

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LTM121XJ-G01

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1. Application

This technical literature applies to a color TFT-LCD module, LTM121XJ-G01

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	248.5 (H)× 187.8(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	(260.0)	(260.5)	(261)	mm
	Height		(203.5)	(204)	mm
	Depth	—	(7.0)	(10)	mm
Mass		—	(400)	450	g

[Note 1] excluding LED backlight FPC.

Outline dimensions is shown in Fig.2

4. Input Terminals

4-1. TFT-LCD panel driving

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

LTM121XJ-G01

Signal Pin

Pin#	Signal Name	Pin#	Signal Name
1	GND	2	VDD
3	VDD	4	VDD _{EDID}
5	AGING	6	CLK _{EDID}
7	DATA _{EDID}	8	RxIN0N
9	RxIN0P	10	GND
11	RxIN1N	12	RxIN1P
13	GND	14	RxIN2N
15	RxIN2P	16	GND
17	RxCLKINN	18	RxCLKINP
19	GND	20	GND

Note: Add 1K ohm resistor and connect to grounding as the solution for not adopting Pin4, Pin5, Pin6, and Pin7.

Signal Description

The module uses a LVDS receiver embedded in AUO's ASIC. LVDS is a differential signal technology for LCD interface and high-speed data transfer device.

Signal Name	Description
RxIN0-, RxIN0+	LVDS differential data input(Red0-Red5, Green0)
RxIN1-, RxIN1+	LVDS differential data input(Green1-Green5, Blue0-Blue1)
RxIN2-, RxIN2+	LVDS differential data input(Blue2-Blue5, Hsync, Vsync, DE)
RxCLKIN-, RxCLKIN0+	LVDS differential clock input
VDD	+3.3V Power Supply
GND	Ground

Note: Input signals shall be in low status when VDD is off.

Internal circuit of LVDS inputs are as following.

[Note 1] Relation between RxIN_i(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.

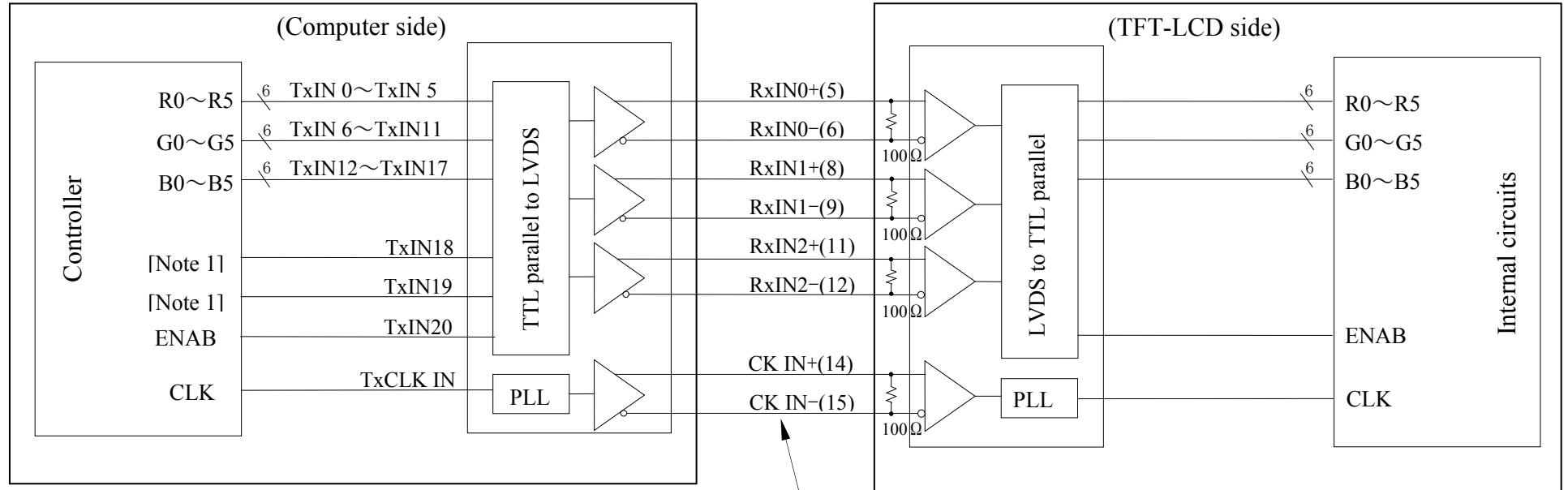
Using connector : DF19L-20P-1H (HIROSE) or equivalent.

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

4-2 LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC

Corresponding Transmitter : THC63LVDM63A (THINE) or equivalent



[Note 1] Do not use at high-impedance TxIN 18 - 19.

Symbol of CN1 (Pin No.)

LED-Back Light FPC

Pin NO		Description	Remark
1	LED_Vi	LED-B/L Cathode1	DC10V-12V
2	LED_V _{GND}	LED-B/L Cathode2	Ground

LED-Back Light Unit (CN2)

Pin No.	Symbol	Function	Remark
1	VCC	12V input	
2	VCC	12V input	
3	ON/OFF	3-5V/oN, 0V/oFF	
4	PWM	Dimming	
5	GND	GND	
6	GND	GND	

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

Corresponding connector : 52746-1071(MOLEX)

(OBEY 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	T _a =25°C	-0.3	V _{CC} +0.3	V	[Note 1]
+3.3V supply voltage	V _{CC}	T _a =25°C	9	+11.0	V	
LED forward current	I _{LED_F}	T _a =25°C	100	500	mA	[Note2]
LED reverse current	I _{LED_R}	T _a =25°C	—	250	mA	[Note2]
Storage temperature	T _{stg}	—	-20	+75	°C	[Note 3]
Operating temperature (Ambient)	T _{opa}	—	-10	+65	°C	

[Note 1] LVDS signals

[Note 2] Value for one LED string

[Note 3] Humidity : 95%RH Max. at T_a ≤ +45°C.

Maximum wet-bulb temperature at +44°C or less at T_a > +45°C.

No condensation.

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

LTM121XJ-G01

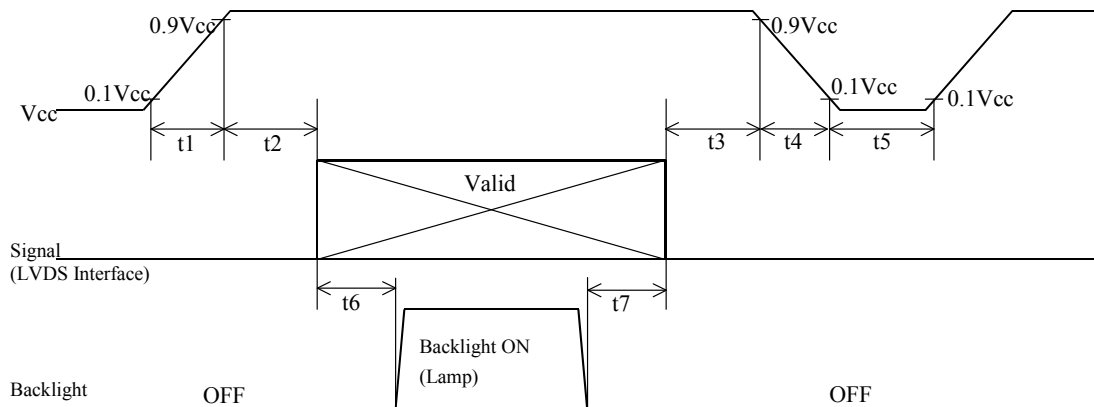
Ta=+25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Supply voltage	V _{CC}	+3.0	+3.3	+3.4	V	[Note 2]	
Current dissipation	I _{CC}	—	(380)	(500)	mA	[Note 3]	
Permissible input ripple voltage	V _{RP}	—	—	100	mV _{P-P}	V _{CC} = +3.3V	
Input voltage range	V _I	0		3.0	V	LVDS signals	
Differential input threshold voltage	High	V _{TH}	—	—	+100	mV	V _{CM} = +1.2V [Note 1]
	Low	V _{TL}	-100	—	—	mV	
Input current (High)	I _{OH}	—	—	± 10	μ A	V _I = +2.4V V _{CC} = +3.6V	
Input current (Low)	I _{OL}	—	—	± 10	μ A	V _I = 0V V _{CC} = 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
t ₁	0	10	ms	
t ₂	0	1	s	
t ₃	0	1	s	
t ₄	0	400	ms	
t ₅	200	—	ms	
t ₆	180	—	ms	*1
t ₇	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

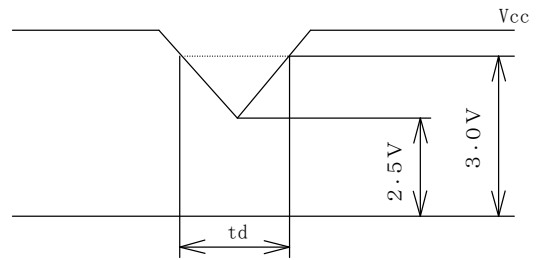
- 1) $2.5\text{ V} \leq V_{cc} < 3.0\text{ V}$

$$t_d \leq 10\text{ ms}$$

Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.

- 2) $V_{cc} < 2.5\text{ V}$

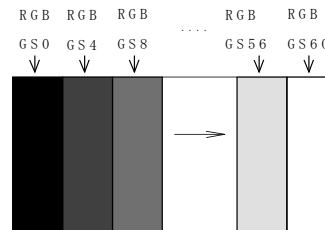
Vcc-dip conditions should also follow the On-off conditions for supply voltage



[Note 3] Typical current situation : 16-gray-bar pattern.

$$V_{cc} = +3.3\text{V}$$

Maximum current situation : $V_{cc} = +3.0\text{V}$



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°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED forward voltage	V_{LED_F}	—	(9.6)	(11)	V	[Note1]
LED forward voltage variation	ΔV_{LED_F}	—	—	3.5	V	[Note1] [Note2]
LED forward current range	I_{LED_F}	—	(50)	(60)	mA	Value for one string
Number of circuit strings		—	14	—		[Note 3]
LED power consumption	W_{LED}	—	(5.0)	8	W	[Note1] [Note 4]
LED life time	L_{LED}	(50000)	—	—	Hour	[Note 5]

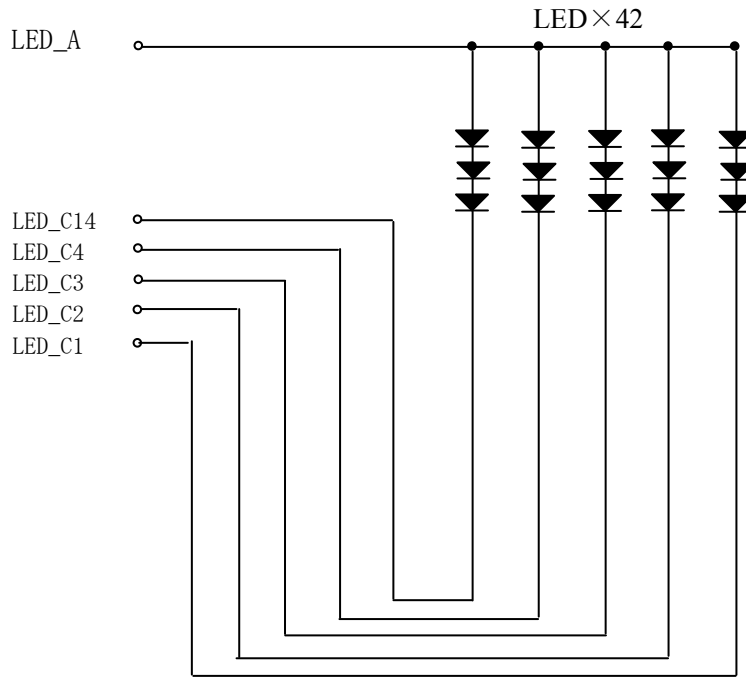
[Note1] $I_{LED_F} = (60mA)$

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

[Note 3] The LED backlight is composed by 14 strings from which 3 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.



[Note 4] Calculated value for reference ($I_{LED_F} \times V_{LED_F}$)

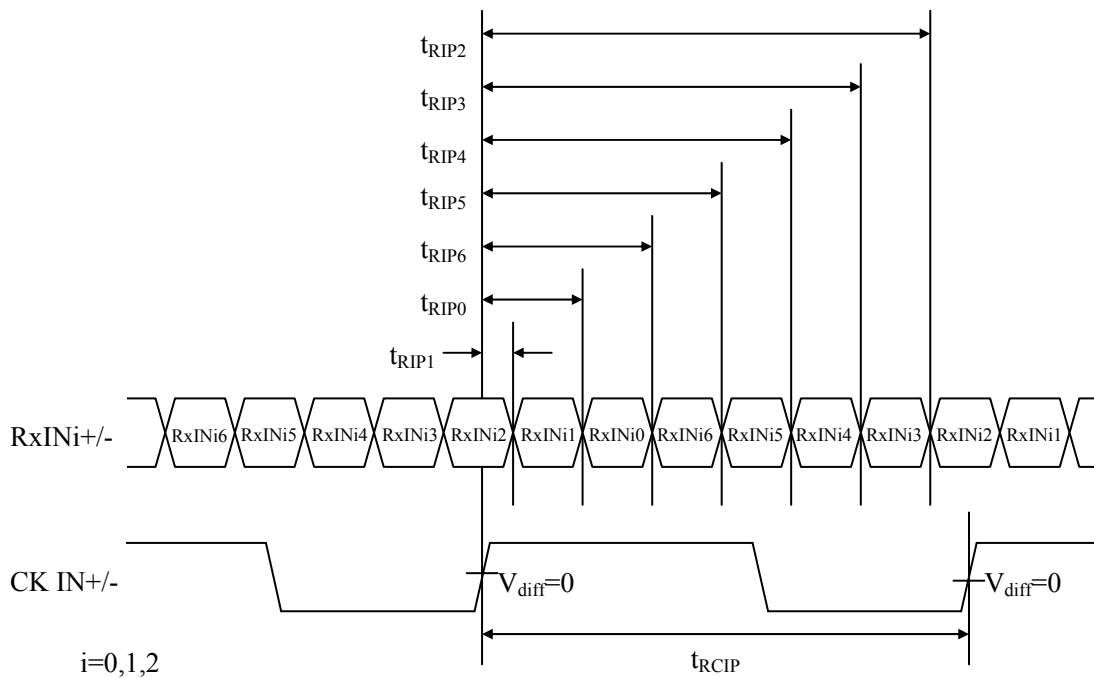
[Note 5] LED life time is defined as the time when Brightness becomes 50 % of the original value. under the condition of Ta = 25°C and $I_{LED_F} = 60mA$, and continuous lighting.

6-3-1. AC characteristics

V_{CC}=+3.0V~+3.6V, T_a=-20°C~+60°C

Parameter	Symbol	Min	Typ.	Max.	Unit
Input Data Position 0 (t _{RCIP} =15.38ns)	t _{RIP1}	-0.25	0.0	+0.25	ns
Input Data Position 1 (t _{RCIP} =15.38ns)	t _{RIP0}	t _{RCIP} /7-0.25	t _{RCIP} /7	t _{RCIP} /7+0.25	ns
Input Data Position 2 (t _{RCIP} =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 (t _{RCIP} =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 (t _{RCIP} =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 (t _{RCIP} =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 (t _{RCIP} =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

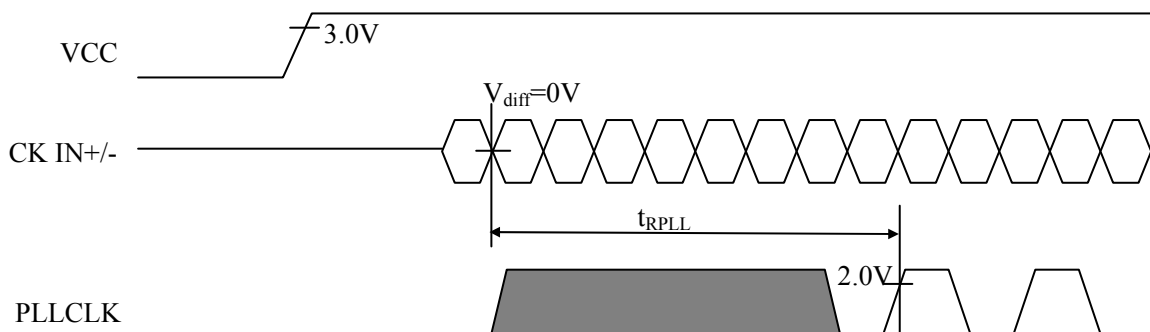
LVDS input timing



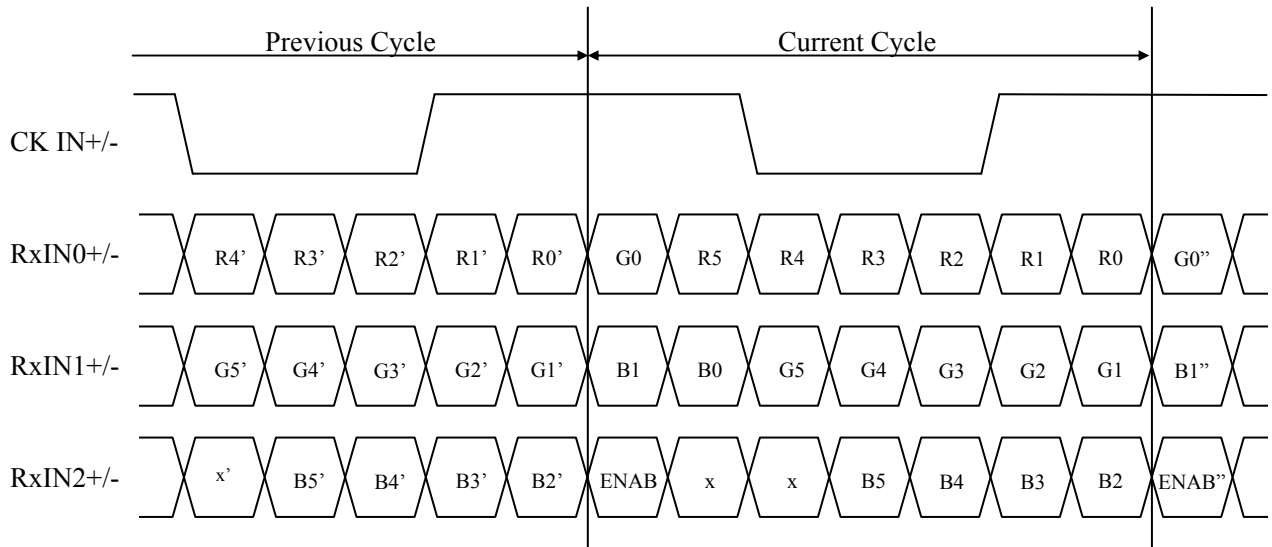
※Note

V_{diff}=(RxINi+)-(RxINi-), (CK IN+)-(CK IN-)

LVDS phase lock loop set



6-3-2.LVDS data



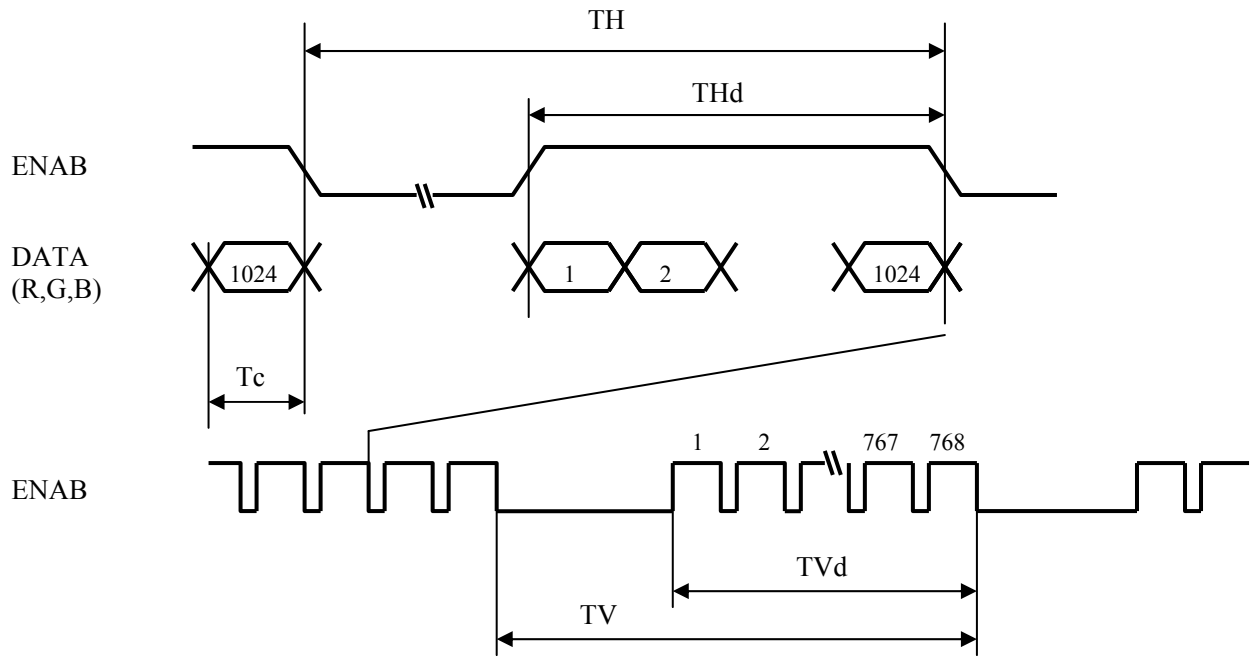
7. Timing Characteristics of Input Signals

7-1. Timing characteristics

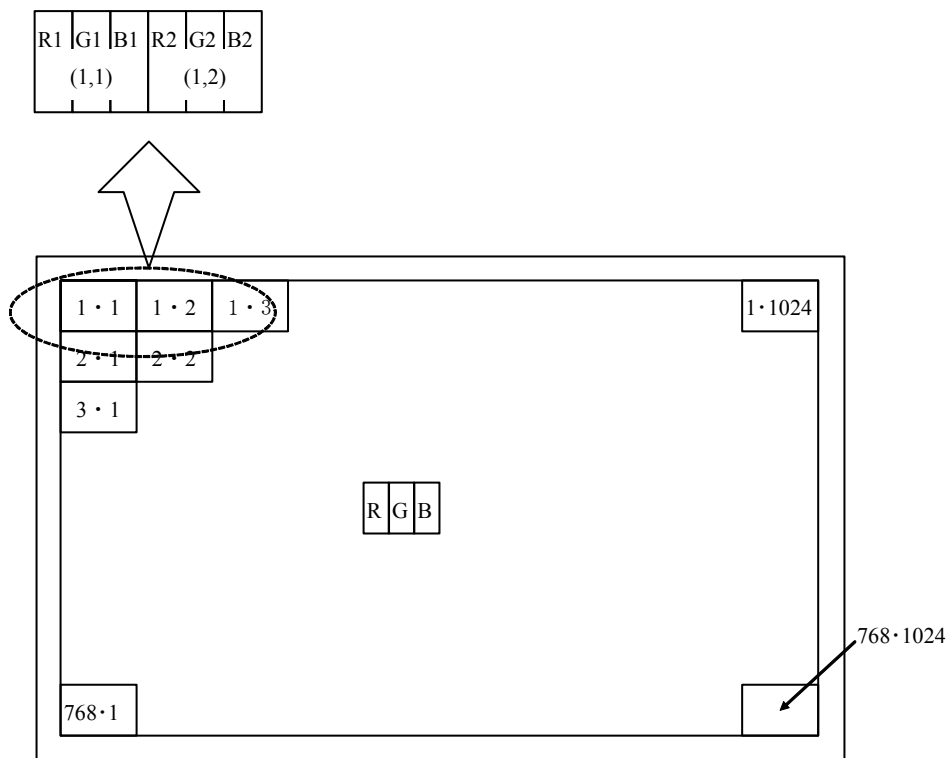
V_{CC}=+3.0V~+3.6V, T_a=-20°C~+60°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/T _c	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.



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



Display position of input data(V · H)

	Colors & Gray scale	Data signal																		
		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

LTM121XJ-G01

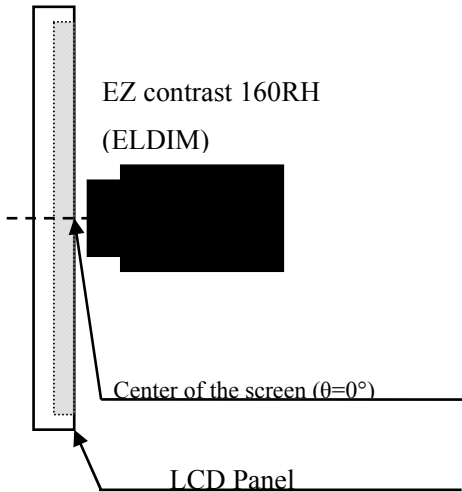
Ta=+25°C, Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing angle range	Horizontal	θ_{21} , θ_{22}	CR>10	(70)	(75)	80	Deg.	[Note 1-1,2,3]	
		θ_{11}		(70)	(75)	80	Deg.		
	Vertical	θ_{12}		(60)	(65)	70	Deg.		
Contrast ratio		CRn	$\theta = 0^\circ$	(600)	—	—		[Note 1-2,3,5]	
		CRo	Optimum viewing angle	(600)	(1000)	—			
Response time		$\tau_r + \tau_d$		—	(3)	(5)	ms	[Note 1-2,4,5]	
Chromaticity of white		x	$\theta = 0^\circ$	0.263	0.313	0.363		[Note 1-2,5]	
		y		0.279	0.329	0.379			
Color gamut (NTSC ratio)				—	(60)	—	%	[Note 1-2,5]	
Luminance of white		Y_{LI}		—	(1200)	—	cd/m ²	[Note 1-2,6]	(I _{LED_F} =60mA)
White Uniformity		δ_w		—	(1.20)	(1.45)		[Note 1-2,7]	

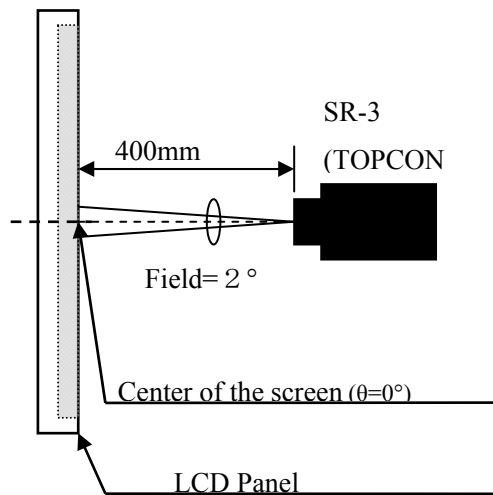
The measurement shall be executed 30 minutes after lighting at rating. Condition : (I_{LED_F}=70mA)

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

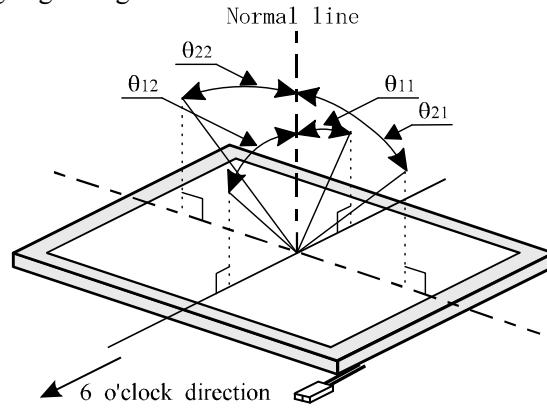
[Note 1-1] Measuring Viewing Angle Range



[Note 1-2] Measuring Viewing Angle Range



[Note 2] Definitions of viewing angle range:



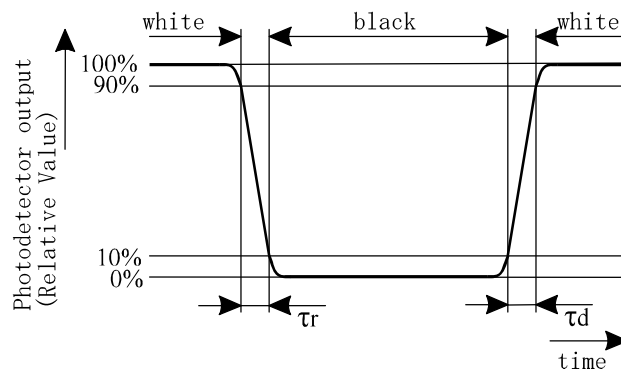
[Note 3] Definition of contrast ratio:

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" .



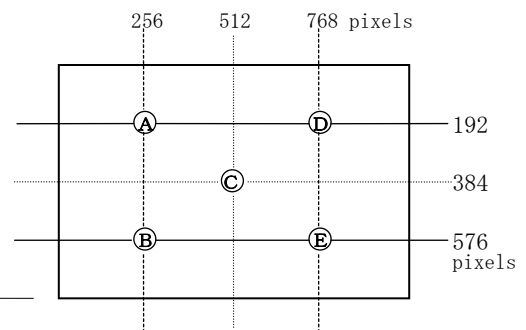
[Note 5] This shall be measured at center of the screen.

[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 N₂ 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 OBEY 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.

12. Packing form

LTM121XJ-G01

This packing form and the specification are tentative.

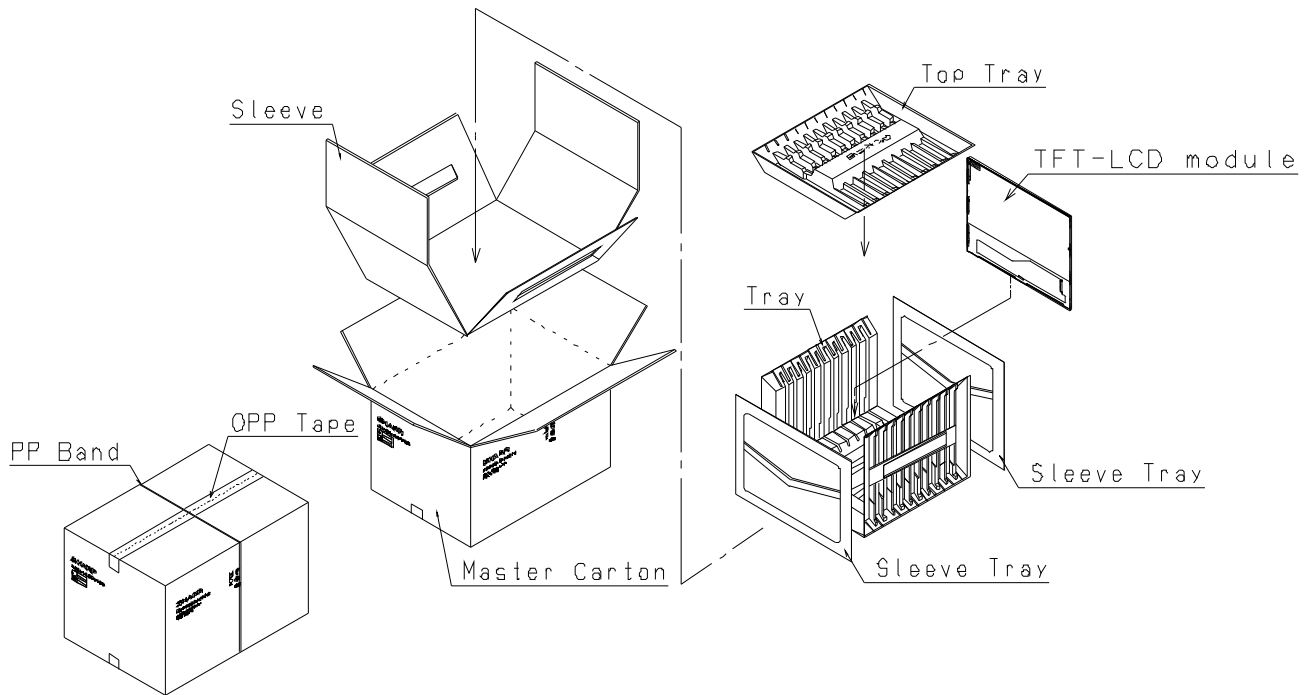
This packing form and specification might be changed because they are designing now.

Piling number of cartons	TBD
Package quantity in one carton	20
Carton size	34 × 25 × 27 (H)mm
Total mass of one carton filled with full modules	
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

