

4-2 Interface block diagram

Using receiver：(THC63LVDF64A(THINE))、Corresponding Transmitter：THC63LVDM63A (THINE), DS90C363,DS90C383(National semiconductor)



TxIN 18～20 must be fixed "Low".

Symbol of CN1 (Pin No.)

4-3. Backlight driving

CN2 : BHSR-02VS-1(JST)

Mating connector : SM02B-BHSS-1(JST)

Pin no.	symbol	function
1	V_{HIGH}	Power supply for lamp (High voltage side)
2	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	【Note1】
+3.3V supply voltage	Vcc	Ta=25℃	0 ～ ＋ 4	V	
Storage temperature	Tstg	—	−25 ～ ＋60	℃	【Note2】
Operating temperature	Topa	—	0 ～ ＋50	℃	

【Note1】LVDS signals

【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
Vcc	Supply voltage		Vcc	+3.0	+3.3	+3.6	V	【Note2】
	Current dissipation		Icc	—	730	1210	mA	【Note3】
Permissive input ripple voltage			V_{RP}	—	—	100	mV p-p	Vcc=+3.3V
Input voltage range			V_I	0	—	2.4	V	LVDS signal
Differential input threshold voltage		High	V_{TH}	—	—	+100	mV	V_{CM}=+1.2V 【Note1】
		Low	V_{TL}	–100	—	—	mV	
Input current (High)			I_{OH}	—	—	±10	μA	V_I=2.4V Vcc=3.6V
Input current (Low)			I_{OL}	—	—	±10	μA	V_I=0V Vcc=3.6V
Terminal resistor			R_T	—	100	—	Ω	Differential input

【Note1】 V_{CM} : Common mode voltage of LVDS driver.

【Note2】 On-off conditions for supply voltage

Vcc rise time

t1≦10 ms

On time Vcc and signal

0≦t2≦50 ms

Off time signal and Vcc

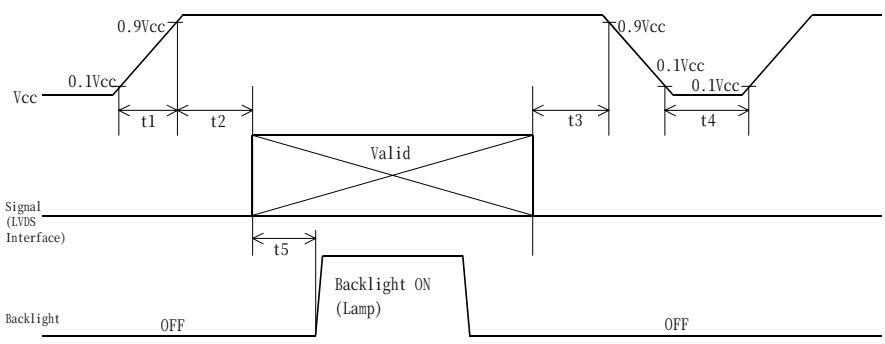
0≦t3≦50 ms

Off time Vcc

400ms≦t4

On time lamp and signal

200ms≦t5



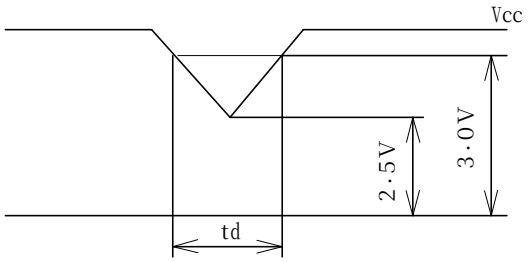
Power sequence for Backlight is not especially specified, however it is recommended to consider some timing difference between LVDS input and Backlight input as shown above.

If the Backlight lights on before LCD starting, or if the Backlight is kept on after LCD stopping, the screen may look white for a moment or abnormal image may be displayed.

This is caused by variation in output signal from timing generator at LVDS input on or off. It does not cause the damage to the LCD module.

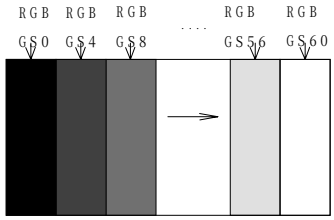
Vcc-dip conditions

1) 2.5 V≦Vcc＜3.0 V
   td≦10 ms
2) Vcc＜2.5 V



Vcc-dip conditions should also follow the On-off conditions for supply voltage.

【Note3】 Typical current situation : 16-gray-bar pattern.
Vcc=+3.3V



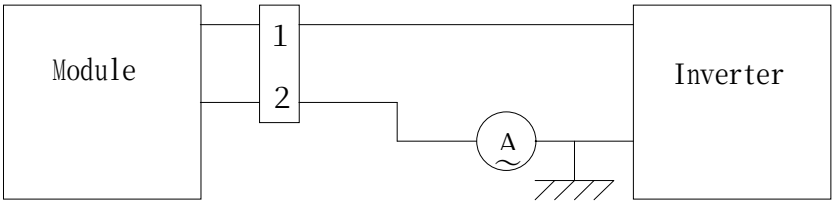
6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

The characteristics of the only lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp current range	I_L	(2.0)		(6.0)	mArms	【Note1】	
Lamp voltage	V_L	—	(675)	—	Vrms		
Lamp power consumption	P_L	—	(4.05)	—	W	【Note2】	
Lamp frequency	F_L	(40)	(50)	(70)	KHz	【Note3】	
Kick-off voltage	V_S	—	—	(1350)	Vrms	Ta=25℃	
		—	—	(1600)	Vrms	Ta=0℃	【Note4】
Lamp life time	L_L	(10000)	—	—	Hour	【Note5】	

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



* 2pin is V_{LOW}

【Note2】 Calculated value for reference (I_L × 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 = (6.0) mArms.

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

② Kick-off voltage at Ta = 0℃ exceeds maximum value, (1600) V rms.

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.

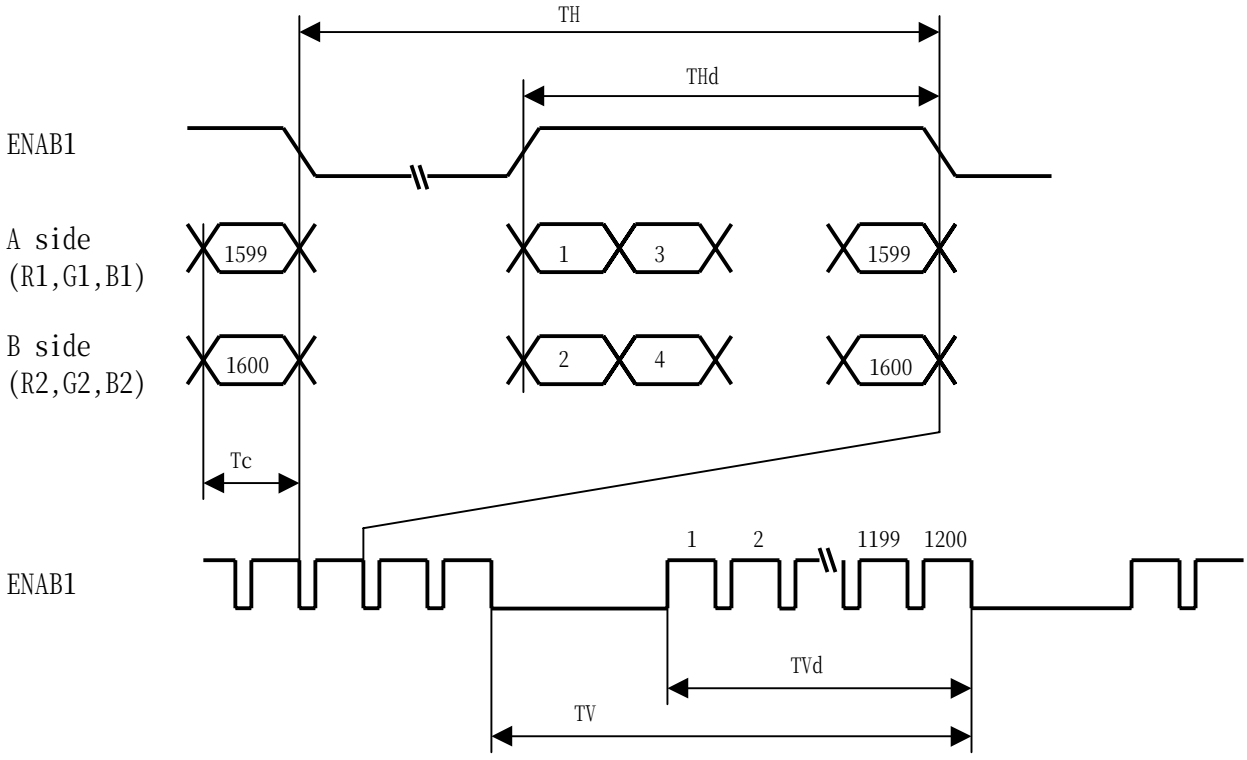
7. Timing characteristics of input signals

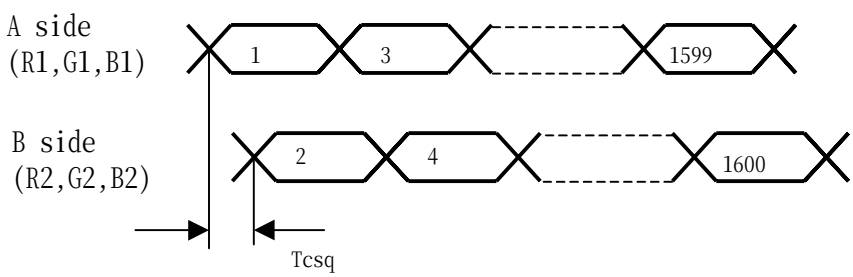
7-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	50	80	80	MHz	
	Skew	Tcsq	–2	0	2	ns	【Note1】
Data enable Signal	Horizontal period	TH	979	1056	1106	clock	
			12.24	13.2	—	μs	
	Horizontal period (High)	THd	800	800	800	clock	
	Vertical period	TV	1202	1250	1280	line	【Note2】
			14.71	16.67	—	ms	
	Vertical period (High)	TVd	1200	1200	1200	line	

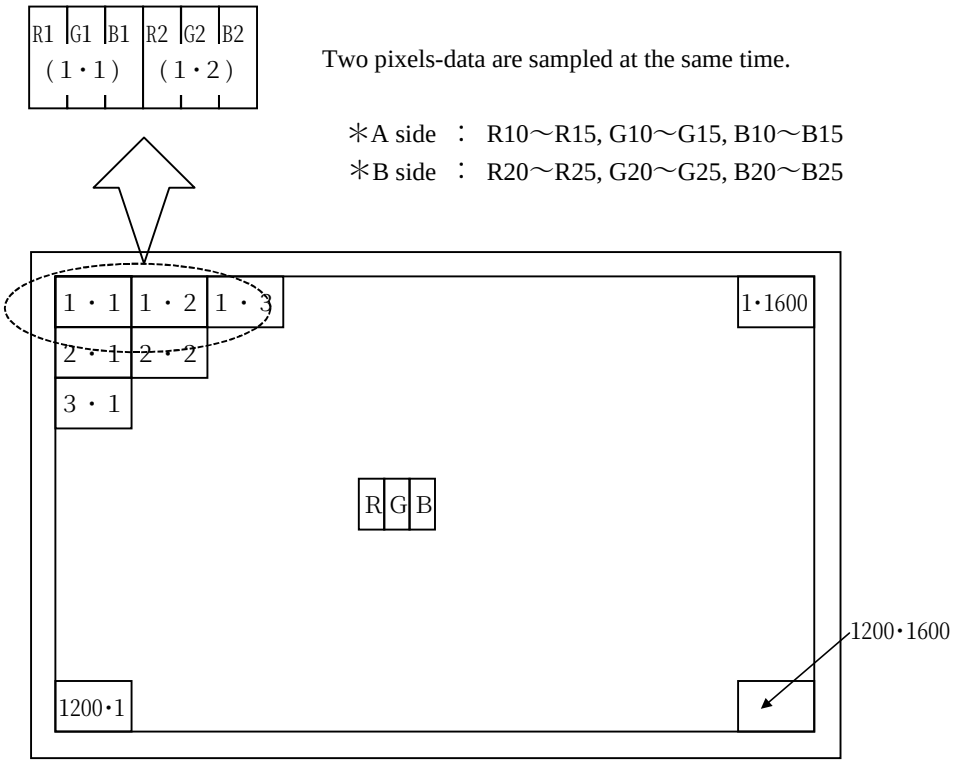
【Note1】 Lvds (A Side data)– Lvds (B side data) phase difference

【Note2】 In case of using the long vertical period, the deterioration of display quality, flicker, etc., may occur.





7-2. Input Data Signals and Display Position on the screen



Display position of input data (V・H)

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

	Colors & Gray scale	Data signal																			
		GrayScale	R10	R11	R12	R13	R14	R15	G10	G11	G12	G13	G14	G15	B10	B11	B12	B13	B14	B15
			R20	R21	R22	R23	R24	R25	G20	G21	G22	G23	G24	G25	B20	B21	B22	B23	B24	B25
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	θ21, θ22	CR>10	45	—	—	Deg.	【Note1,4】
	Vertical	θ11		10	—	—	Deg.	
		θ12		30	—	—	Deg.	
Contrast ratio		CRn	θ=0°	150	—	—		【Note2,4】
		CRo	Optimum viewing angle	—	300	—		
Response time	Rise	Tr	θ=0°	—	15		ms	【Note3,4】
	Decay	Td		—	30		ms	
Chromaticity of white		x		—	0.313	—		【Note4】
		y		—	0.329	—		
【Note4】		Y_{L2}		120	150	—	cd/m^2	I_L = (6mA) F_L=(60kHz)
White Uniformity		δ_W		—	—	1.45		【Note5】

※ The measurement shall be executed 30 minutes after lighting at rating. (typical condition: I_L =(6mA)rms)

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.2 below.

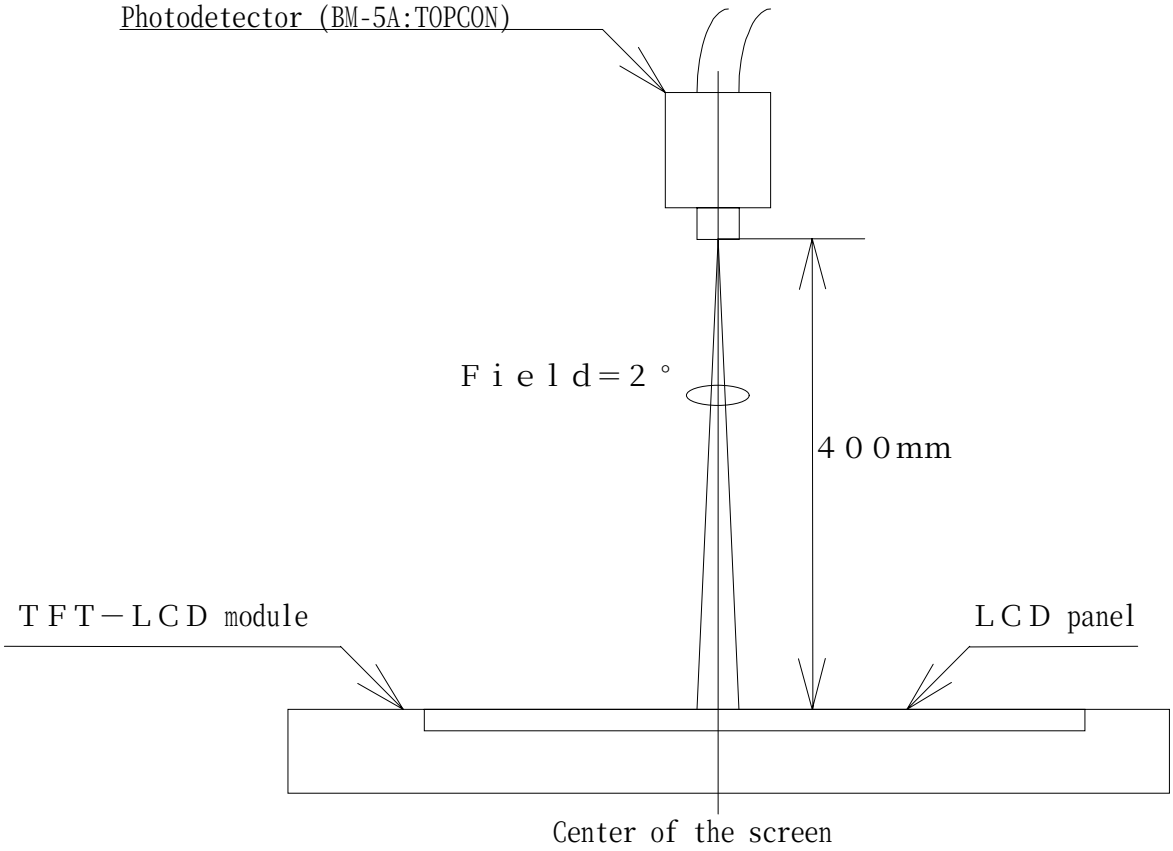
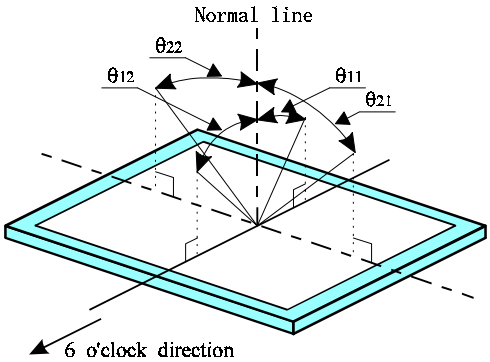


Fig.2 Optical characteristics measurement method

【Note1】Definitions of viewing angle range:



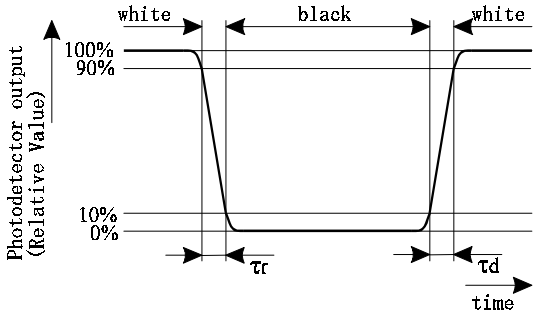
【Note2】Definition of contrast ratio:

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:

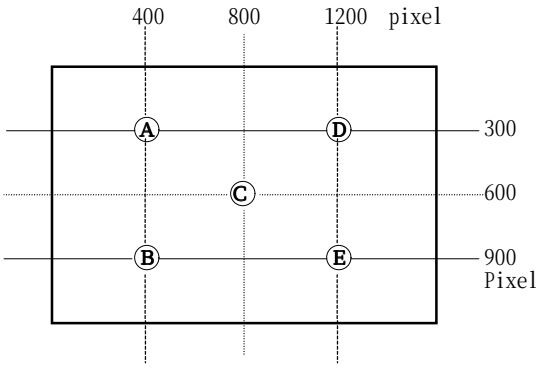
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



【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. 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 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 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 handled carefully 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 the 'dust' on the polarizer by using an ionized nitrogen gun, etc..

k) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

12. Packing form

a) Piling number of cartons (TBD) cartons

b) Package quantity in one carton : (TBD) pcs

c) Carton size : (TBD)mm

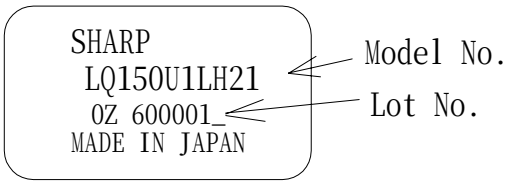
d) Total mass of one carton filled with full modules : (TBD)g

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 (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 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 : 490 m/s^2 Pulse width : 11 ms, sine wave Direction : ±X,±Y,±Z once for each direction.

14. Others

1) Lot No. Label:：

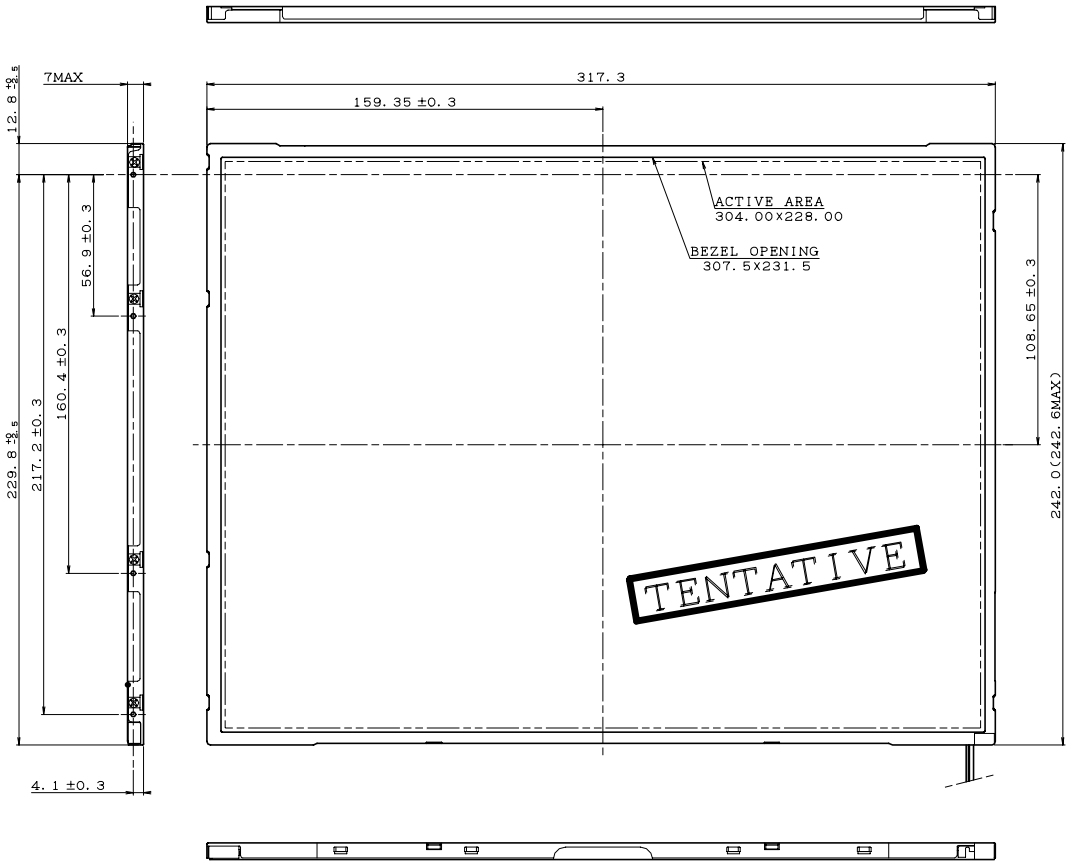


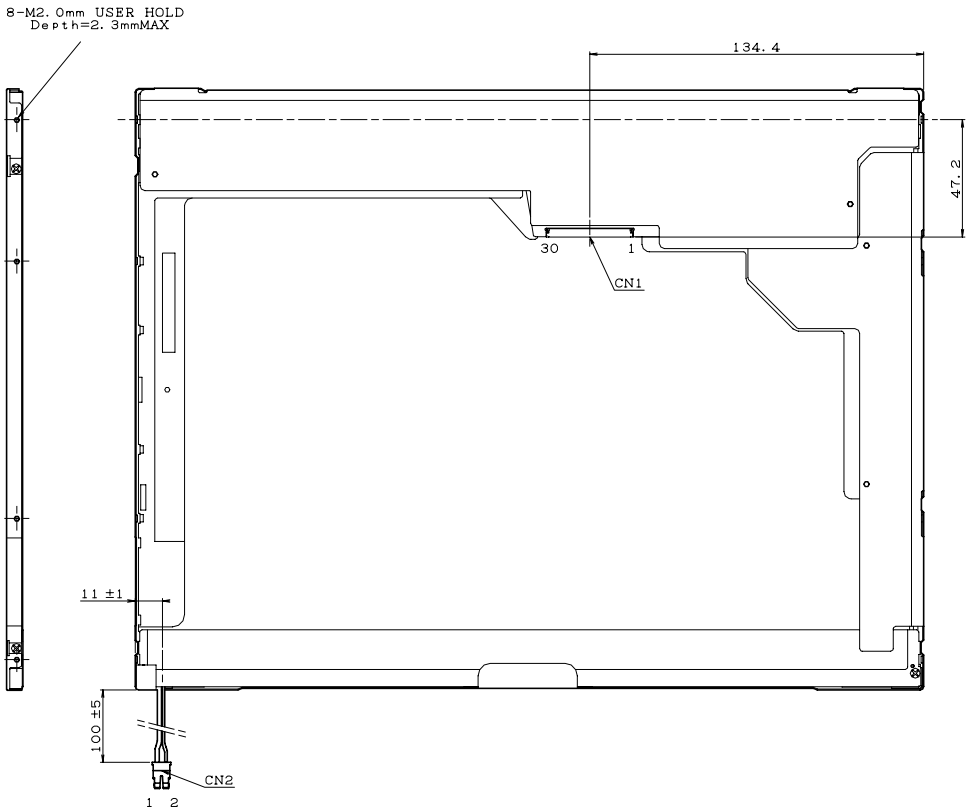
2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.
If adjusted value is changed, this technical literature may not be satisfied.

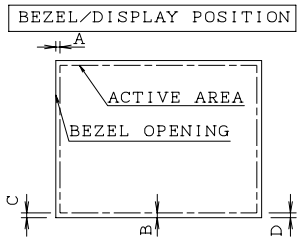
3) Disassembling the module can cause permanent damage and should be strictly avoided.

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 technical literature, it shall be resolved through discussion with spirit of cooperation.







1)TOLERANCE X-DIRECTION A:1.75±0.5
2)TOLERANCE Y-DIRECTION B:1.75±0.5
3)OBLIQUITY OF DISPLAY AREA |C-D|<0.5

CN1:INTERFACE CONNECTOR
IF-XB30P-HF10(JAE)

CN2:CCFT CONNECTOR
BHSR-02VS-1(JST)

NOTES
1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. WARP AND FLATING FOR
PCB AND CHASSIS ARE EXCLUDED FROM
THICKNESS AND DIMENSION OF THE UNIT.

CN1 Pin Assign

1	GND
2	VCC
3	VCC
4	VEDID
5	NC
6	CLKEDID
7	DATAEDID
8	R1IN0-
9	R1IN0+
10	GND
11	R1IN1-
12	R1IN1+
13	GND
14	R1IN2-
15	R1IN2+
16	GND
17	CK1IN-
18	CK1IN+
19	GND
20	R2IN0-
21	R2IN0+
22	GND
23	R2IN1-
24	R2IN1+
25	GND
26	R2IN2-
27	R2IN2+
28	GND
29	CK2IN-
30	CK2IN+

fig1. LQ150U1LH21 OUTLINE DIMENSIONS