SPECIFICATION

For

APPROVAL

(●) Preliminary Specification
( ) Final Specification

Title	**12.1” SVGA TFT LCD**

BUYER NAME	
MODEL NAME	

SUPPLIER	LG Electronics Inc.
MODEL NAME	LP121SA-A2

SIGNATURE	DATE
Please return 1 copy for our confirmation with your signature and comments.	

SIGNATURE	DATE
APPROVED BY H. YOUN	
REVIEWED BY S.C. YUN	
PREPARED BY J.H. PARK	NOV.1998
Product Engineering Dept. LCD DIVISION LG Electronics, Inc.	

TABLE of CONTENTS

Record of Revision

DATE AND VERSION	DESCRIPTION

1. General Description

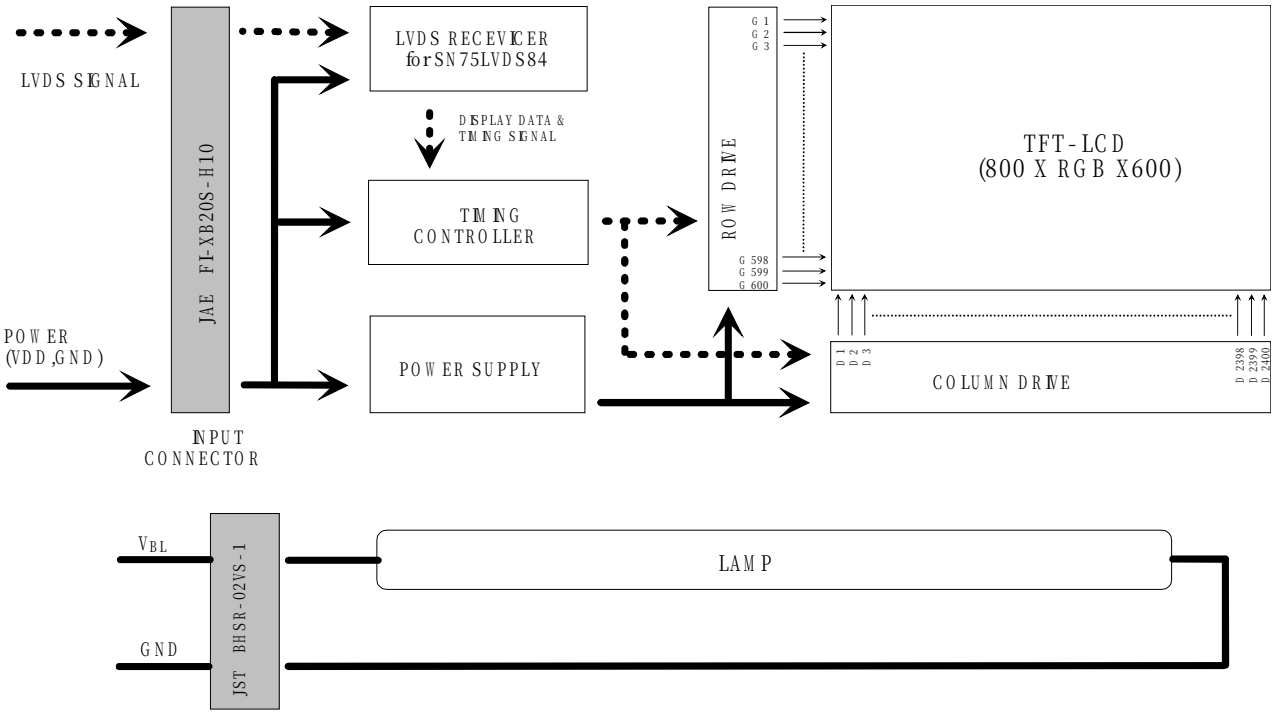
The LG Electronics model LP121SA-A2 LCD is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode

Fluorescent Tube(CCFT) back light system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has a 12.1 inch diagonally measured active display area with SVGA resolution(600 vertical by 800 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a pallete of more than 262,144 colors.

The LP121SA-A2 LCD is intended to support applications where low power consumption, weight and thickness are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LP121SA-A2 characteristics provide an excellent flat panel display for office automation products such as portable computers.

This LCM has LVDS Interface for SN75LVDS84 Transmitter supplied by TI or compatible device.

LP121SA-A2 BLOCK DIAGRAM



General Display Characteristics

The following are general feature of the model LP121SA-A2 LCD;

Active display area	12.1 inches(26cm) diagonal
Outsize dimensions	275 W x 199 H x 5.2 D mm Typ.
Pixel pitch	0.3075 mm * 0.3075 mm
Pixel format	800 horiz. By 600 vert. pixels RGB stripe arrangement
Color depth	6-bit
Display operating mode	transmissive mode, normally white
Surface treatment	hard coating(2H), anti-glare treatment of the front polarizer

2. Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1 ABSOLUTE MAXIMUM RATINGS

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V_{DD}	-0.5	+3.63	Vdc	at 25℃
Logic Input Voltage	$V_{L/H}$	0	V_{DD}+0.3	Vdc	at 25℃
Operating Temperature	T_{OP}	0	+50	℃	1
Storage Temperature	T_{ST}	-20	+60	℃	1

Note: 1. The Relative Humidity must not exceed 80% non-condensing at temperatures of 50℃ or less.
At temperatures greater than 40℃, the wet bulb temperature must not exceed 49℃.
At low temperature the brightness of CCFL drop and the life time of CCFL become to be short.
2. Under no condition should the unit be exposed to corrosive chemicals.

3. Electrical Specifications

The LP121SA-A2 requires two power inputs. One is employed to power the LCD electronics and to derive the voltages to drive the TFT array and liquid crystal. The second input which powers the backlight CCFT, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2 ELECTRICAL CHARACTERISTICS:

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE:						
Power Supply Input Voltage	V_{DD}	3.0	3.3	3.6	Vdc	
Power Supply Input Current	I_{DD}	-	330	-	mA	1
Ripple/Noise	-	-	-	60	mV	
Logic Input Level, High	V_{IH}	0.6V_{DD}	-	VDD	Vdc	2
Logic Input Level, Low	V_{IL}	Vss	-	0.3V_{DD}	Vdc	2
Power Consumption	P	-	1	1.4	W	1
BACKLIGHT			125nit			
Backlight Input voltage	V_{BL}	560	590	705	V_{RMS}	3
Backlight Current	I_{BL}	3.0	5.5	7.0	mA	
Lamp Kick-Off Voltage		945	-	-	V_{RMS}	25±2℃
Operating Frequency	F_{BL}	40	55	80	KHz	

Notes:
1. The current draw and power consumption specified is for 3.3 Vdc at 25℃ and 38MHz (DCLK). Typical power consumption check pattern is 8 gray scale bar.
2. Logic levels are specified for V_{DD} of 3.3 Vdc at 25℃. The values specified apply to all logic inputs; Hsync, Vsync, clock, data signals, etc.
3. The backlight power consumption shown above does not include loss of external inverter.

4. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25℃. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Appendix A presents additional information concerning the specified characteristics.

Table 3 OPTICAL CHARACTERISTICS

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	105	-	-		1
Surface Brightness, white(IBL=4.0mA)	SB_{WH}	80	100	-	cd/m^2	2
Brightness Variation	SB_V	-	-	1.45		3
Response Time						
Rise Time	Tr_R		20	50	msec	4
Decay Time	Tr_D	-	35	50	msec	4
CIE Color Coordinates						
Red	x_R		0.563			
	y_R		0.348			
Green	x_G		0.302			
	y_G		0.538			
Blue	x_B		0.157			
	y_B		0.139			
White	x_W		0.293			
	y_W		0.333			
Viewing Angle(CR>10:1)						
x axis, right (Φ =0º)	θ			40		5
x axis, left(Φ =180º)	θ			40	degree, °	
y axis, up(Φ =90º)	θ			10		
y axis, down (Φ =270º)	θ			30		

Notes 1. Contrast Ratio (CR) is defined mathematically as:

$$\frac{\text{(Surface Brightness with all white pixels)}}{\text{(Surface Brightness with all black pixels)}}$$

2. Surface brightness is measured in the center of 5 points(this means number 3 in Appendix A-1 Brightness) across the LCD surface 50cm from the surface with all pixels displaying white. For more information see Appendix A.

3. The variation in surface brightness, SB_V is determined by measuring B_{ON} at each test position 1 through 5, and then dividing the maximum B_{ON} by the minimum B_{ON}.

$$\frac{\text{Maximum } (B_{ON1}, B_{ON2}, ...B_{ON5})}{\text{Minimum } (B_{ON1}, B_{ON2}, ...B_{ON5})}$$

4. Response time is the time required for the display to transition from white to black(Rise Time, Tr_R) and from black to white (Decay Time, Tr_D). For additional information see Appendix A.

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD

surface. For more information see Appendix A.

5. Interface Connections

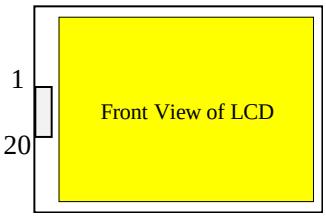
This LCD employs two interface connections, a 20 pin connector is used for the module electronics and a three pin connector is used for the integral backlight system.

The electronics interface connector is DF19K-20P-1H, manufactured by HIROSE. The pin configuration for the connector is shown in the table below.

Table 4 MODULE CONNECTOR PIN CONFIGURATION

Pin	Symbol	Description	Notes
1	VDD	Power supply, 3.3V	
2	VDD	Power supply, 3.3V	
3	GND	Ground	
4	GND	Ground	
5	A1M	Receiver signal (-)	Red Data R0 ~ R5, G0
6	A1P	Receiver signal (+)	Red Data R0 ~ R5, G0
7	GND	Ground	
8	A2M	Receiver signal (-)	Green Data G1 ~ G5, B0 ~ B1
9	A2P	Receiver signal (+)	Green Data G1 ~ G5, B0 ~ B1
10	GND	Ground	
11	A3M	Receiver signal (-)	Blue Data B2 ~ B5, Hsync, Vsync, DE
12	A3P	Receiver signal (+)	Blue Data B2 ~ B5, Hsync, Vsync, DE
13	GND	Ground	
14	CLKM	Clock signal (-)	Main Clock
15	CLKP	Clock signal (+)	Main Clock
16	GND	Ground	
17	NC	Reserved	
18	NC	Reserved	
19	GND	Ground	
20	GND	Ground	

CONNECTOR PLACEMENT



]Notes: 1. All GND(ground) pins should be connected together and the LCD's metal frame.
2. All V_{DD}(power input) pins should be connected together.

The backlight interface connector is a model BHSR-02VS-1, manufactured by JST. The mating connector part number is SM02B-BHSS-1 or equivalent. The pin configuration for the connector is shown in the table below.

Table 5 BACKLIGHT CONNECTOR PIN CONFIGURATION

Pin	Symbol	Description	Notes
1 2	HV LV	Lamp power input Ground	1

Notes: 1. The input power terminal is colored pink.

6. Signal Timing Specifications

6.1. Interface Signal Timing.

The Interface Signal Timing is based on LVDS(Tx:SN75LVDS84 or compatible device) SPEC.

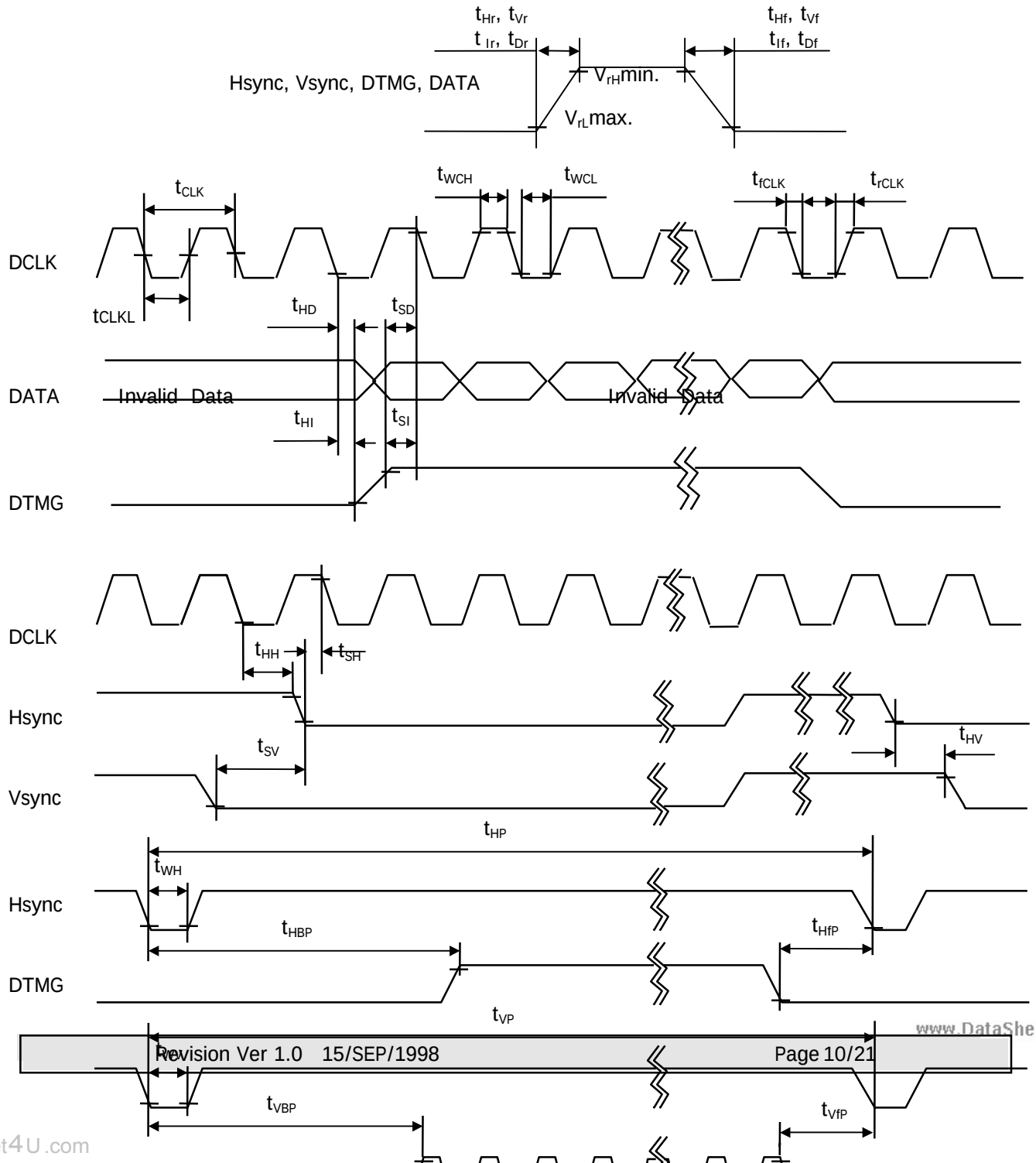
6.2. Signal timing for LCD controller.

ITEM		Symbol	Value			Units	Notes
			Min.	Typ.	Max.		
DCLK	Period	f_{CLK}	25	(26)	-	ns	
	Width-Low	t_{WCL}	5	-	-	ns	
	Width-High	t_{WCH}	5	-	-	ns	
	Rise Time	t_{rCLK}	-	-	25	ns	
	Fall Time	t_{fCLK}	-	-	25	ns	
	Duty	D	0.45	0.5	0.55	-	D=tCLKL /tCLK
Hsync	Set-up Time	t_{SH}	3	-	-	ns	for DCLK
	Hold Time	t_{HH}	8	-	-	ns	
	Period	t_{HP}	990	(1024)	1200	tCLK	
				-			
	Width-Active	t_{WH}	12	-	128	tCLK	
	Rise/Fall Time	t_{Hr},t_{Hf}	-		30	ns	
Vsync	Set-up Time	t_{SV}	0	-	- -	tCLK	for Hsync
	Hold Time	t_{HV}	2	-		tCLK	
	Period	t_{VP}	603	(625)	730	tHP	
	Width-Active	t_{WV}	1	-	24	tHP	
	Rise/Fall Time	t_{Vr},t_{Vf}	-	-	50	ns	
DTMG	Set up Time	t_{SI}	3	-	-	ns	for DCLK
	Hold Time	t_{HI}	8	-	-	ns	
	Rise/Fall Time	t_{Ir},t_{If}	-	-	30	ns	
	Horizental Back Porch	t_{HBP}	32	-	-	tCLK	
	Horizental Front Porch	t_{HFP}	16	-	-	tCLK	
	Vertical Back Porch	t_{VBP}	0	-	-	tHP	
	Vertical Front Porch	t_{VFP}	3	-	-	tHP	
DATA	Set up Time	t_{SD}	3	-	-	ns	for DCLK
	Hold Time	t_{HD}	8	-	-	ns	
	Rise/Fall Time	t_{Dr},t_{Df}	-	-	25	ns	

7. Signal Timing Wave Forms (for LCD Controller)

* The Interface Signal Timing Wave Form is based on LVDS(Tx:SN75LVDS84 or compatible device) SPEC.

(DATA : Latched at Fall edge of DCLK)



Vsync

DTMG

8. Color Input Data Reference

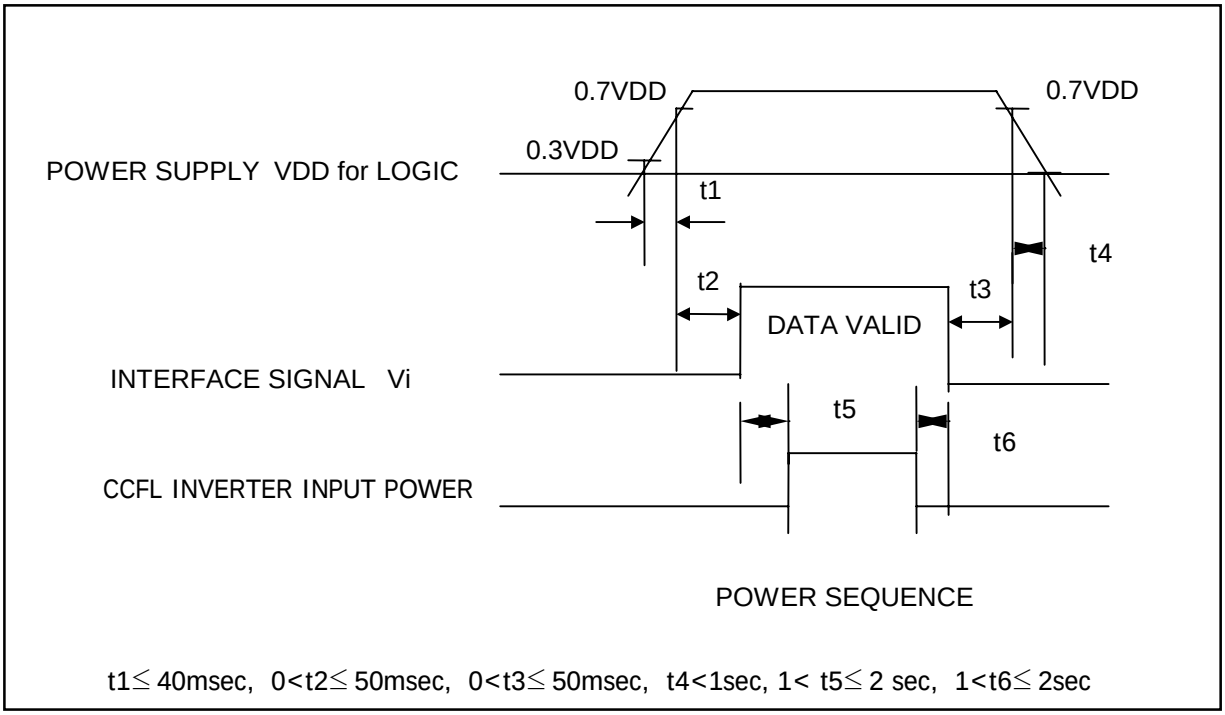
The brightness of each primary color(red, green and blue) is based on the 6-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 6 COLOR DATA REFERENCE

Color		Input Color Data																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(00)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(00)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(00)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	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
Red	Red(63) Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(61)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		:	:	:	:	:	:	0	0	0	0	0	0	0	0	0	0	0	0
	Red(02)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(01)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(00)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(63) Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(61)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
		0	0	0	0	0	0	:	:	:	:	:	:	0	0	0	0	0	0
	Green(02)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(01)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(00)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(63) Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		0	0	0	0	0	0	0	0	0	0	0	0	;	:	:	:	:	:
	Blue(02)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1

	Blue(01)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(00)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

9. Power Sequence



POWER SEQUENCE

t1≤ 40msec, 0<t2≤ 50msec, 0<t3≤ 50msec, t4<1sec, 1< t5≤ 2 sec, 1<t6≤ 2sec

* Set 0 Volt ＜ Vi(t) ≤ V_{DD}(t)

Here Vi(t), V_{DD}(t) indicate the transitive state of Vi, V_{DD} when power supply is turned ON or OFF

Notes : 1. Please avoid floating state of interface signal at invalid period.

2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{DD} to 0V.

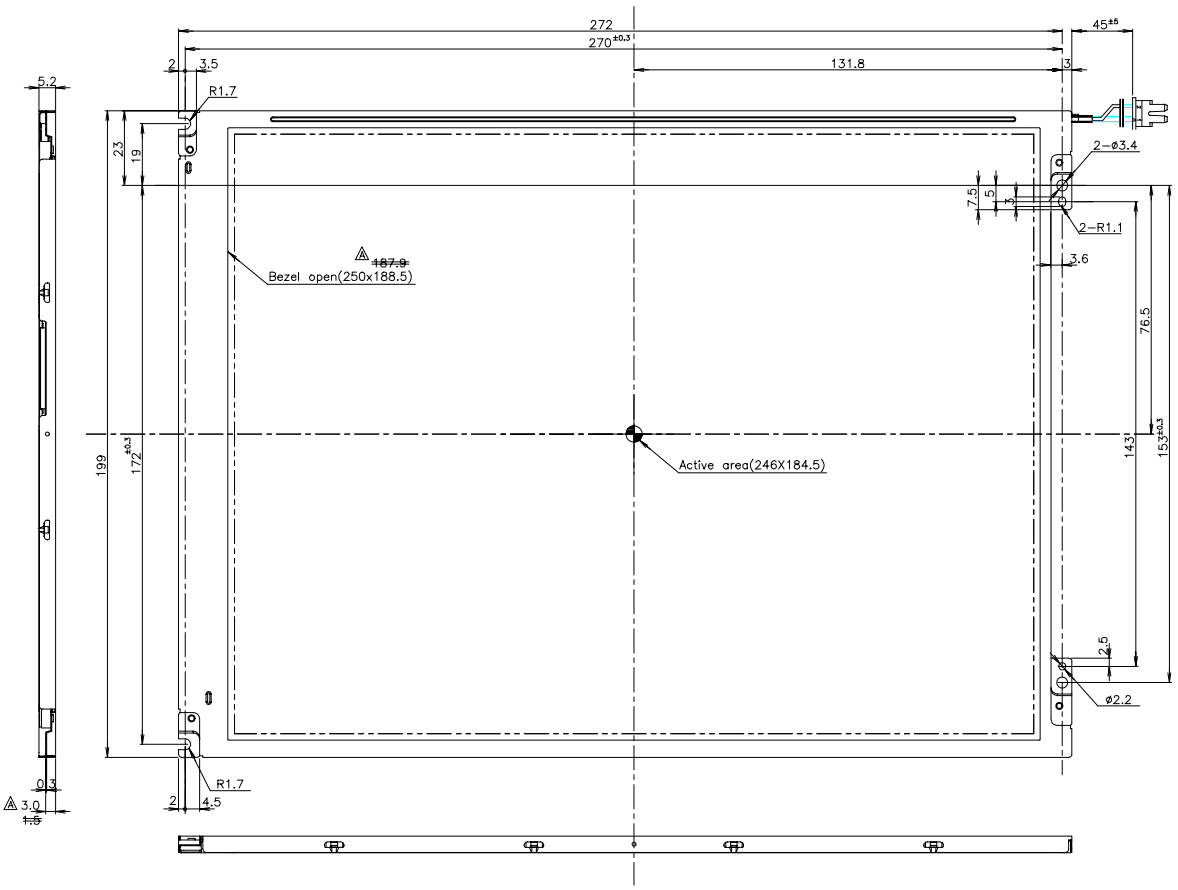
10. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LP121SA-A2 LCD. The surface of the LCD has an anti-glare coating to minimize reflection and a 2H hard coating to reduce scratching. In addition, the figure below is a detailed mechanical drawing of the LCD. Note that dimension are given for reference purposes only.

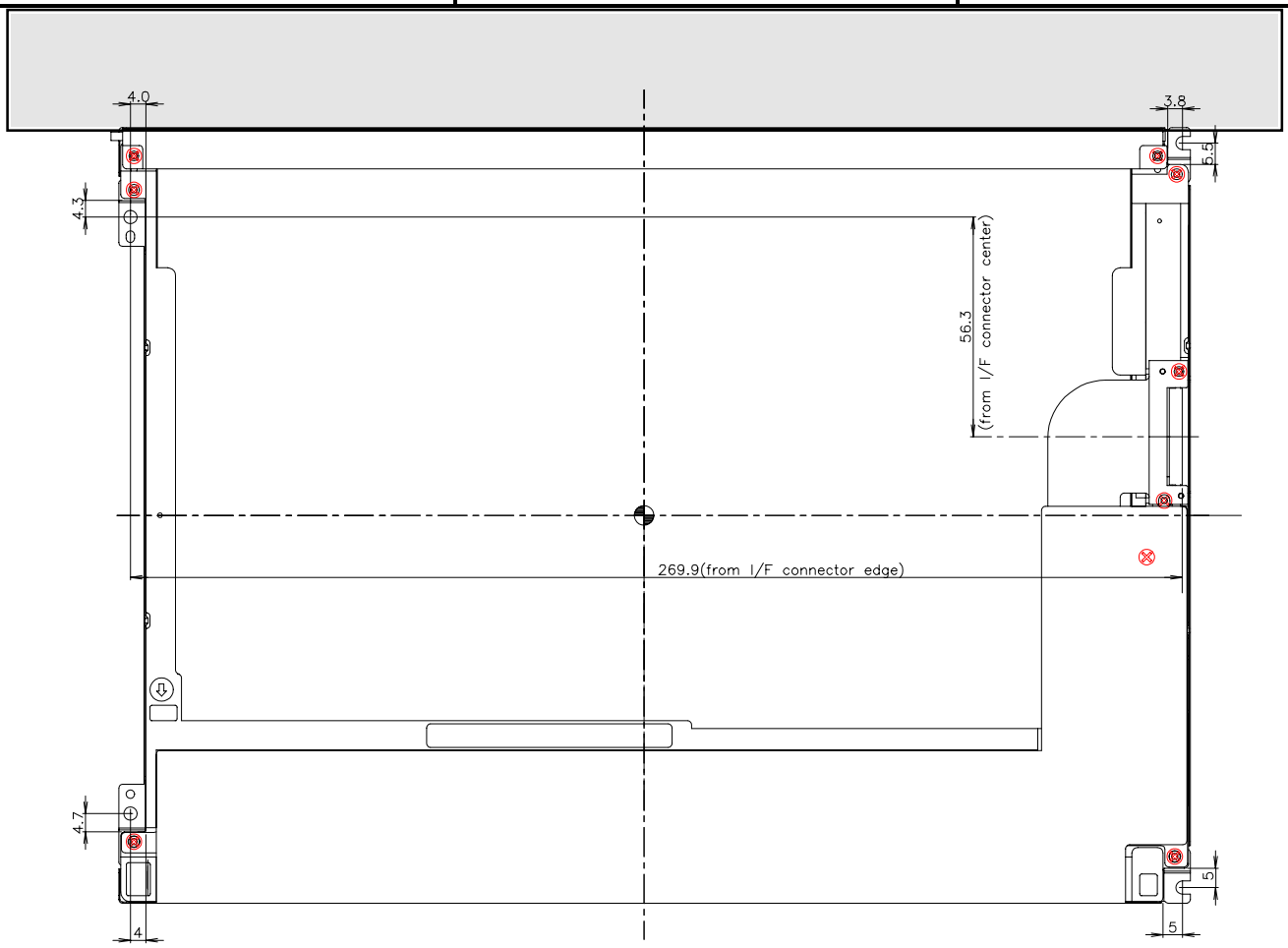
深圳三基电子 http://www.sangise.com 0755-83666260
Rgb-rgb@163.com

Outside dimensions	Width	275 mm
	Height	199 mm
	Thickness	5.2 mm
Active Display area	Width	246 mm
	Height	184.5 mm
	Diagonal	307.34 mm
Weight (approximate)		399 gram

<Front View>



<Rear View>



11. Reliability

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% 240h (no condensation)
4	High temperature operation test	Ta = 50℃ 240h

5	Low temperature operation test	Ta = 0℃ 240h
6	Vibration test (non-operating)	Sinusoidal Vibration 10~500~10Hz 1.5G 0.5 oct/min 1 Sweep(23min)/each direction(X,Y,Z)
7	Shock test (non-operating)	Half SINE Wave, 180 G, 2 ms one time/each direction(X,Y,Z)

{Result Evaluation Criteria}

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

In High temperature and low temperature operation test, lamp current should be (4.0) mA.

12. International Standards

12.1. Safety

UL1950 “Safety of Information Technology Equipment Including Electrical Business Equipment. Third Edition” Underwriters Laboratories, Inc. 1995

CAS C22.2 “Safety of Information Technology Equipment Including Electrical Business Equipment.

Third Edition" Canadian Standards Association, 1995

EN 60950 "Safety of Information Technology Equipment Including Electrical Business Equipment."
European Committee for Electrotechnical Standardization(CENELEC), 1995
Ref. No. EN 60950: 1992 + A1: 1993 + A2: 1993 + A3: 1995 E
(IEC 950: 1991 + A1: 1992 + A2: 1993 + A3: 1995, modified)

12.2. EMC

ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz."
American National Standards Institute(ANSI),1992.

C.I.S P.R "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."International Special Committee on Radio Interference

EN 55 022 "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."European Committee for Electrotechnical Standardization (CENELEC),1988

13. Designation of Lot Mark

13.1.Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L

A, B : SBU CODE
C, D, E : MODEL CODE
F : YEAR
G : MONTH
H, I, J, K, L : SERIAL NO.

NOTE

1) YEAR

YEAR	89	90	91	92	93	94	95	96	97	98	99
Mark	9	0	1	2	3	4	5	6	7	8	9

2) MONTH

MONTH	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	O	N	D

13.2. Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the backlight unit. This is subject to change without prior notice.

14. Packing Form

a) Package quantity in one box : 10pcs
b) Box size : 372(W) X 331(H) X 308(D)

15. Handling Precautions

Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

15.1.MOUNTING PREACAUTION

1)You must mount Module using mounting holes arranged in 4 corners. Be sure to turn off the power when connecting or disconnecting the circuit.

2) Note that the polarizers are easily damaged. Pay attention not to scratch or press this surface with any hard object.

3) When the LCD surface become dirty, please wipe it off with a soft material.(ie.cotton ball)

4) Protect the module from the ESD as it may damage the electronic circuit (C-MOS).
Make certain that treatment person's body are grounded thru wrist bend.

5) Do not disassemble the module and be careful not to incur a mechanical shock that might occur during installation. It may cause permanent damage.

6) Do not leave the module in high temperatures, Particularly in areas of high humidity for a long time.

7) The module not be expose to the direct sunlight.

8) Avoid contact with water as it may a short circuit within the module.

15.2. OPERATING PRECAUTION

1) The spike noise causes the mis-operation of circuits. Be lower the spike noise as follows :
VDD=±200mV, V1=±200mV(Over and under shoot voltage.)

2) Response time depends on the temperature. (In lower temperature, it becomes longer.)

3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (Required time that brightness is stable after turn on)becomes longer.

4) Be careful for condensation at sudden temperature change. Condensation make damage to polarizer or electrical contact part. And after fading condensation, smear or spot will occur.

5) When fixed pattern are displayed at long times, remnant image is likely to occur.

6) Module has high frequency circuit. If you need to shield the electromagnetic noise. Please do in yours.

7) When Back-light unit is operating, it sounds. If you need to shield the noise, please do in yours.

15.3 ELECTROSTATIC DISCHARGE CONTROL

Since module is composed with electronic circuit, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through list band etc.. And don't touch I/F pin directly.

15.4 PRECAUTION FOR STRONG LIGHT EXPOSURE.

Strong light exposure causes degradation of polarizer and color filter.

15.5 STORAGE

When storing module as spares for long time, the following precautions are necessary.

1) Store them in a dark place : do not expose then to sunlight or fluorescent light. Keep the temperature between 5 and 35 at normal humidity.

2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

15.6 HANDLING PRECAUTIONS FOR PROTECTION FILM

1) When the protection film is pealed off, static electricity is generated between the film and the polarizer. This film should be pealed off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition. etc.

2) The protection film is attached the polarizer with a small amount of glue.If some stress is applied to rub the protection film against the polarizer during the time you peal off the film, the glue is apt to remain more on the polarizer. So please carefully peal off the protection film without rubbing it against the polarizer.

3) When the module with protection film attached is stored for long time, sometimes there remains a very small amount of glue still on the polarizer after the protaction film is pealed off.
Please refrain from storing the module at the high temperature and high humidity for glue is apt to remain in these condition.

4) The glue may be taken for the modules failure, but you can remove the giue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with Normal-hexane.

15.7 SAFETY

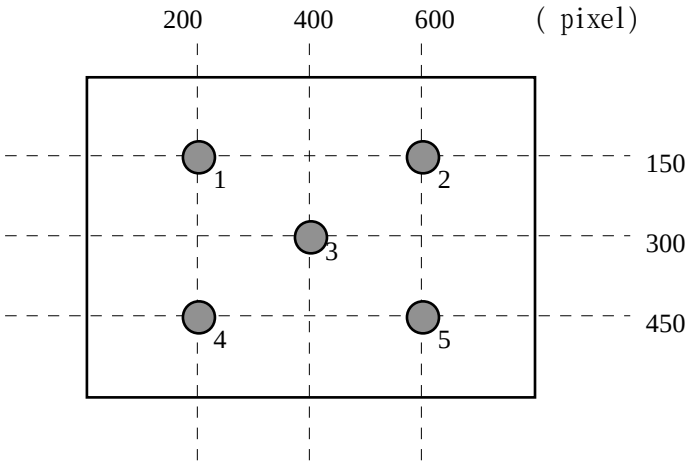
1) If module is broken, be careful to handle not to injure. (TFT/LCD and lamp are made of glass)
Please wash hands sufficiently when you touch the liquid crystal coming out from broken LCDs.

2) As it is possible for PCB or other electronic parts of module to small to smoke and to take fire becauseof the short circuit. Please design the circuit of your instrument not to flow the electric current to TFT/LCD module more than 500mA. (by apply the fuse for example)

3) As Back-light unit has high voltage circuit internal, do not open the case and do not insert foreign materials in the case.

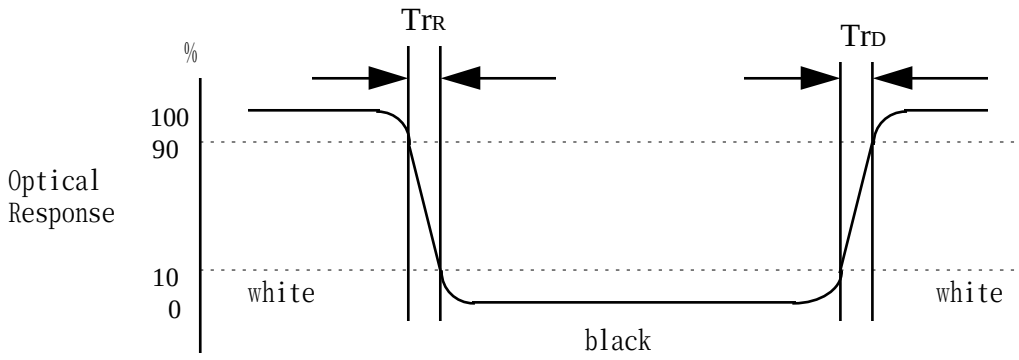
A-1 Brightness

<measurement point>



A-2 RESPONSE TIME

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



A-3 Viewing angle

<Definition of viewing angle range>