SHARP

TECHNICAL   LITERATURE

FOR

TFT - LCD   module

MODEL   No.   LQ121X3LGxx

PC DISPLAY & LCD MONITOR BUSINESS
PLANNING & MARKETING PROJECT TEAM ,
DIVISIONⅡ MOBILE LCD Group
SHARP CORPORATION

RECORDS OF REVISION

LQ121X3LGxx

SPEC No.	DATE	REVISED		SUMMARY	NOTE
		No.	PAGE		
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1. Application

    This technical literature applies to a color TFT-LCD module, LQ121X3LGxx.

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 LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

    In this TFT-LCD panel , low reflection / color filters of excellent color performance and LED backlights of high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

    Optimum viewing direction is 6 o'clock.

    LED Backlight-driving DC/DC converter is not built in this module.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	30.7(12.1") Diagonal	cm
Active area	245.8 (H)× 184.3(V)	mm
Pixel format	1024(H)×768(V)	pixel
	(1 pixel = R+G+B dots)	
Aspect ratio	4 : 3	
Pixel pitch	0.240(H)×0.240 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Surface treatment	Antiglare and hard-coating 2H	

Parameter		Min.	Typ.	Max.	Unit
Unit outline dimensions [Note 1]	Width	(258.5)	(259)	(259.5)	mm
	Height	(204.5)	(205)	(205.5)	mm
	Depth	－	(7.5)	(8.0)	mm
Mass		－	(530)		g

[Note 1] excluding LED backlight FPC.

Outline dimensions is shown in Fig.2

4. Input Terminals
  4-1. TFT-LCD panel driving
    CN1 (LVDS signals and +3.3V DC power supply)

Pin No.	Symbol	Function	Remark
1	Vcc	+3.3V power supply	
2	Vcc	+3.3V power supply	
3	GND		
4	GND		
5	RxIN0-	Receiver signal of LVDS CH0 (-)	[Note 1]
6	RxIN0+	Receiver signal of LVDS CH0 (+)	[Note 1]
7	GND		
8	RxIN1-	Receiver signal of LVDS CH1 (-)	[Note 1]
9	RxIN1+	Receiver signal of LVDS CH1 (+)	[Note 1]
10	GND		
11	RxIN2-	Receiver signal of LVDS CH2 (-)	[Note 1]
12	RxIN2+	Receiver signal of LVDS CH2 (+)	[Note 1]
13	GND		
14	CK IN-	Receiver signal of LVDS CLK (-)	[Note 1]
15	CK IN+	Receiver signal of LVDS CLK (+)	[Note 1]
16	GND		
17	NC		[Note 1]
18	NC		[Note 1]
19	GND		
20	GND		

[Note 1] Relation between RxINi(i=0,1,2) and actual data is shown in following section (4-2)(7-2).

[Note 2] The shielding case is connected with signal GND.

[Note 3] Please use NC by OPEN or GND. NC terminal is not connected with the internal circuit.

Using connector : DF19L-20P-1H (HIROSE) or equivalent.

Corresponding connector : DF19G-20S-1C(HIROSE)

(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

4-2　LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC

Corresponding Transmitter : THC63LVDM63A (THINE) or equivalent

Symbol of CN1 (Pin No.)
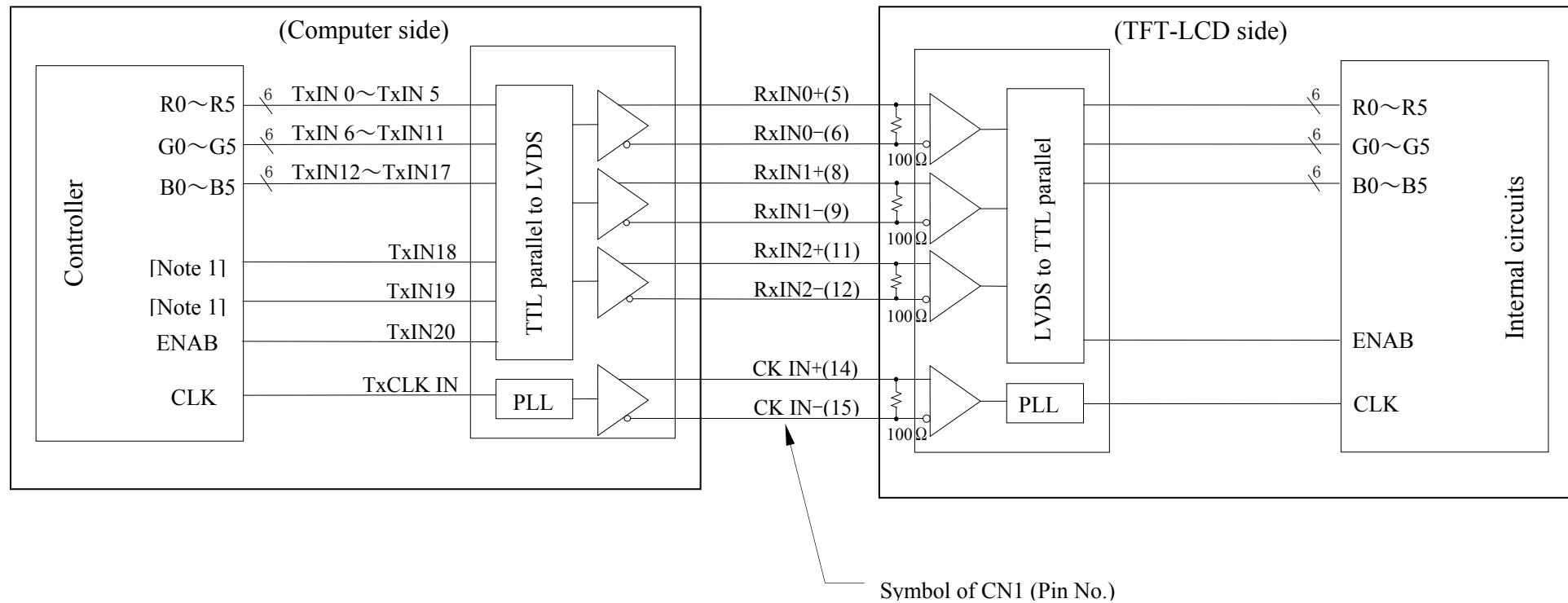
[Note 1] Do not use at high-impedance TxIN 18 - 19.

4-3. Backlight driving

LED-Back Light FPC

Pin No.	Symbol	Function	Remark
1	LED_C1	LED-B/L Cathode1	
2	LED_C2	LED-B/L Cathode2	
3	LED_C3	LED-B/L Cathode3	
4	LED_C4	LED-B/L Cathode4	
5	LED_C5	LED-B/L Cathode5	
6	NC		[Note 1]
7	LED_A	LED-B/L Anode	
8	LED_A	LED-B/L Anode	
9	LED_A	LED-B/L Anode	
10	LED_A	LED-B/L Anode	

[Note1]Please use NC by OPEN. NC terminal is not connected with the internal circuit.

Corresponding connector : 52746-1071(MOLEX)

(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above

model.)

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
Input voltage	V_I	Ta=25℃	-0.3	Vcc+0.3	V	[Note 1]
+3.3V supply voltage	Vcc	Ta=25℃	0	+4.0	V	
LED forward current	I_{LED_F}	Ta=25℃	0	280	mA	[Note2]
LED reverse current	I_{LED_R}	Ta=25℃	—	85	mA	[Note2]
Storage temperature	Tstg	—	-40	+85	℃	[Note 3]
Operating temperature (Ambient)	Topa	—	-20	+60	℃	

[Note 1] LVDS signals

[Note 2] Value for one LED string

[Note 3] Humidity：95%RH Max. at Ta≦+45℃.

Maximum wet-bulb temperature at +44℃ or less at Ta>+45℃.

No condensation.

6. Electrical Characteristics
  6-1.TFT-LCD panel driving

Ta＝+25℃

| Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		Vcc	+3.0	+3.3	+3.6	V	[Note 2]
Current dissipation		Icc	−	(380)	(600)	mA	[Note 3]
Permissive input ripple voltage		V_{RP}	−	−	100	mV_{P-P}	Vcc = +3.3V
Input voltage range		V_I	0		2.4	V	LVDS signals
Differential input threshold voltage	High	V_{TH}	−	−	+100	mV	V_{CM} = +1.2V
	Low	V_{TL}	−100	−	−	mV	[Note 1]
Input current (High)		I_{OH}	−	−	±10	μ A	V_I = +2.4V Vcc = +3.6V
Input current (Low)		I_{OL}	−	−	±10	μ A	V_I = 0V Vcc = 3.6V
Terminal resistor		R_T	−	100	−	Ω	Differential input

[Note 1] V_{CM} : Common mode voltage of LVDS driver.

[Note 2]

On-off conditions for supply voltage
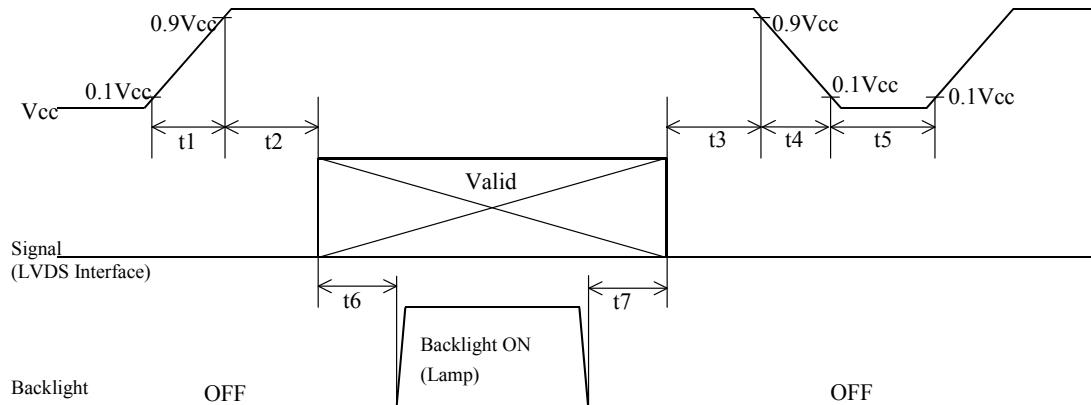
Symbol	Min.	Max.	Unit	Remark
t1	0	10	ms	
t2	0	1	s	
t3	0	1	s	
t4	0	400	ms	
t5	200	−	ms	
t6	180	−	ms	*1
t7	5	−	ms	*1

*1 : As for the power sequence for backlight, it is recommended to apply
     above mentioned input timing. If the backlight is lit on and off at a
     timing other than shown above, displaying image may get disturbed.
     This is due to variation of output signal from timing generator when
     LVDS signal is changed from on to off or vice versa, but has no harm
     to the module itself.

[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

Vcc-dip conditions

1) 2.5 V ≦ Vcc ＜ 3.0 V
       td ≦ 10 ms
    Under above condition, the display image should return
   to an appropriate figure after Vcc voltage recovers.

2) Vcc ＜ 2.5 V
    Vcc-dip conditions should also follow the
    On-off conditions for supply voltage
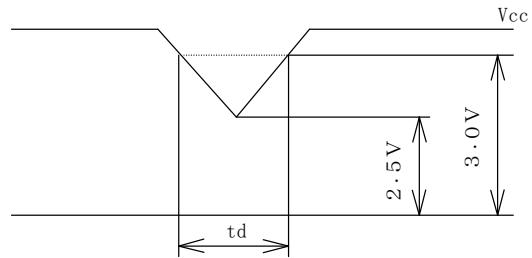
[Note 3] Typical current situation : 16-gray-bar pattern.
         Vcc=+3.3V

         Maximum current situation : Vcc=+3.0V
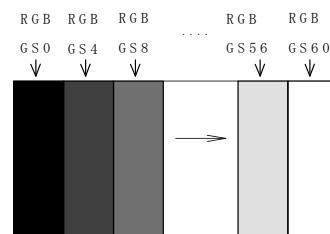
6-2. Backlight driving

The backlight system is edge-lighting type with 40 White-LED(White Light Emitting Diode).

The characteristics of White-LED are shown in the following table.   (Ta=25 ^{o}C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED forward voltage	V_{LED_F}	−	(24.0)	(27.2)	V	[Note1]
LED forward voltage variation	$\triangle V_{LED\_F}$	−	−	3.2	V	[Note1] [Note2]
LED forward current range	I_{LED_F}	−	(70)	(70)	mA	Value for one string
Number of circuit strings		−	5	−		[Note 3]
LED power consumption	W_{LED}	−	(8.4)	(9.5)	W	[Note1] [Note 4]
LED life time	L_{LED}	(50000)	−	−	Hour	[Note 5]

[Note1] I_{LED_F} = (70mA)

[Note2] Variation of V_{LED_F} between each string in one LCD module.

[Note 3] The LED backlight is composed by 5 strings from which 8 LED is connected with the series.

The figure below shows the circuit chart of each string.

In each circuit, there is a ceramic capacitor for the electrostatic protection.

LED×40

LED_A

LED_C5
LED_C4
LED_C3
LED_C2
LED_C1
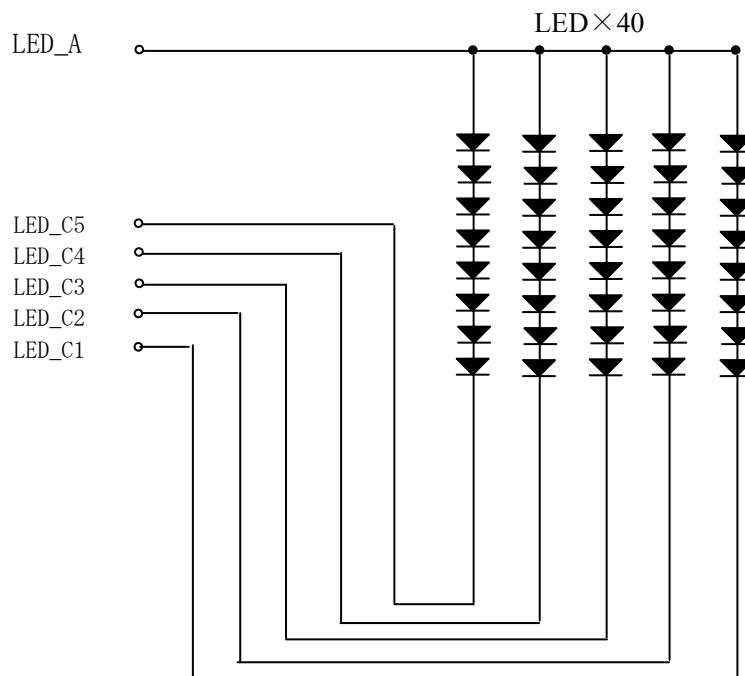
[Note 4] Calculated value for reference ($I_{LED\_F} \times V_{LED\_F}$)

[Note 5] LED life time is defined as the time when Brightness becomes 50 % of the original value.

under the condition of Ta = 25℃ and I_{LED_F} = (70mA), and continuous lighting.

6-3. LVDS input specification

6-3-1. AC characteristics

Vcc=+3.0V～+3.6V,　Ta＝－20℃～+60℃

Parameter	Symbol	Min	Typ.	Max.	Unit
Input Data Position 0 (tRCIP=15.38ns)	t_{RIPI}	-0.25	0.0	+0.25	ns
Input Data Position 1 (tRCIP=15.38ns)	t_{RIP0}	$t_{RCIP}/7-0.25$	$t_{RCIP}/7$	$t_{RCIP}/7+0.25$	ns
Input Data Position 2 (tRCIP=15.38ns)	t_{RIP6}	$2\,t_{RCIP}/7-0.25$	$2\,t_{RCIP}/7$	$2\,t_{RCIP}/7+0.25$	ns
Input Data Position 3 (tRCIP=15.38ns)	t_{RIP5}	$3\,t_{RCIP}/7-0.25$	$3\,t_{RCIP}/7$	$3\,t_{RCIP}/7+0.25$	ns
Input Data Position 4 (tRCIP=15.38ns)	t_{RIP4}	$4\,t_{RCIP}/7-0.25$	$4\,t_{RCIP}/7$	$4\,t_{RCIP}/7+0.25$	ns
Input Data Position 5 (tRCIP=15.38ns)	t_{RIP3}	$5\,t_{RCIP}/7-0.25$	$5\,t_{RCIP}/7$	$5\,t_{RCIP}/7+0.25$	ns
Input Data Position 6 (tRCIP=15.38ns)	t_{RIP2}	$6\,t_{RCIP}/7-0.25$	$6\,t_{RCIP}/7$	$6\,t_{RCIP}/7+0.25$	ns
Phase Lock Loop Set	t_{RPLL}	－	－	10	ms
Input Clock Period	t_{RCIP}	14.9	15.4	20	ns

LVDS input timing
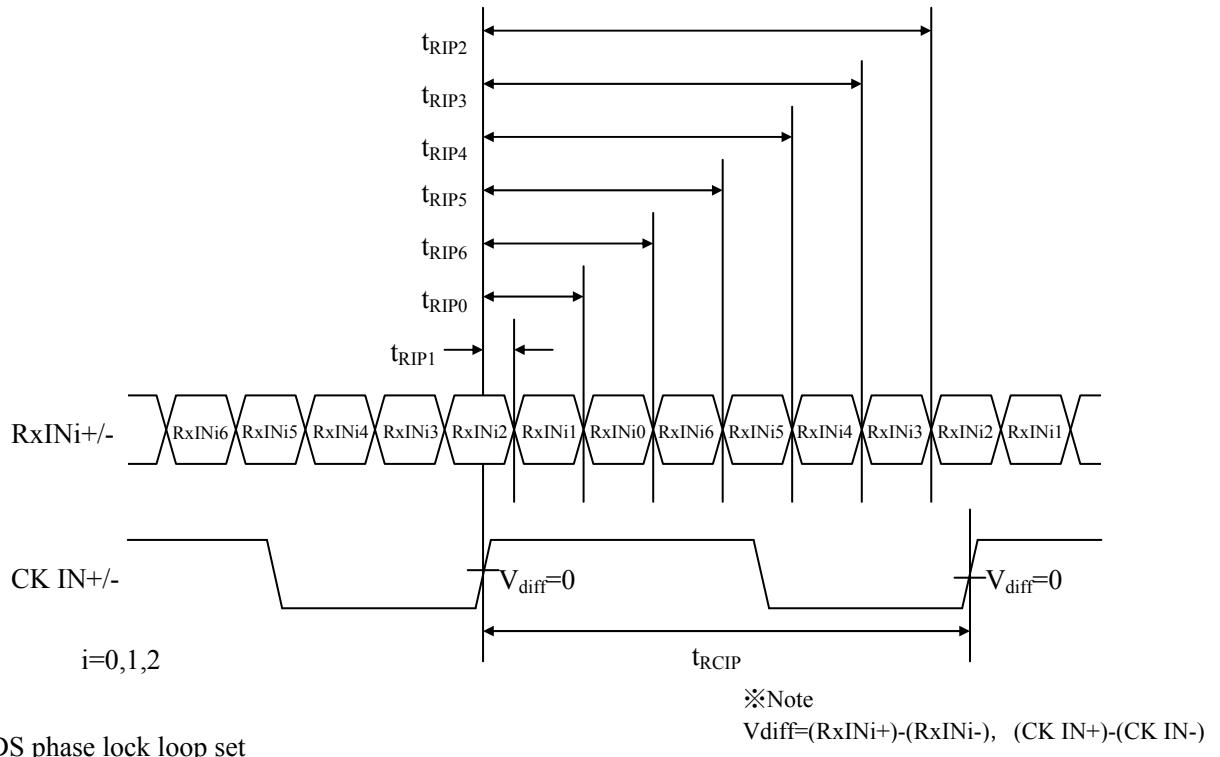
LVDS phase lock loop set

6-3-2.LVDS data

| Previous Cycle | Current Cycle |

CK IN+/-

RxIN0+/-: R4' R3' R2' R1' R0' G0 R5 R4 R3 R2 R1 R0 G0"

RxIN1+/-: G5' G4' G3' G2' G1' B1 B0 G5 G4 G3 G2 G1 B1"

RxIN2+/-: x' B5' B4' B3' B2' ENAB x x B5 B4 B3 B2 ENAB"
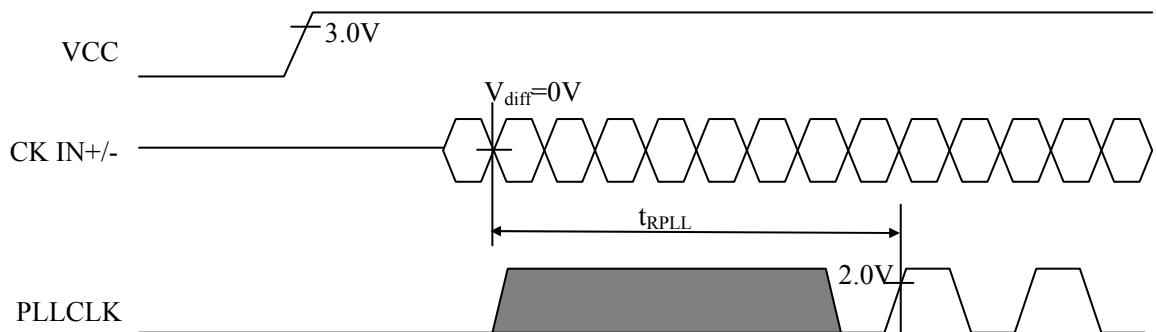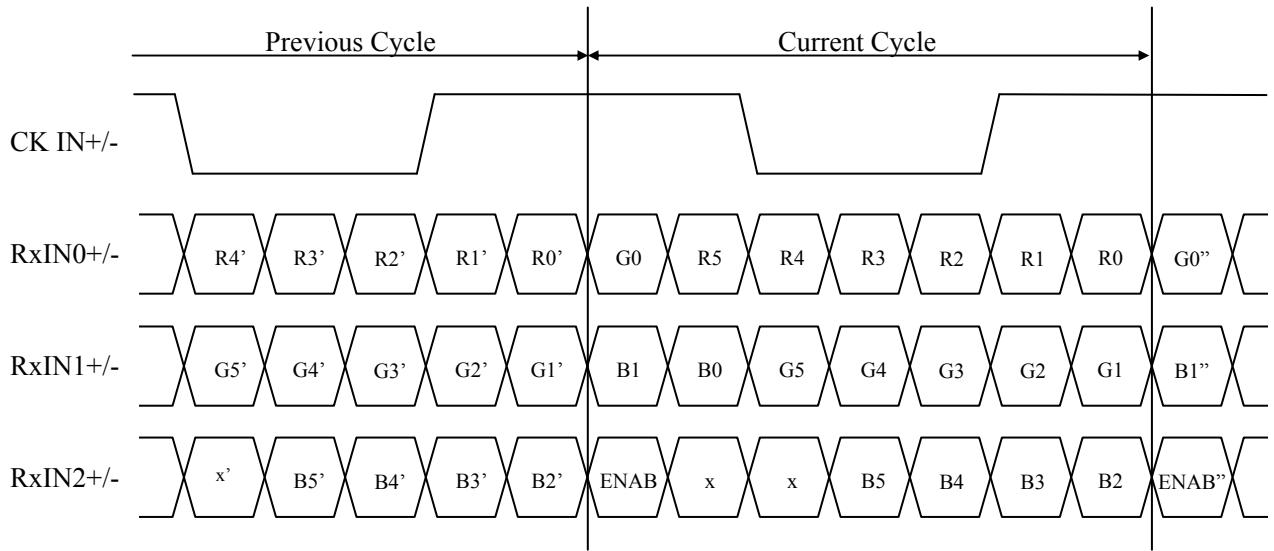
7. Timing Characteristics of Input Signals
  7-1. Timing characteristics

Vcc=+3.0V～+3.6V, Ta=-20℃～+60℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	50	65	67	MHz	[Note 1]
Data enable Signal	Horizontal period	TH	1260	1344	1408	clock	
			19.38	20.68	—	μs	
	Horizontal period (High)	THd	1024	1024	1024	clock	
	Vertical period	TV	803	806	900	Line	
			15.56	16.67	—	ms	
	Vertical period (High)	TVd	768	768	768	line	

[Note 1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.

TH

THd

ENAB

DATA
(R,G,B)

1024

1

2

1024

Tc

ENAB

1   2   767 768

TVd

TV
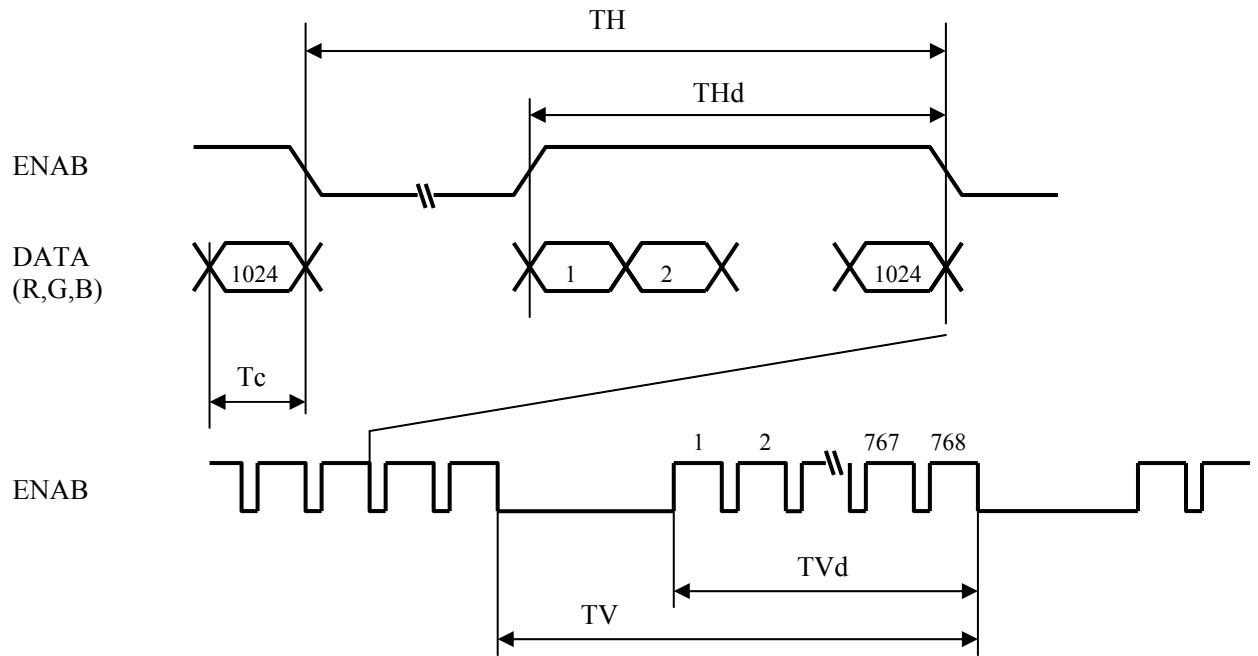
7-2. Input data signals and display position on the screen

R1	G1	B1	R2	G2	B2
(1,1)			(1,2)		

1・1	1・2	1・3		1・1024
2・1	2・2			
3・1				

R	G	B

768・1

768・1024
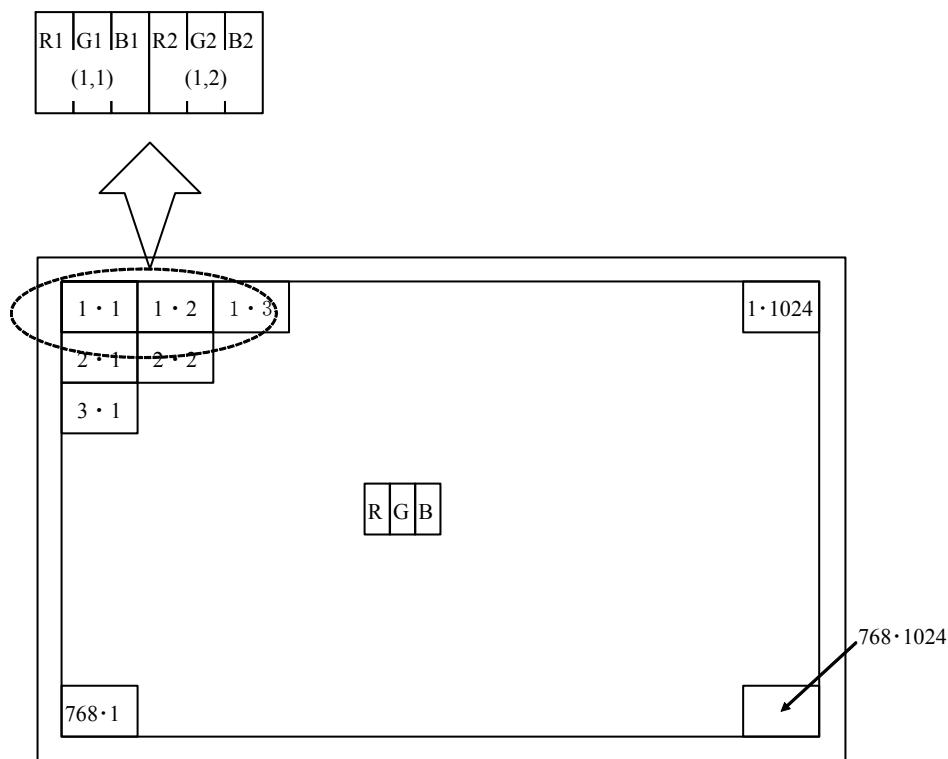
Display position of input data(V・H)

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

	Colors & Gray scale	Gray Scale	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	$\theta 21$, $\theta 22$	CR>10	(60)	(70)	—	Deg.	[Note 1-1,2,3]	
	Vertical	$\theta 11$		(40)	(50)	—	Deg.		
		$\theta 12$		(50)	(60)	—	Deg.		
Contrast ratio		CRn	$\theta =0°$	(600)	—	—		[Note 1-2,3,5]	
		CRo	Optimum viewing angle	(600)	(1000)	—			
Response time		$\tau r+ \tau d$	$\theta =0°$	—	(30)	(40)	ms	[Note 1-2,4,5]	
Chromaticity of white		x		0.263	0.313	0.363		[Note 1-2,5]	
		y		0.279	0.329	0.379			
Color gamut (NTSC ratio)				—	(40)	—	%	[Note 1-2,5]	
Luminance of white		Y_{LI}		—	(1200)	—	cd/m^2	[Note 1-2,6]	(I_{LED_F}=70mA)
White Uniformity		δw		—	(1.20)	(1.45)		[Note 1-2,7]	

The measurement shall be executed 30 minutes after lighting at rating. Condition : (I_{LED_F}=70mA)

The optical characteristics shall be measured in a dark room or equivalent.

[Note 1-1] Measuring Viewing Angle Range
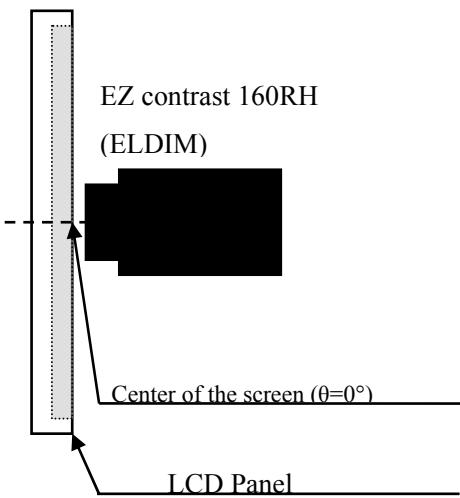
[Note1-2] Measuring Viewing Angle Range

EZ contrast 160RH (ELDIM)

Center of the screen (θ=0°)

LCD Panel

SR-3 (TOPCON

400mm

Field= 2 °

Center of the screen (θ=0°)

LCD Panel
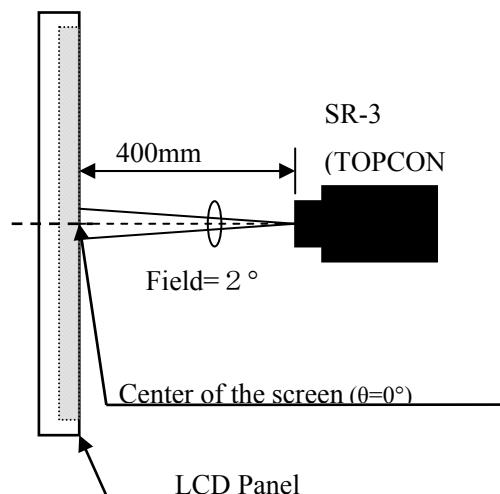
[Note 2] Definitions of viewing angle range:
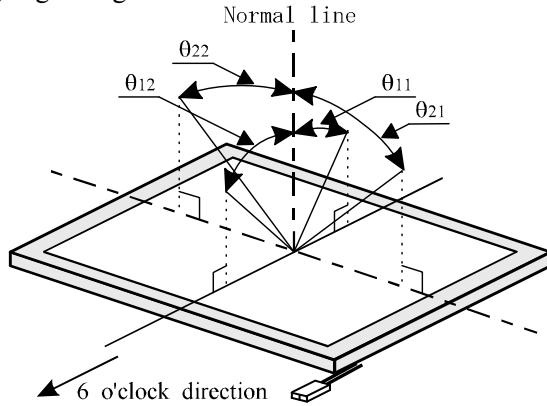
[Note 3] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 4] 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" .
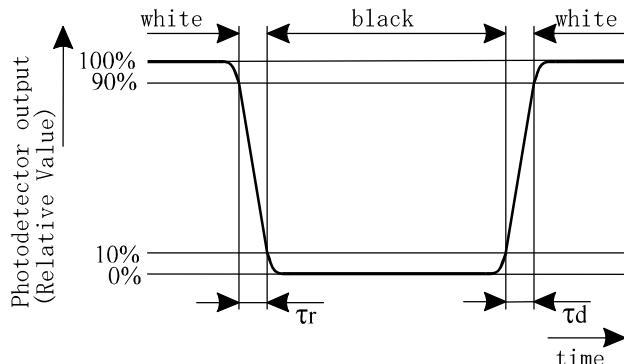

[Note 5] This shall be measured at center of the screen.

[Note 6] Luminance of center.(C)

[Note 7] Definition of white uniformity:

White uniformity is defined as the following with five measurements (A～E).

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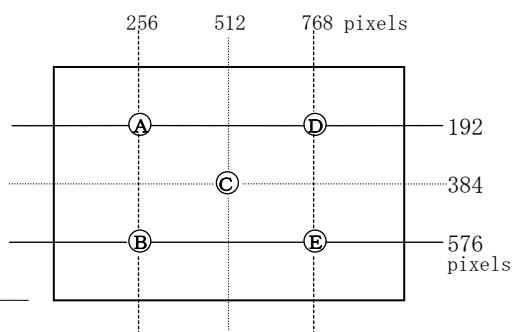
10. Display Quality

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.

Blow away dust on the polarizer with antistatic N_2 blow. It is undesirable to wipe off because a polarizer is sensitive.
It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer.
When unavoidable, wipe off carefully with a cloth for wiping lenses.

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) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.
Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.

i) Protection 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.
Blow off 'dust' on the polarizer by using an ionized nitrogen.

j) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from
the ultra violet ray.

k) Connect GND of mounting holes to stabilize against EMI and external noise.

l) When handling LCD modules and assembling them into cabinets, please avoid that long-terms 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 modules.

m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets
inside your eye or mouth by mistake.

n) Notice : Never dismantle the module , because it will cause failure.
Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.
(Except for protection film of the panel and the crepe tape (yellow tape) of fixing LED FPC temporarily.)

o) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)

p) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.
If adjusted value is changed, the specification may not be satisfied.

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12. Packing form

This packing form and the specification are tentative.
This packing form and specification might be changed because they are designing now.

Piling number of cartons	TBD
Package quantity in one carton	10 pcs
Carton size	(474(W)×335(D)×296(H)mm)
Total mass of one carton filled with full modules	(7500g)
Packing form	Fig.1

13. RoHS Regulations

This LCD module is compliant with RoHS Directive.
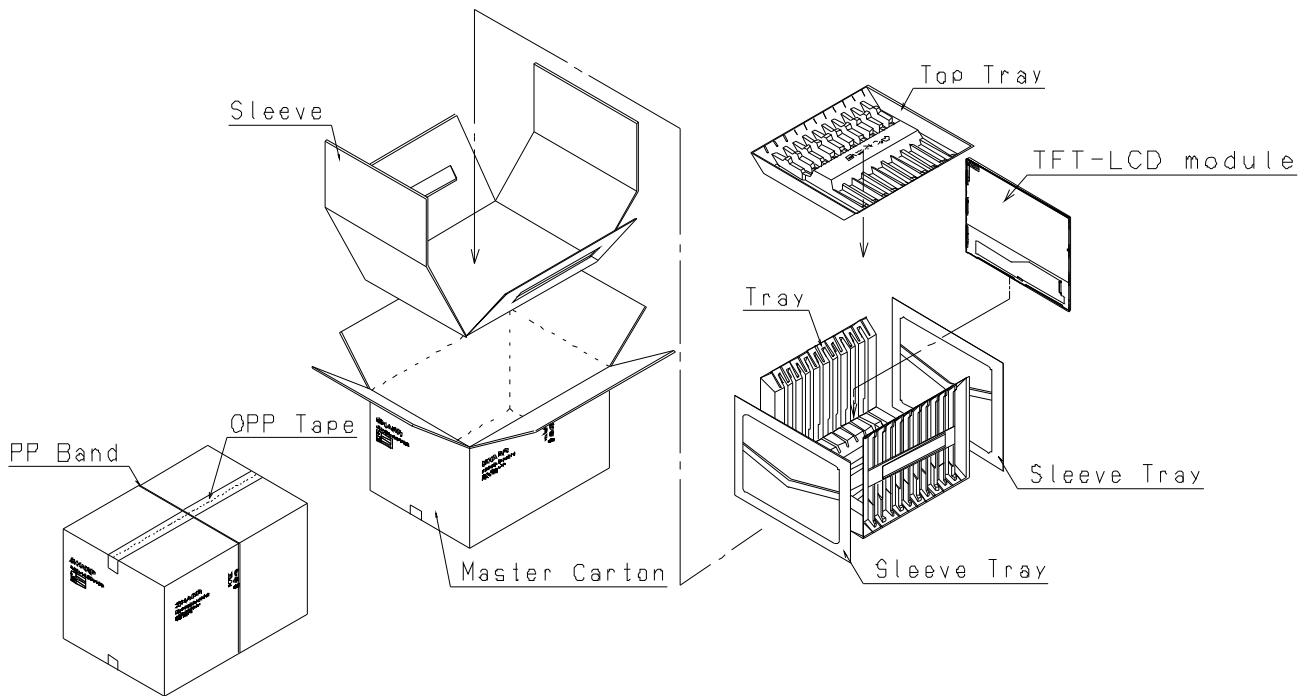
This packing form and the specification are tentative.
This packing form and the specification might be changed because they are designing now.

Fig. 1 Packing form

Fig. 2 Outline Dimensions

CN1 Pin Assign

1	Vcc
2	Vcc
3	GND
4	GND
5	RxIN0-
6	RxIN0+
7	GND
8	RxIN1-
9	RxIN1+
10	GND
11	RxIN2-
12	RxIN2+
13	GND
14	CK IN-
15	CK IN+
16	GND
17	NC
18	NC
19	GND
20	GND

BL-FPC

1	LED_C1
2	LED_C2
3	LED_C3
4	LED_C4
5	LED_C5
6	NC
7	LED_A
8	LED_A
9	LED_A
10	LED_A

The terminal side is the back

DETAIL A

DETAIL A
(SCALE 4/1)

NOTES
1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. UNSPECIFIED RADIUS TO BE R1

D/N:2D-09Y-063-01

4-M2 USER HOLES
Depth=2.2mmMAX

4-M2 USER HOLES
Depth=1.9mmMAX

Active Area[A.A.]

LED Side

TENTATIVE

A.A.Center

It bends on the reverse