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	SPECIFICATION	APPLICABLE GROUP
		MOBILE LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ123K1LG03

These parts have corresponded with the RoHS directive.

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

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SHARP CORPORATION

RECORDS OF REVISION

LQ123K1LG03

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-19201A	Feb.1.2007	-	-	-	1 st Issue

1. Application

This specification applies to the color 12.3 dual-VGA TFT-LCD module LQ123K1LG03.

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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, inveter circuit, power supply circuit and a backlight unit. Graphics and texts can be displayed on a 1280 × RGB × 480 dots panel with about 16 million colors by using LVDS (Low Voltage Differential Signaling) system for interface and supplying +3.3V DC supply voltage forTFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module is a higher-color-saturation type color filter (NTSC 72%). 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.

And in order to improve the response time of LCD, this module applies the O/S (Over Shoot) driving technology for the control circuit.

Backlight-driving DC/AC inverter is built in this module.

3. Outline specification.

Parameter	Specifications	Unit
Display size	31.242 (12.3") Diagonal	cm
Active area	291.84 (H) × 109.44 (V)	mm
Pixel format	1280 (H) × 480 (V)	pixel
	(1 pixel=R+G+B dots)	-
Aspect ratio	8 : 3	
Pixel pitch	0.228 (H) × 0.228 (V)	mm
Pixel configuration	R,G,B vertical stripe	-
Display mode	Normally white	-
Unit outline dimensions	312.4 (W) × 130.4 (H) × 26.4 (D)	mm
Mass	530 ± 40	g
Surface treatment	Anti-glare and hard-coating 3H	-

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)

Used connector : DF14H-20P-1.25H (56) [HIROSE ELECTRIC Co.,Ltd]

Corresponding connector : DF14-20S-1.25C (connector) [HIROSE ELECTRIC Co.,Ltd]

DF14-2628SCFA(terminal) [HIROSE ELECTRIC Co.,Ltd]

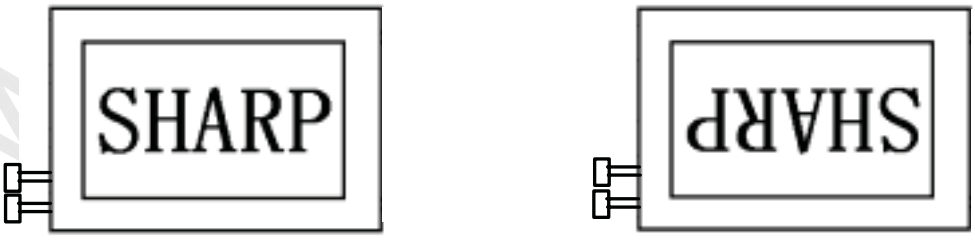
Used LVDS receiver : Type with built-in control IC (THC63LVDF84A[Thine] equivalent device)

Corresponding LVDS transmitter : THC63LVDM83R[Thine] or equivalent device

Pin No.	Symbol	Function	Remark
1	V_{CC}	+3.3V power supply	
2	V_{CC}	+3.3V power supply	
3	GND	GND	
4	GND	GND	
5	RXIN0-	Receiver signal, CH0 (−)	LVDS
6	RXIN0+	Receiver signal, CH0 (+)	LVDS
7	GND	GND	
8	RXIN1-	Receiver signal, CH1 (−)	LVDS
9	RXIN1+	Receiver signal, CH1 (+)	LVDS
10	GND	GND	
11	RXIN2-	Receiver signal, CH2 (−)	LVDS
12	RXIN2+	Receiver signal, CH2 (+)	LVDS
13	GND	GND	
14	RXCLK IN-	Receiver signal, CK (−)	LVDS
15	RXCLK IN+	Receiver signal, CK (+)	LVDS
16	GND	GND	
17	RXIN3-	Receiver signal, CH3 (−)	LVDS
18	RXIN3+	Receiver signal, CH3 (+)	LVDS
19	RL/UD	Horizontal/Vertical display mode select signal	[Note1]
20	SELLVDS	SELLVDS	[Note2]

[Note 1]

RL/UD = Low or Open RL/UD = High



[Note 2] Relation between LVDS signals and actual data shows below section (4- 4)

4-2. Inveter for backlight driving

CN2 (+12.0V DC power supply)

Used connector : S6B-ZR-SM4A-TF(LF)(SN) [J.S.T. Mfg.Co.,Ltd]

Corresponding connector : ZHR-6 [J.S.T. Mfg.Co.,Ltd]

Pin No.	Symbol	Function
1	VDD	+12.0V power supply
2	VDD	+12.0V power supply
3	VDD	+12.0V power supply
4	GND	GND
5	GND	GND
6	Vdim	Dimming

4-3. Backlight driving (Reference)

Used connector : BHR-02(8.0)VS-1N [J.S.T. Mfg.Co.,Ltd]

Corresponding connector : SM02(8.0)B-BHS-1R-TB [J.S.T. Mfg.Co.,Ltd]

Pin No.	Symbol	Function	Color of cable	
			CN A	CN B
1	V_{HIGH}	Power supply for lamp (High voltage side)	Pink	White
2	V_{LOW}	Power supply for lamp (Low voltage side)	White	Gray

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.

Because the lamp is article of consumption, it is the reference value. It is not the one to secure this value.

Parameter	Min.	Typ.	Max.	Unit	Remark
Lamp life time	50000 (Lamp unit)	—	—	H	[Note1] [Note2]
	—	20000 (LCD module)	—		

[Note1] Lamp life time is defined as the time when the center brightness of LCD module becomes 50% of the original value under the condition of Ta=25℃ and I_L=6.0mArms.

[Note2] Above value is applicable when lamp (the longest side of LCD module) is placed horizontally. Lamp lifetime may vary if lamp (the longest side of LCD module) is placed vertically due to change of mercury density inside the lamp.

[Attention] In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower. Especially, please avoid continuous operation under lower temp environment.

(Continuous operating for around 1 month under lower temp condition may reduce the brightness to a half of the original brightness.)

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

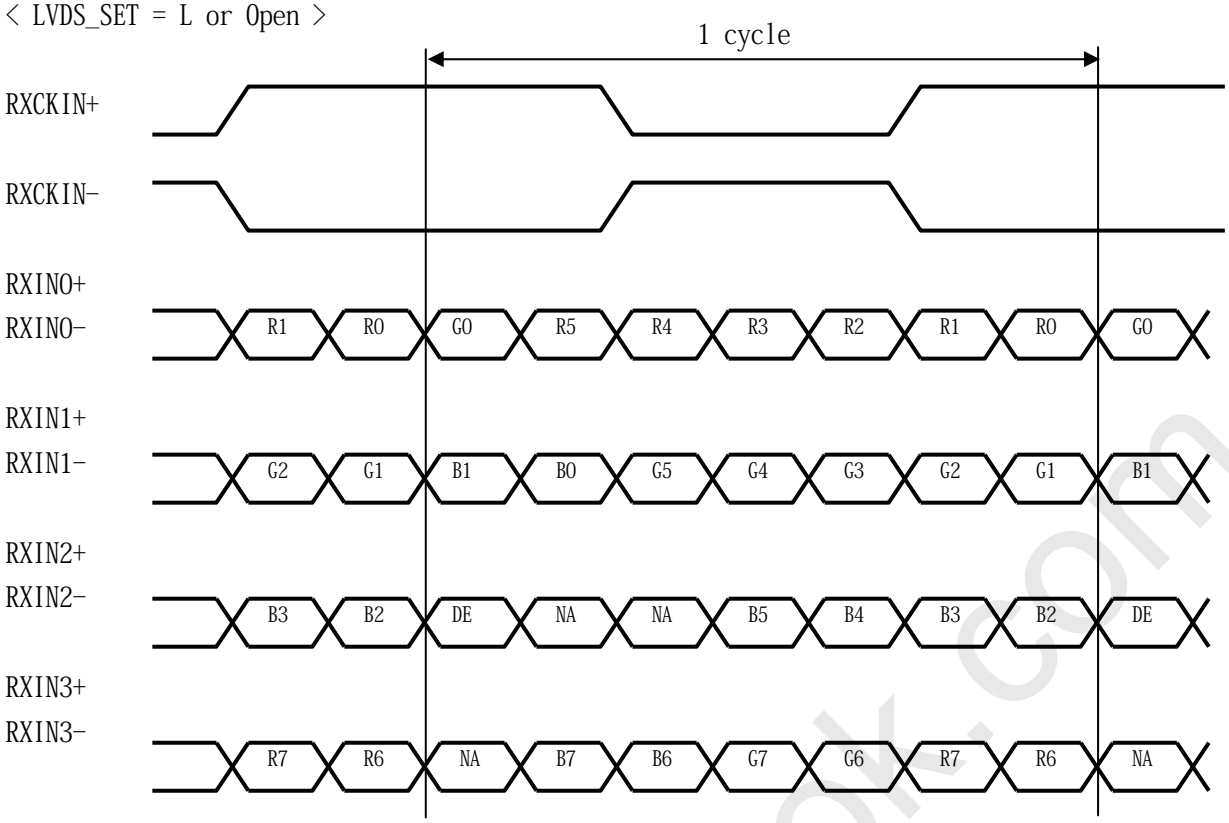
4-4 Data Mapping

1) 8 bit input

[Note2] pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

Transmitter		20pin LVDS_SET	
Pin No	Data	=L (GND) or Open	=H (3.3V)
51	TA0	R0 (LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7 (MSB)
4	TA6	G0 (LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7 (MSB)
15	TB5	B0 (LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7 (MSB)
27	TC4	(NA)	(NA)
28	TC5	(NA)	(NA)
30	TC6	DE	DE
50	TD0	R6	R0 (LSB)
2	TD1	R7 (MSB)	R1
8	TD2	G6	G0 (LSB)
10	TD3	G7 (MSB)	G1
16	TD4	B6	B0 (LSB)
18	TD5	B7 (MSB)	B1
25	TD6	(NA)	(NA)

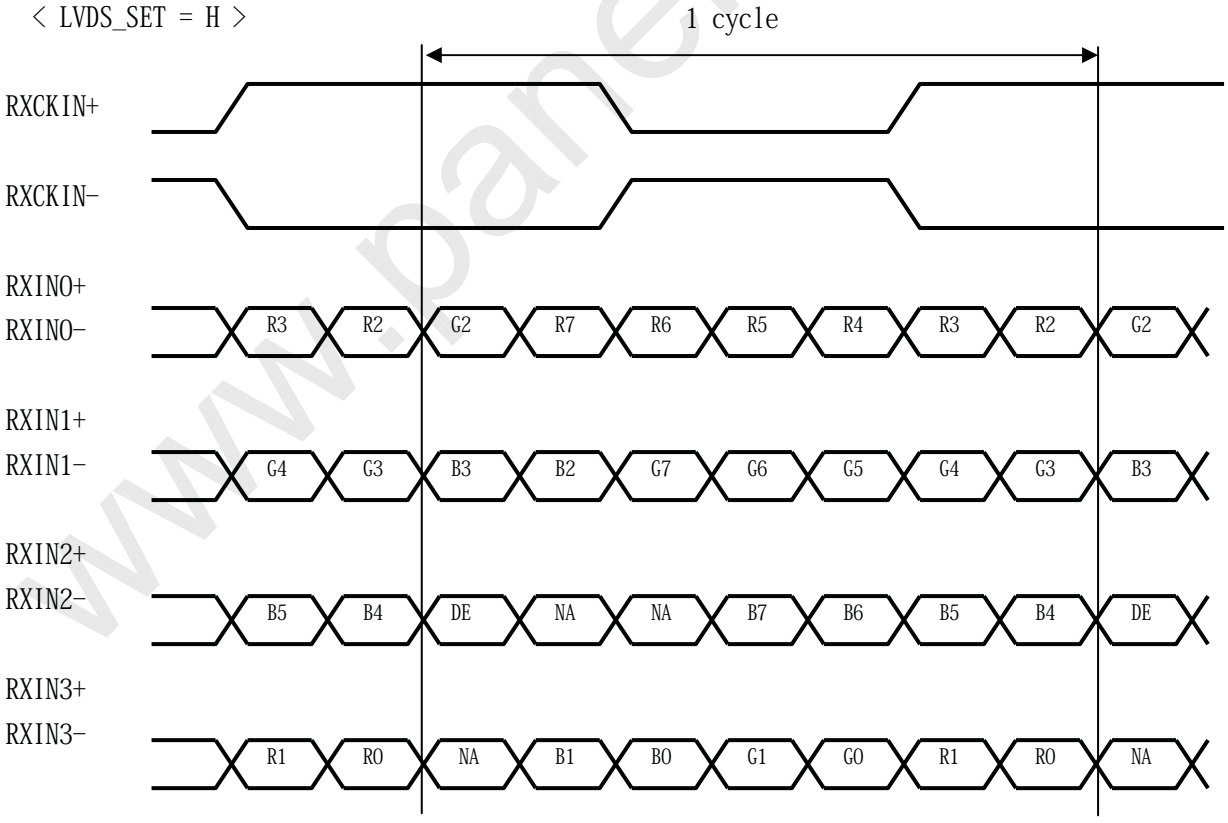
< LVDS_SET = L or Open >



DE: Display Enable

NA: Not Available

< LVDS_SET = H >



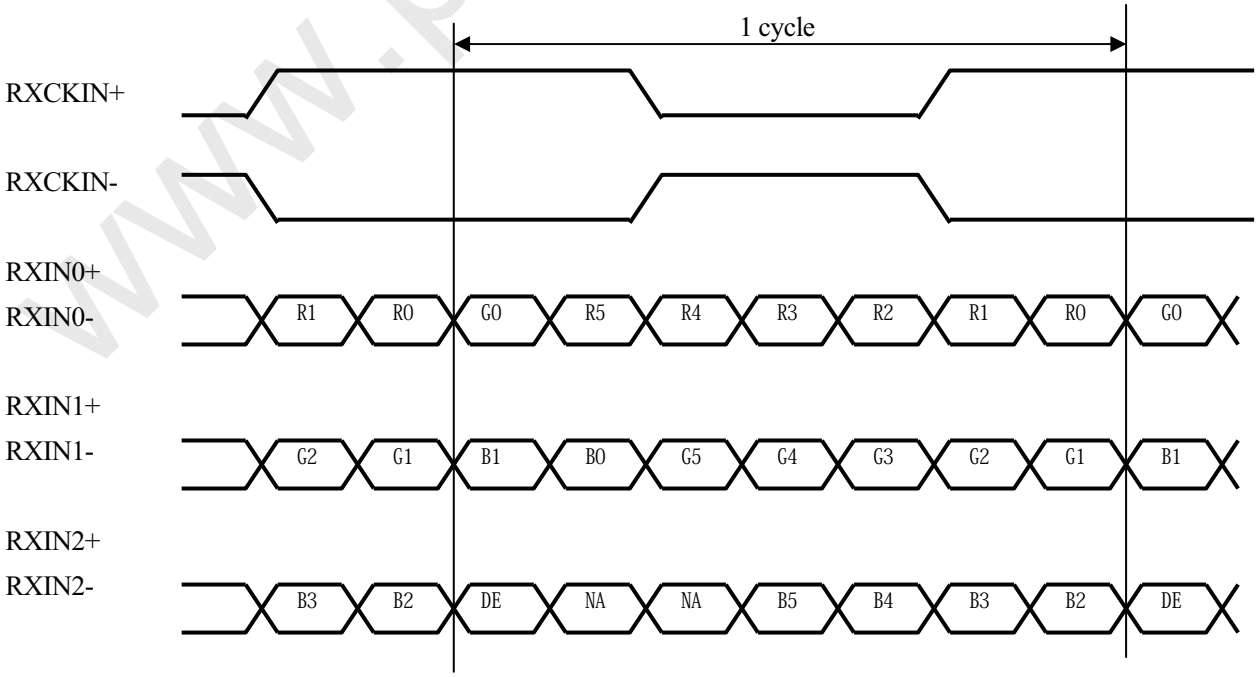
DE: Display Enable

NA: Not Available

2) 6 bit input

[Note2] pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

Transmitter		20pin LVDS_SET	
Pin No	Data	=L (GND) or Open	=H (3.3V)
51	TA0	—	R0 (LSB)
52	TA1	—	R1
54	TA2	—	R2
55	TA3	—	R3
56	TA4	—	R4
3	TA5	—	R5 (MSB)
4	TA6	—	G0 (LSB)
6	TB0	—	G1
7	TB1	—	G2
11	TB2	—	G3
12	TB3	—	G4
14	TB4	—	G5 (MSB)
15	TB5	—	B0 (LSB)
19	TB6	—	B1
20	TC0	—	B2
22	TC1	—	B3
23	TC2	—	B4
24	TC3	—	B5 (MSB)
27	TC4	—	(NA)
28	TC5	—	(NA)
30	TC6	—	DE
50	TD0	—	GND
2	TD1	—	GND
8	TD2	—	GND
10	TD3	—	GND
16	TD4	—	GND
18	TD5	—	GND
25	TD6	—	(NA)



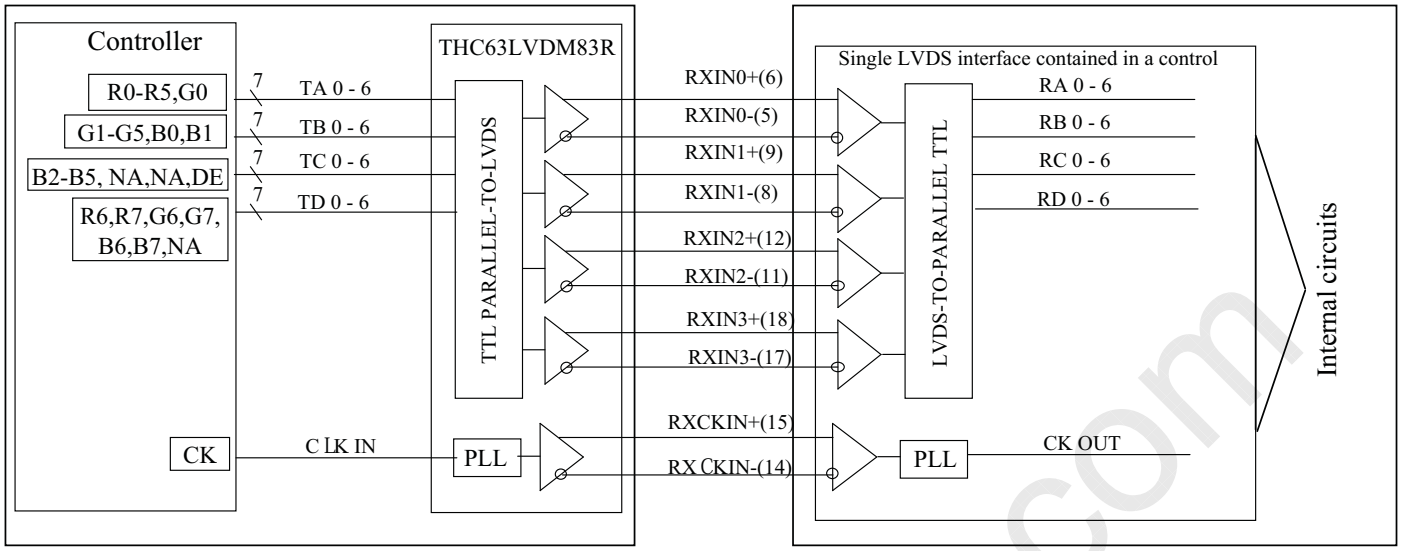
DE: Display Enable

NA: Not Available

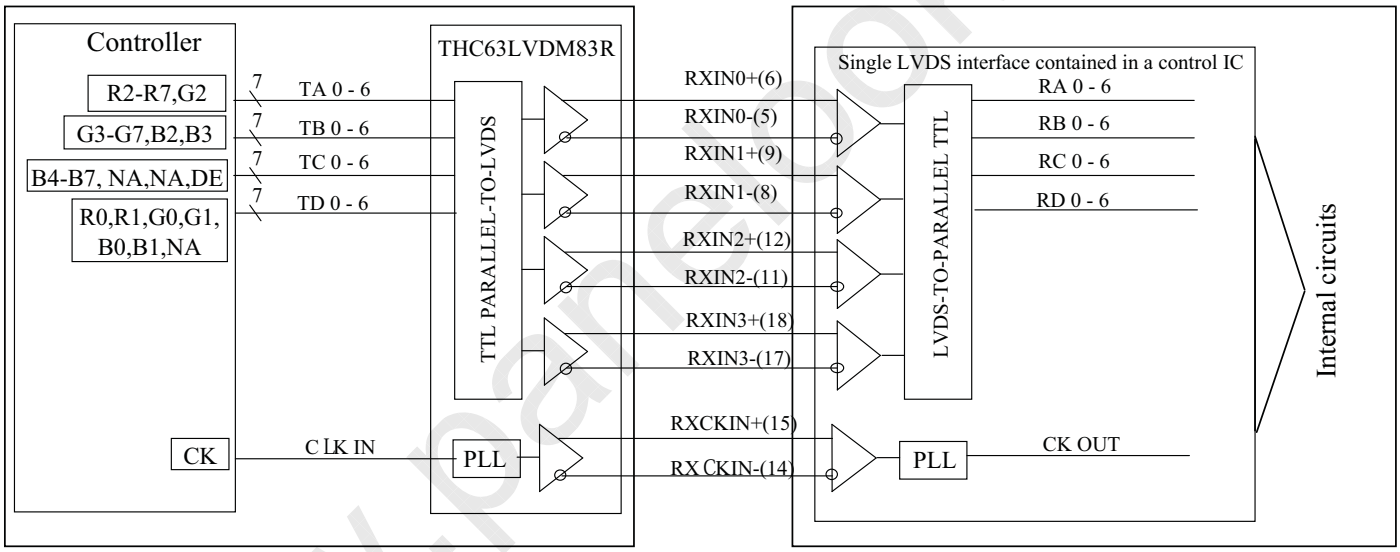
4-5 Interface block diagram

(Computer side) (TFT-LCD side)

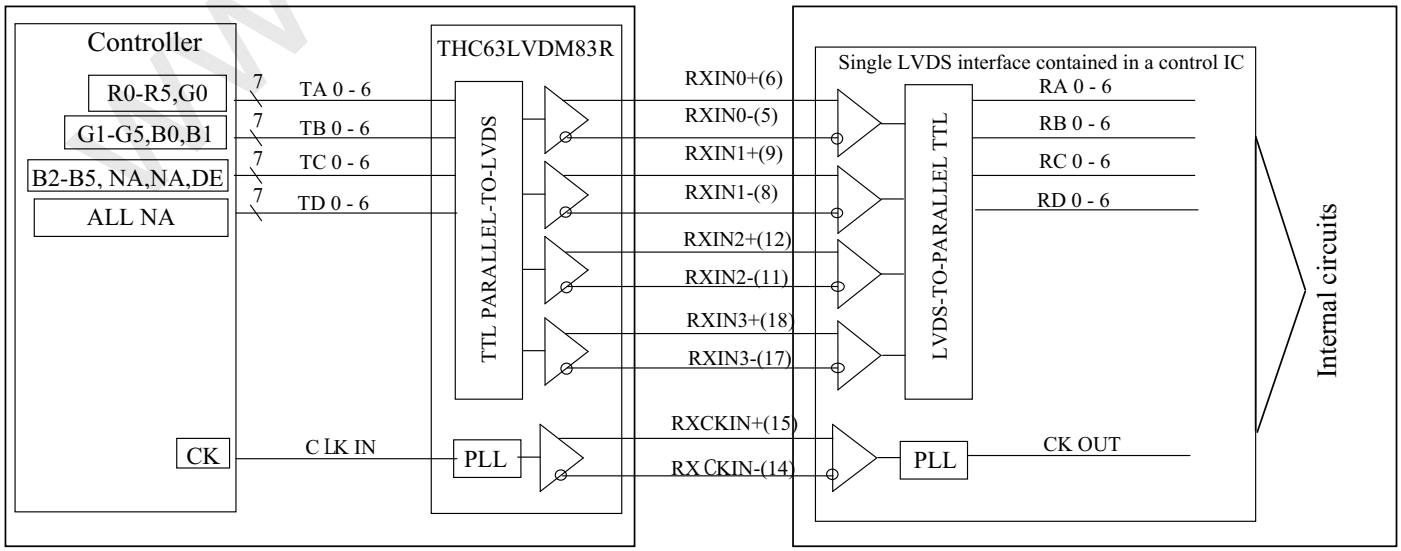
①8Bit Mode
LVDS_SET=L (20 pin=GND or OPEN)



②8Bit Mode
LVDS_SET=H (20 pin=3.3[V])



③6Bit Mode
LVDS_SET=H (20 pin=3.3[V])



5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Pin name	Ratings	Unit	Remark
Supply voltage (LCD)	V_{cc}	Ta=25 °C	Vcc	-0.3 to +4.0	V	[Note1,2]
Supply voltage (Inverter)	V_{DD}		VDD	0 to 16	V	[Note1]
Input voltage	V_{I1}		RXINi-/+(i= 0,1,2,3) RXCLK IN-/+	-0.3 to Vcc+0.3	V	
	V_{I2}		RL/UD,SELLVDS	-0.3 to Vcc+0.3	V	
Storage temperature	T_{STG}	-	-	-30 to +75	°C	
Operating temperature	T_{OPA}	Surroundings	-	0 to +75 (panel surface)	°C	[Note1,3]

[Note1] Humidity: 95%RH Max. at Ta=<40°C.

Maximum wet-bulb temperature at 39°C or less at Ta>40 °C. No condensation.

[Note2]Please use the one of 3A or more in current capacity about the power-supply voltage.

[Note3] When used on condition of Operating temperature [65℃≦T_{OPA}＜75℃], degradation of display grace, such as screen stain etc, may be caused.

6. Electrical Characteristics

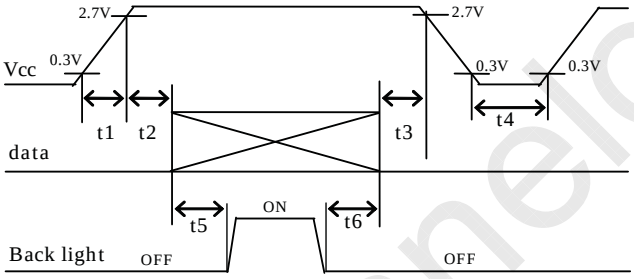
6-1.TFT-LCD panel driving Ta=+25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		V_{cc}	+3.0	+3.3	+3.6	V	[Note3]
Current dissipation	Vcc=+3.3V	I_{cc}	-	450	530	mA	[Note4]
LVDS Input voltage range	LVDS signal	V_L	0	-	2.4	V	
Permissive input ripple voltage		V_{RP}	-	-	100	mV_{p-p}	Vcc=+3.3V
Differential input Threshold voltage	High	V_{TH}	-	-	V_{CM}+100	mV	V_{CM}=1.2V [Note1]
	Low	V_{TL}	V_{CM}–100	-	-	mV	
Input voltage	High	V_{IH}	2.1	-	-		[Note2]
	Low	V_{IL}	-	-	0.8	V	
Input current(High)	High	I_{OH}	-	-	400	uA	VI2=+3.3V [Note2]
Input current(Low)	Low	I_{OL}	-10.0	-	10.0	uA	VI2=0V [Note2]
Input impedance (Differential input)		R_T	-	100	-	Ω	[Note2]

[Note1] V_{CM} : Common mode voltage of LVDS driver

[Notel2]RL/UD,SELLVDS

[Note3]On-off conditions for supply voltage

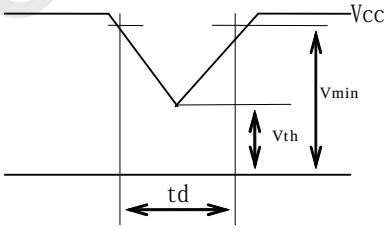


0<t1≦10ms 0<t2≦10ms

0<t3≦1s 1s≦t4

300ms≦t5 200ms≦t6

Vcc-dip conditions



1) Vth ≦ Vcc ＜ Vmin

td ≦ 10ms

2) Vcc<Vth

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

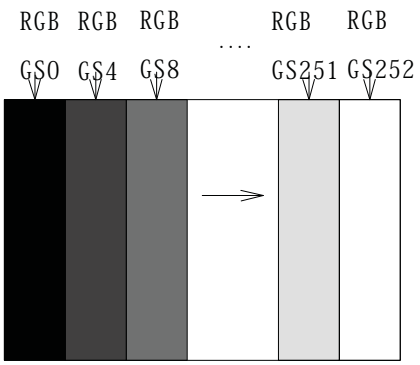
It is recommended to consider some timing difference between LVDS input and Backlight input as shown above.

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

[Note 4] Typical current situation : 253-gray-bar pattern.

(Vcc=+3.3V,fck=53.172MHz,Ta=25℃)

The explanation of each gray scale is described below section 8



6-2. Backlight driving

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

(It is usually required to measure under the following condition.Ta=25℃)

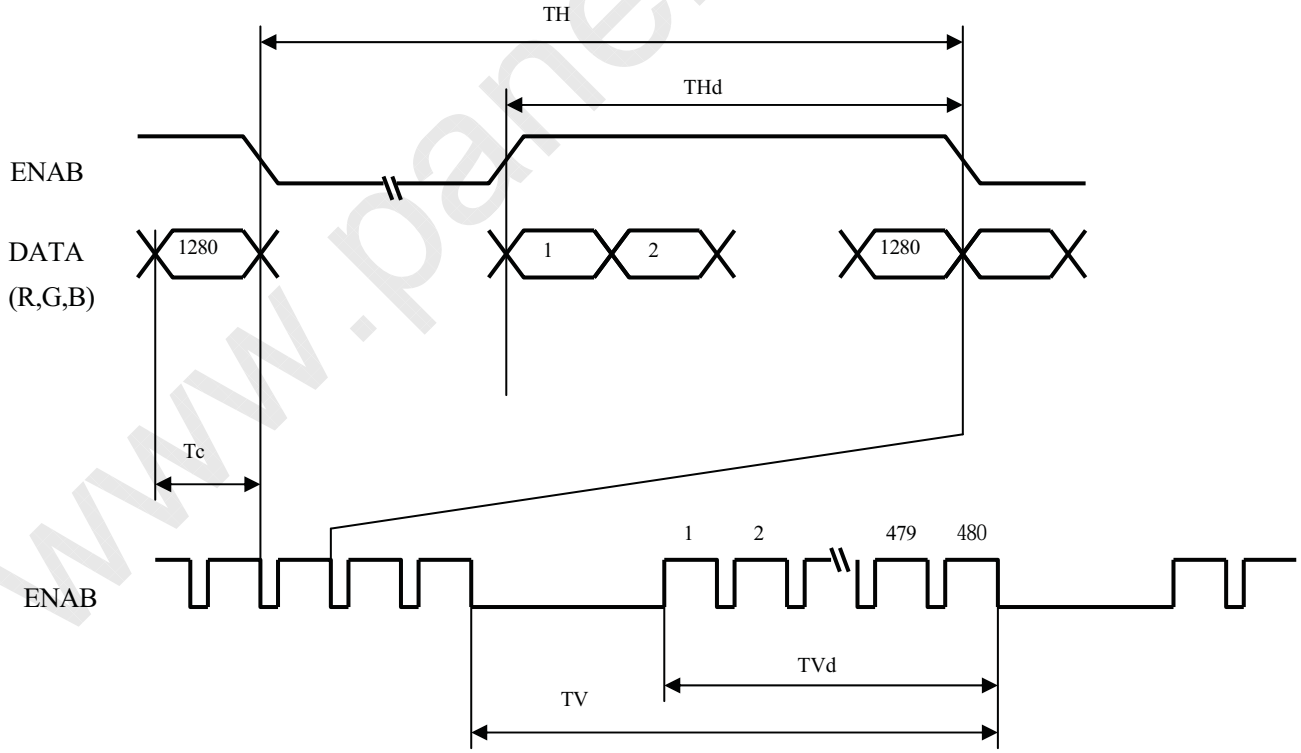
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	V_{DD}	10.8	12.0	13.2	V	
Current dissipation	I_{DD}	-	1.1	1.65	A	High luminance
Dimming voltage	V_{dim}	0	-	VDD	V	0 to 0.6V : Standard luminance
						2.5V to VDD : High luminance
Output current	Iout1,2	5.5	6.0	6.5	mArms	Standard luminance
		6.5	7.0	7.5		High luminance
frequency	F	45	50	55	kHz	

7. Timing Characteristics of input signals

7-1. Timing characteristics

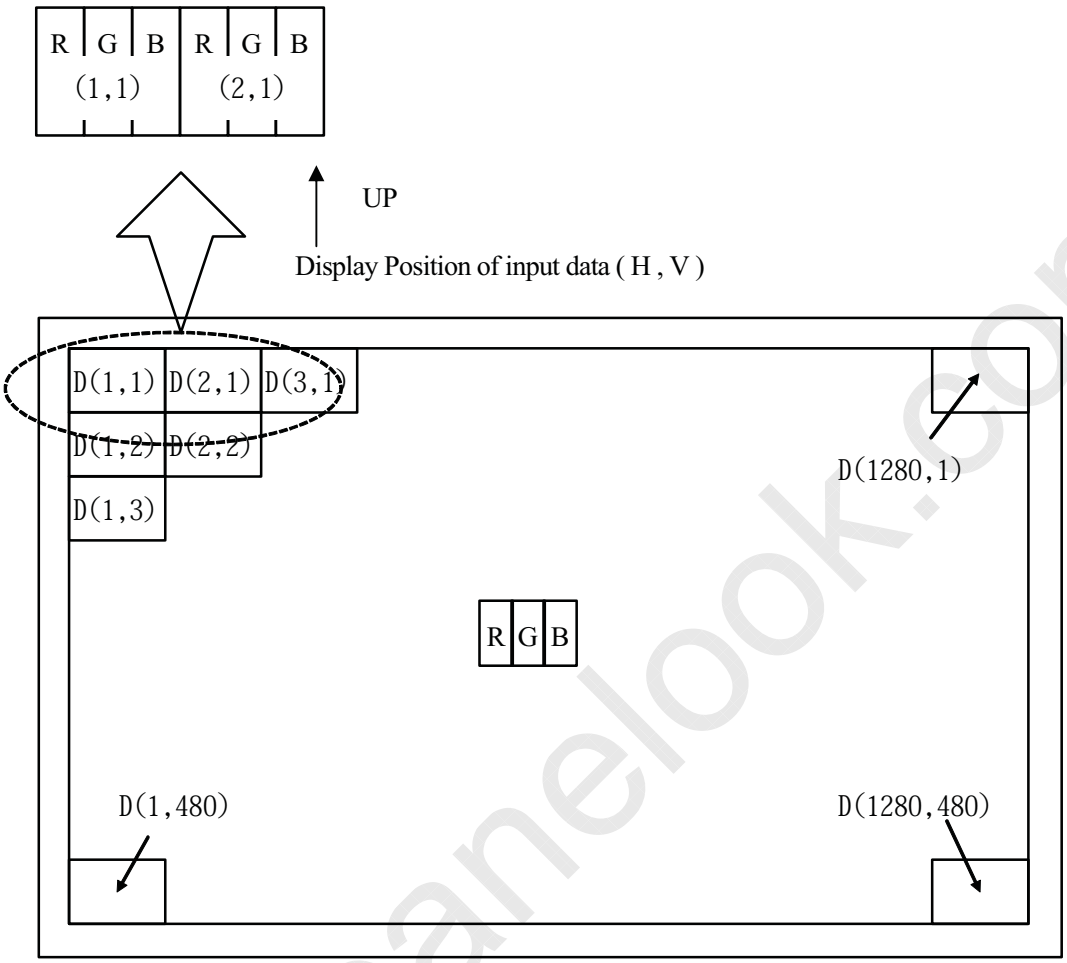
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Frequency	$1/T_c$	40	53.172	56	MHz	
Horizontal period	T_H	1420	1688	1895	clock	
		25.4	31.746	47.4	μs	
Horizontal period (High)	T_{Hd}	1280	1280	1280	clock	
Vertical period	T_V	487	525	575	line	【Note1】
		-	16.7	-	ms	
Vertical period (High)	T_{Vd}	480	480	480	line	

[Note1] In case of lower frequency, the deterioration of display quality, flicker etc.,may be occurred.



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

Graphics and texts can be displayed on a 1280 × RGB × 480 dots panel with 16-million-color by supplying 24 bit data signal (8bit/color [253 gray scales] × 3).



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

8-1. 8bit input

	Colors & Gray scale	Gray Scale	Data signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Basic Color	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
	Blue	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1
	Red	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Yellow	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	X	X	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	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	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	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS250	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS251	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS252	X	X	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS250	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS251	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS252	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1
	⇩	GS251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
	Blue	GS252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage. X :Don't care.

Each basic color can be displayed in 253 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, about 16-million-color display can be achieved on the screen.

8-2 6bit input

	Colors & Gray scale	Gray Scale	Data signal																	
			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 Characteristics9. Optical Characteristics

Ta=25℃, Vcc =+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21, θ22	CR≧10	55	65	-	Deg.	
	Vertical	θ11		40	50	-	Deg.	
		θ12		50	60	-	Deg.	
Contrast ratio		C R	Optimum viewing angle	250	400	-	-	[Note2,4]
Response time	gray scale	τ	θ=0°	-	10	-	ms	[Note3(Condition 1),4,5]
	black and white	τd+τr		-	35	-	ms	[Note3(Condition 2),4,5]
Chromaticity of White		x		0.283	0.313	0.343	-	[Note4]
		y		0.299	0.329	0.359	-	
Chromaticity of Red		x		0.618	0.648	0.678	-	
		y		0.306	0.336	0.366	-	
Chromaticity of Green		x		0.253	0.283	0.313	-	
		y		0.582	0.612	0.642	-	
Chromaticity of Blue		x		0.114	0.144	0.174	-	
		y		0.052	0.082	0.112	-	
Luminance of white		YL		260	330	—	cd/m^2	[Note4]
White Uniformity		δw		—	—	1.33	—	[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.2 below.

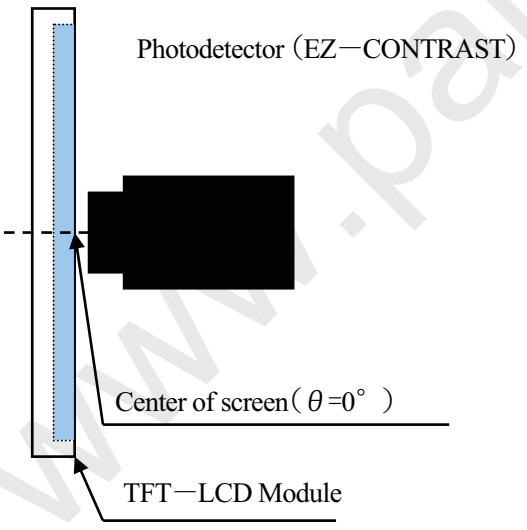


Fig2-1 Viewing angle measurement method

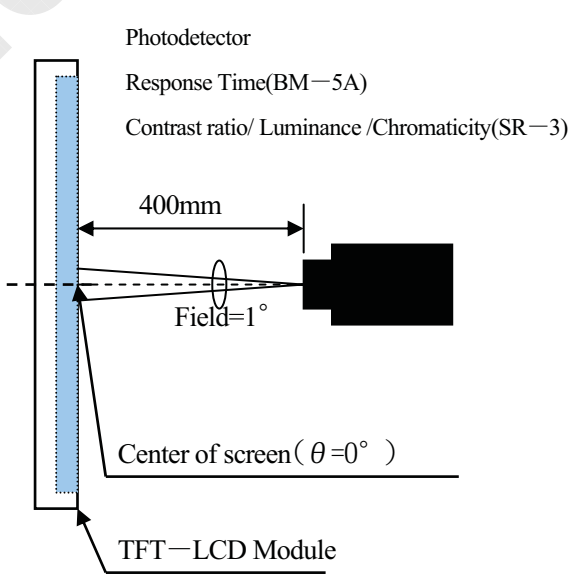
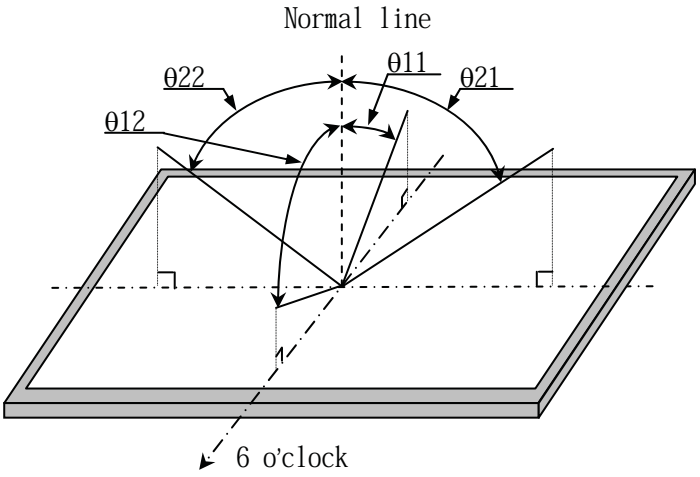


Fig2-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

Fig2 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:

<Condition 1 : > Definition by gray scal

The response time is defined as the following figure and shall be measured by switching the input signal for nine kinds of gray scales (GS0,32,64,96,128,160,192,224,255) and nine kinds of scales gray signal. (GS0,32,64,96,128,160,192, 224,255)

(Panel surface temperature ： 40℃)

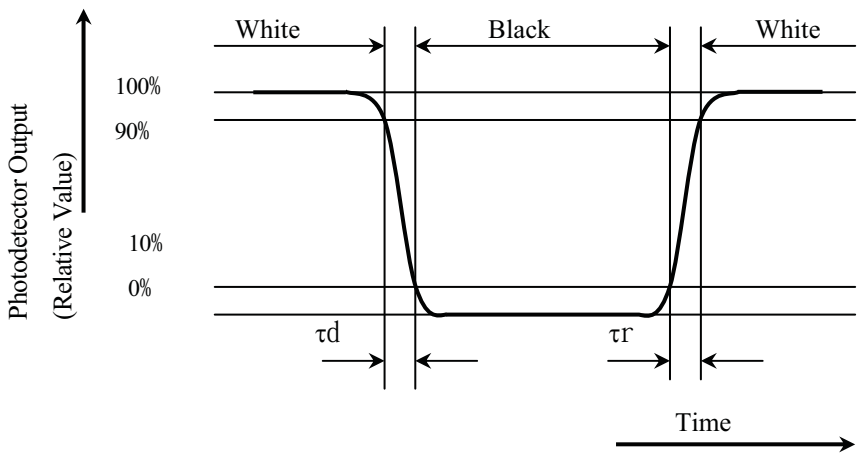
	GS0	GS32	GS64	GS96	GS128	GS160	GS192	GS224	GS255
GS0		τ r:0-32	τ r:0-64	τ r:0-96	τ r:0-128	τ r:0-160	τ r:0-192	τ r:0-224	τ r:0-255
GS32	τ d:32-0		τ r:32-64	τ r:32-96	τ r:32-128	τ r:32-160	τ r:32-192	τ r:32-224	τ r:32-255
GS64	τ d:64-0	τ d:64-32		τ r:64-96	τ r:64-128	τ r:64-160	τ r:64-192	τ r:64-224	τ r:64-255
GS96	τ d:96-0	τ d:96-32	τ d:96-64		τ r:96-128	τ r:96-160	τ r:96-192	τ r:96-224	τ r:96-255
GS128	τ d:128-0	τ d:128-32	τ d:128-64	τ d:128-96		τ r:128-160	τ r:128-192	τ r:128-224	τ r:128-255
GS160	τ d:160-0	τ d:160-32	τ d:160-64	τ d:160-96	τ d:160-128		τ r:160-192	τ r:160-224	τ r:160-255
GS192	τ d:192-0	τ d:192-32	τ d:196-64	τ d:196-96	τ d:196-128	τ d:196-160		τ r:192-224	τ r:192-255
GS224	τ d:224-0	τ d:224-32	τ d:224-64	τ d:224-96	τ d:224-128	τ d:224-160	τ d:224-192		τ r:224-255
GS255	τ d:255-0	τ d:255-32	τ d:255-64	τ d:255-96	τ d:255-128	τ d:255-160	τ d:255-192	τ d:255-224	

τ *:x-y… Switching time from a option gray scale (x) to other option gray scale (y)

$$\tau = \{\Sigma(\tau\,\text{r:x-y}) + \Sigma(\tau\,\text{d:x-y})\} / 72$$

<Condition 2 : > Definition by black and white

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

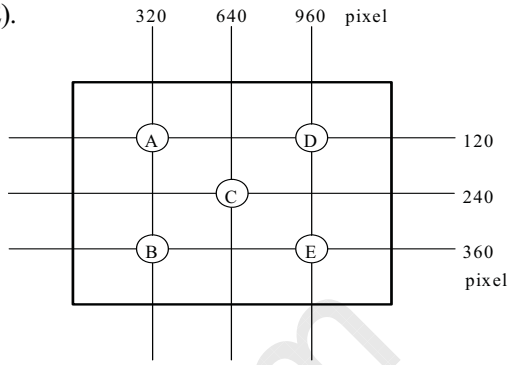


[Note4] This shall be measured at center of the screen.

[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 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.Observe all other precautionary requirements in handling components.

h) This module has its circuit board on the rear side and shoud be handled carefully in order not to be stressed.

i) 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 interface fringe etc. which degrades display quality.

j) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.

k) 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.

l) 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.

. m) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.

11. Packing form

Product countries / Areas	JAPAN	TAIWAN	CHINA
Piling number of cartons	maximum 6 curtons		
Package quantity in one carton	20 modules		
Carton size	724×650×203(H)		
Total mass of one carton filled with full modules	13kg		
Packing form	Refer to figure.3		

12.Reliability test items

No.	Test item	Conditions	Remark
1	High temperature storage test	Ta=75℃ 240h	[Note 1]
2	Low temperature storage test	Ta=-30℃ 240h	[Note 1]
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)	[Note 1]
4	High temperature operation test	Tp(Panel surface)=75℃ 240h	[Note 1]
5	Low temperature operation test	Ta= 0℃ 240h	[Note 1]
6	Vibration test (non- operating)	Frequency: 10 to 57Hz/Vibration width (one side): 0.075mm : 57 to 500Hz/Gravity: 9.8m/s^2 Sweep time : 11 minutes Test period : 3 hours (1 hour for each direction of X,Y,Z)	[Note 1] [Note 2]
7	Shock test (non- operating)	Max. gravity : 490m/s^2 Pulse width : 11ms, half sine wave Direction : ±X,±Y,±Z once for each direction.	[Note 1] [Note 2]
8	ESD test	Contact discharge (150pF 330Ω) non-operating = ±10kV, operating = ±8kV Atmospheric discharge (150pF 330Ω) non-operating = ±20kV, operating = ±15kV Terminal discharge (200pF 0Ω) Each terminal One time ±200V	[Note 1]
9	Thermal shock test (non- operating)	Ta= -30℃ to 70℃ ; 50 cycles (1 hour for each temperature)	[Note 1]

[Note 1]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state：Temperature:15 to 35℃, Humidity:45 to 75%, Atmospheric pressure:86 to 106kpa)

[Note 2]

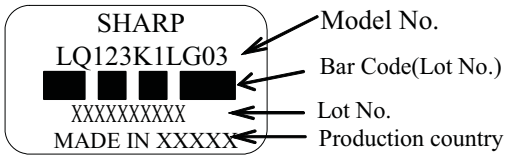
A gap of panel shall not occur by vibration or the shock

13.Others

1) Lot No. and indication Bar Code Label:

A) Module serial label

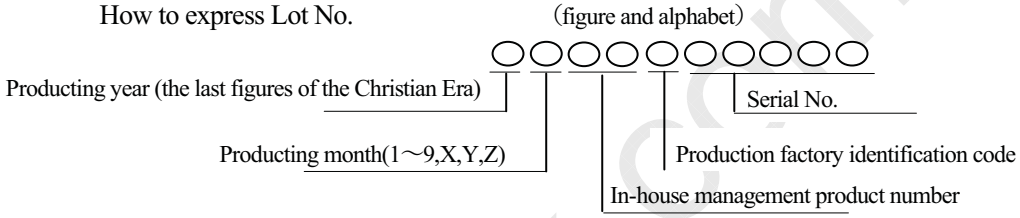
The label that displays SHARP, product type name (LQ123K1LG03), the manufacturer's serial number and producing country is stuck on the back of the module.



Production Country

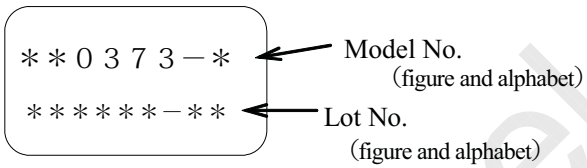
JAPAN	MADE IN JAPAN
TAIWAN	MADE IN TAIWAN
CHINA	MADE IN CHINA

How to express Lot No.



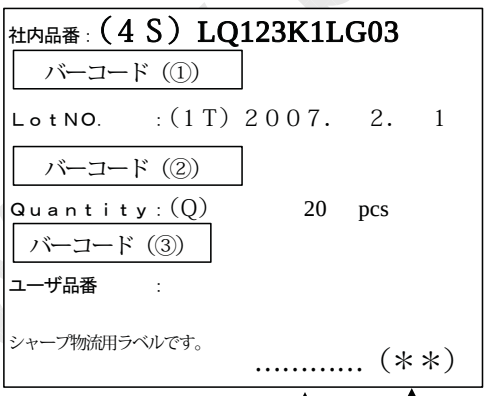
B) Backlight serial label

The label that displays the product type name and the manufacturer's serial number for the backlight is stuck on the back of the module.



2) Packing box display

①the product type name (LQ123K1LG03), ②the shipment date and ③the module amount are displayed in the display column in the packing box.
(Moreover, the bar code display also applies to this.)



① the product type name (LQ123K1LG03)
② the shipment date
③ the module amout

Maid in JAPAN / CHINA / TAIWAN

Production factory identification code

There is a case to fill in our management product number.
(ex. LQ123K1LG03A)

3) 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.

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

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

6) The chemical compound which causes the destruction of ozone layer is not being used.

7) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury, Please follow local ordinances or regulations for disposal. (put on the back of the module.)

・COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY, PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR DISPOSAL. ・当該液晶ディスプレーパネルは蛍光管が組込まれていますので、地方自治体の条例、または、規則に従って廃棄してください。

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

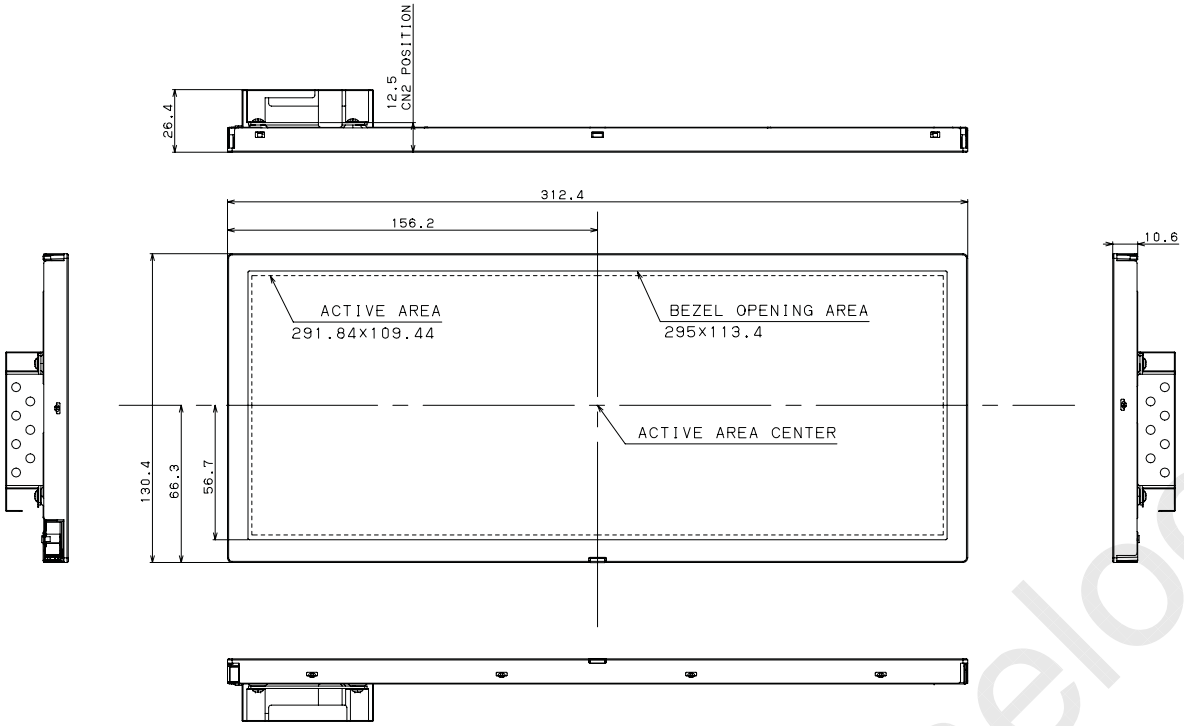
9) Please refer to Figure 4 for the assembly form of the module ,and refer to Figure 5 for lot No. of the back of the module.

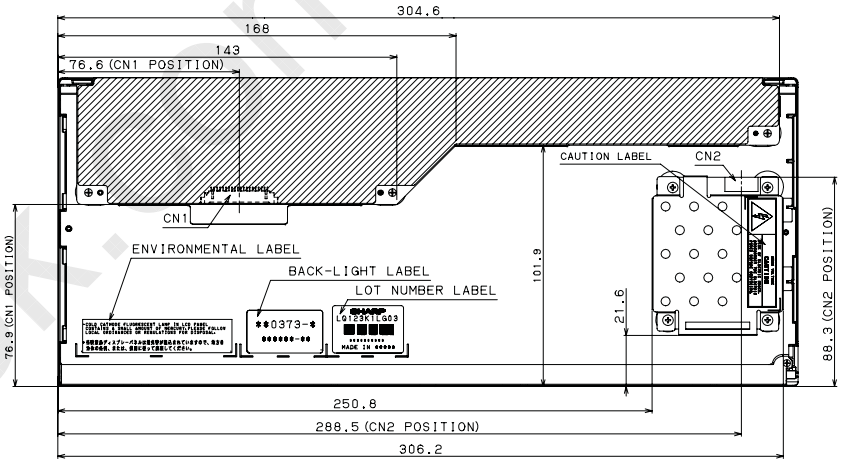
※R.C.（RoHS Compliance）means these parts have corresponded with the RoHS directive.

Internal Use Only
R. C.

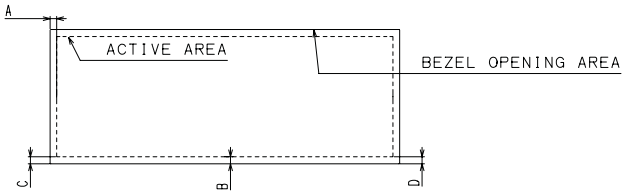
14. Carton storage condition

Temperature	0℃ to 40℃
Humidity	95%RH or less
Reference condition :	20℃ to 35℃ , 85%RH or less (summer)
:	5℃ to 15℃ , 85%RH or less (winter)
	・the total storage time (40℃,95%RH) : 240H or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.
Notes	Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment
Storage period	1 year or less





BEZEL/DISPLAY POSITION



1) TOLERANCE X-DIRECTION A:1.6±0.8
2) TOLERANCE Y-DIRECTION B:2.0±0.8
3) OBLIQUITY OF DISPLAY AREA |C-D|<0.8

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.

INTERFACE CONNECTOR

CN1:DF14H-20P-1.25H

PIN LAYOUT(20PIN)

pin	1	2	3	4	5	6	7
	VCC	VCC	GND	GND	RxIN0-	RxIN0+	GND
8	9	10	11	12	13	14	15
RxIN1-	RxIN1+	GND	RxIN2-	RxIN2+	GND	CK IN-	CK IN+
16	17	18	19	20			
GND	RxIN3-	RxIN3+	RL/UD	SELLVDS			

CORRESPONDING CONNECTOR: [DF14-20S-1.25C(CONNECTOR)]
[DF14-2628SCFA(TERMINAL)]

INVERTOR CONNECTOR

CN2: S6B-ZR-SM4A-TF(LF)(SN)

PIN LAYOUT

pin	1	2	3
	VDD	VDD	VDD
4	5	6	
GND	GND	Vdim	

CORRESPONDING CONNECTOR: [ZHR-6(JST)]

Fig1. OUTLINE DIMENSIONS
LQ123K1LG03

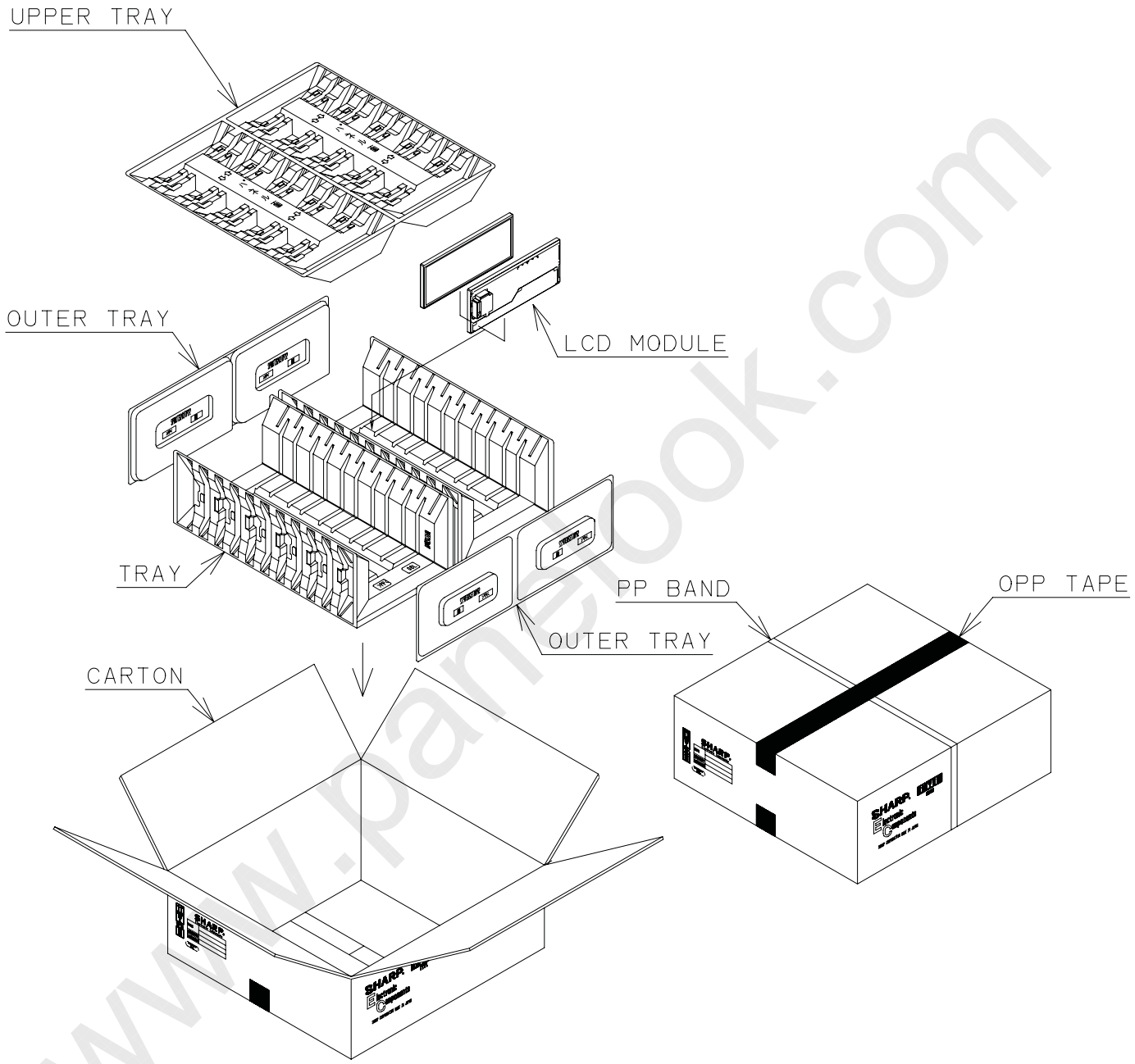


FIG3. PACKING FORM

LD-19201A-23

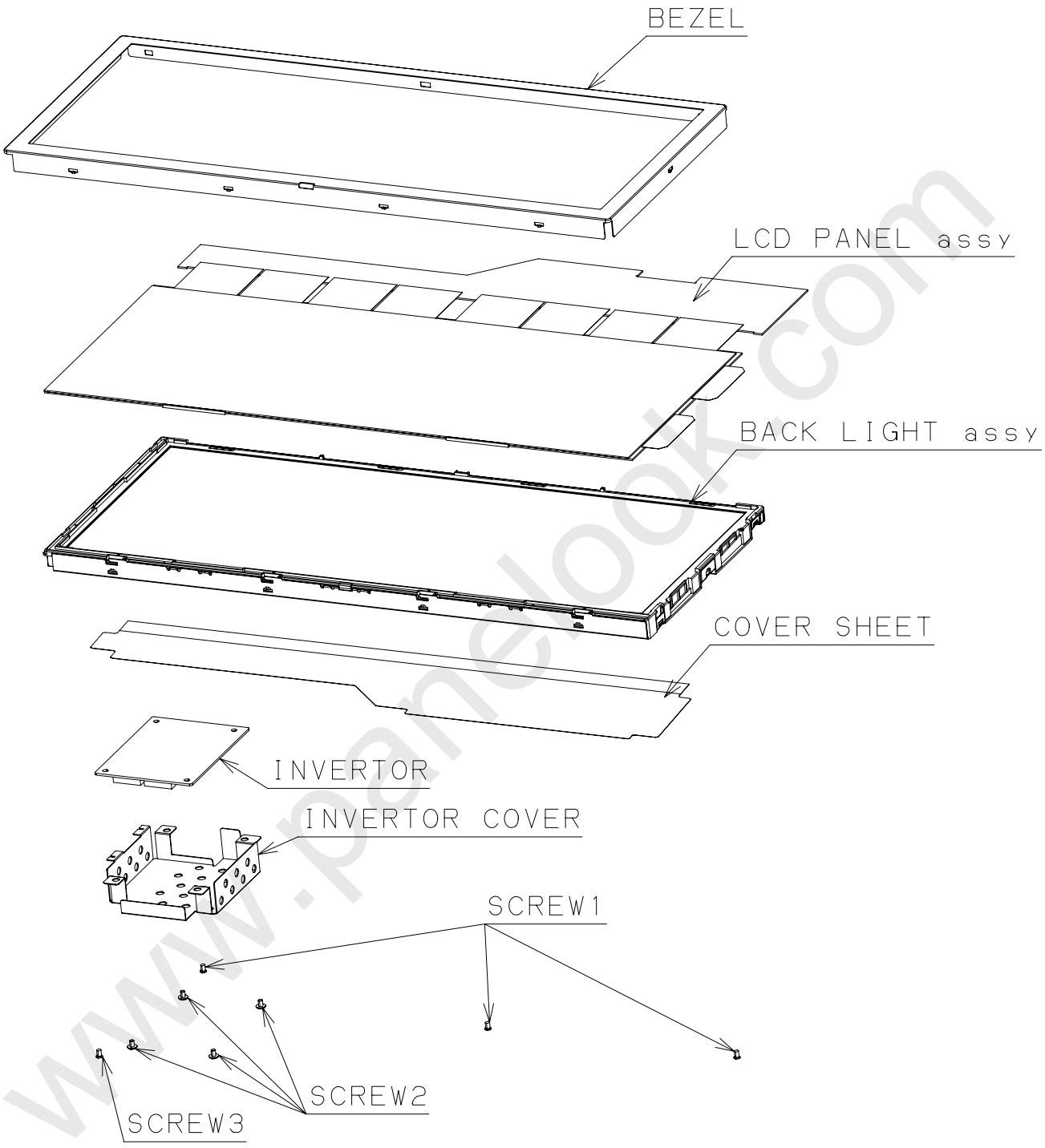


FIG4. Module Diagram

LD-19201A-24

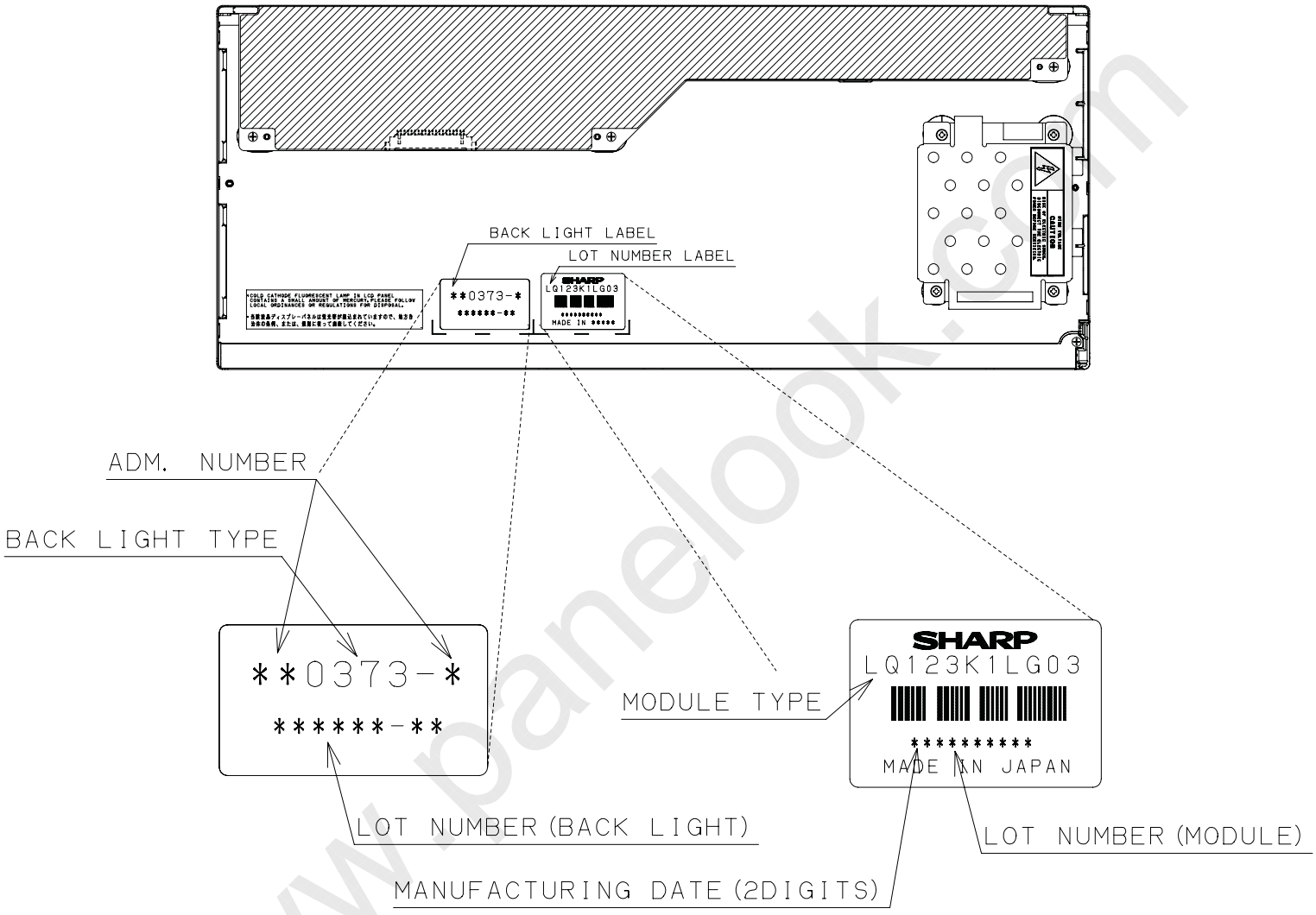


FIG5. LOT NUMBER