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Record of Revision

DATE AND VERSION	DESCRIPTION

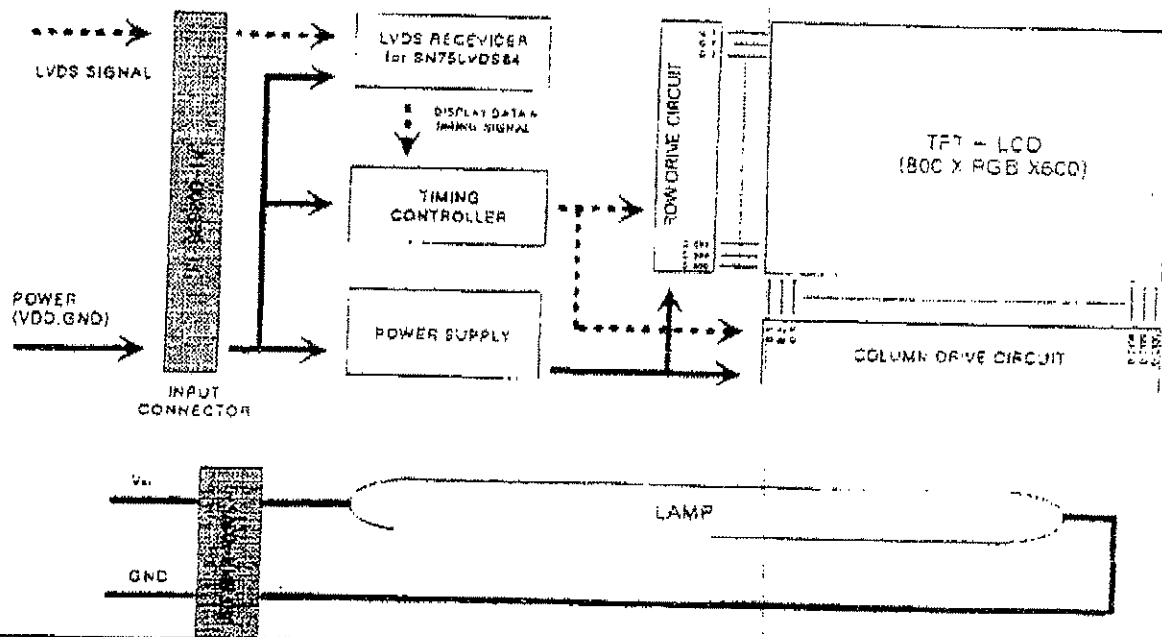
1. General Description

The LG Electronics model LP121S3-A LCD is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp (CCFL) system. This TFT-LCD 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 palette of more than 262,144 colors.

The LP121S3-A 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 LP121S3-A 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.

LP121S3-A BLOCK DIAGRAM



General Display Characteristics

The following are general feature of the model LP121S3-A LCD:

Active display area	12.1 inches(26cm) diagonal
Outsize dimensions	275 W x 199 H x 5.5 D mm Typ.
Pixel pitch	0.3075 mm * 0.3075 mm
Pixel format	800 horiz. By 600 vert. pixels
Color depth	RGB stripe arrangement
Display operating mode	6-bit
Surface treatment	transmissive mode, normally white
	hard coating(2H).
	anti-glare treatment of the front polarizer

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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°C
Logic Input Voltage	V_{LH}	0	$V_{DC}+0.3$	Vdc	at 25°C
Operating Temperature	T_{OP}	0	+50	°C	1
Storage Temperature	T_{ST}	-20	+60	°C	1

- Note: 1. The Relative Humidity must not exceed 80% non-condensing at temperatures of 50°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 49°C. 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 LP121S3-A 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 CCFL, 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}	-	252	410	mA	1
Ripple/Noise	-	-	-	60	mV	
Logic Input Level, High	V_{IH}	$0.6V_{DD}$	-	V_{DD}	Vdc	2
Logic Input Level, Low	V_{IL}	V_{SS}	-	$0.3V_{DD}$	Vdc	2
Power Consumption	P	-	1	1.4	W	1
BACKLIGHT						
Backlight Input voltage	V_{BL}	630	660	775	V_{RMS}	3
Backlight Current	I_{BK}	2.0	4.0	5.0	mA	
Lamp Kick-Off Voltage	-	945	-	-	V_{RMS}	25±2°C
Operating Frequency	F_{BL}	30	55	70	KHz	

- Notes: 1. The current draw and power consumption specified is for 3.3 Vdc at 25°C 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°C. 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°C. 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 2 OPTICAL CHARACTERISTICS

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	105	-	-		1
Surface Brightness, white (BL=4.0mA)	SB _w	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	T B D				
	y _R					
Green	x _G					
	y _G					
Blue	x _B					
	y _B					
White	x _w					
	y _w					
Viewing Angle (CR>10:1)						
x axis, right ($\Phi=0^\circ$)	θ			40	degree.	5
x axis, left ($\Phi=180^\circ$)	θ			40		
y axis, up ($\Phi=90^\circ$)	θ			10		
y axis, down ($\Phi=270^\circ$)	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 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_{ow} at each test position 1 through 5, and then dividing the maximum B_{ow} by the minimum B_{ow}.

$$\frac{\text{Maximum (B}_{ow1}, \text{B}_{ow2}, \dots, \text{B}_{ow5})}}{\text{Minimum (B}_{ow1}, \text{B}_{ow2}, \dots, \text{B}_{ow5})}}$$

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

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which is normal to the LCD surface. For more information see Appendix A.

5. Interface Connections

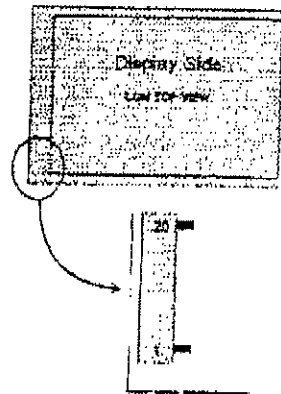
This LCD employs two interface connections, a 20 pin connector is used for the module electronics and a three pin connector is used for the integral backlight system.

The electronics interface connector is a model FI-SEB20P-HF, manufactured by JAE. The pin configuration for the connector is shown in the table below.

Table 3 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	Rin0 -	Receiver signal (-)	Red Data R0 ~ R5, G0
6	Rin0 +	Receiver signal (+)	Red Data R0 ~ R5, G0
7	GND	Ground	
8	Rin1 -	Receiver signal (-)	Green Data G1 ~ G5, B0 ~ B1
9	Rin1 +	Receiver signal (+)	Green Data G1 ~ G5, B0 ~ B1
10	GND	Ground	
11	Rin2 -	Receiver signal (-)	Blue Data B2 ~ B5, Hsync, Vsync, DE
12	Rin2 +	Receiver signal (+)	Blue Data B2 ~ B5, Hsync, Vsync, DE
13	GND	Ground	
14	CLK -	Clock signal (-)	Main Clock
15	CLK +	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 BHR-03VS-1, manufactured by JST. The mating connector part number is SM02(8.0)B-BHS-1-TB or equivalent. The pin configuration for the connector is shown in the table below.

Table 4 BACKLIGHT CONNECTOR PIN CONFIGURATION

Pin	Symbol	Description	Notes
1	HV	Lamp power input	1
2	NC	No connect	
3	LV	Ground	

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

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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.

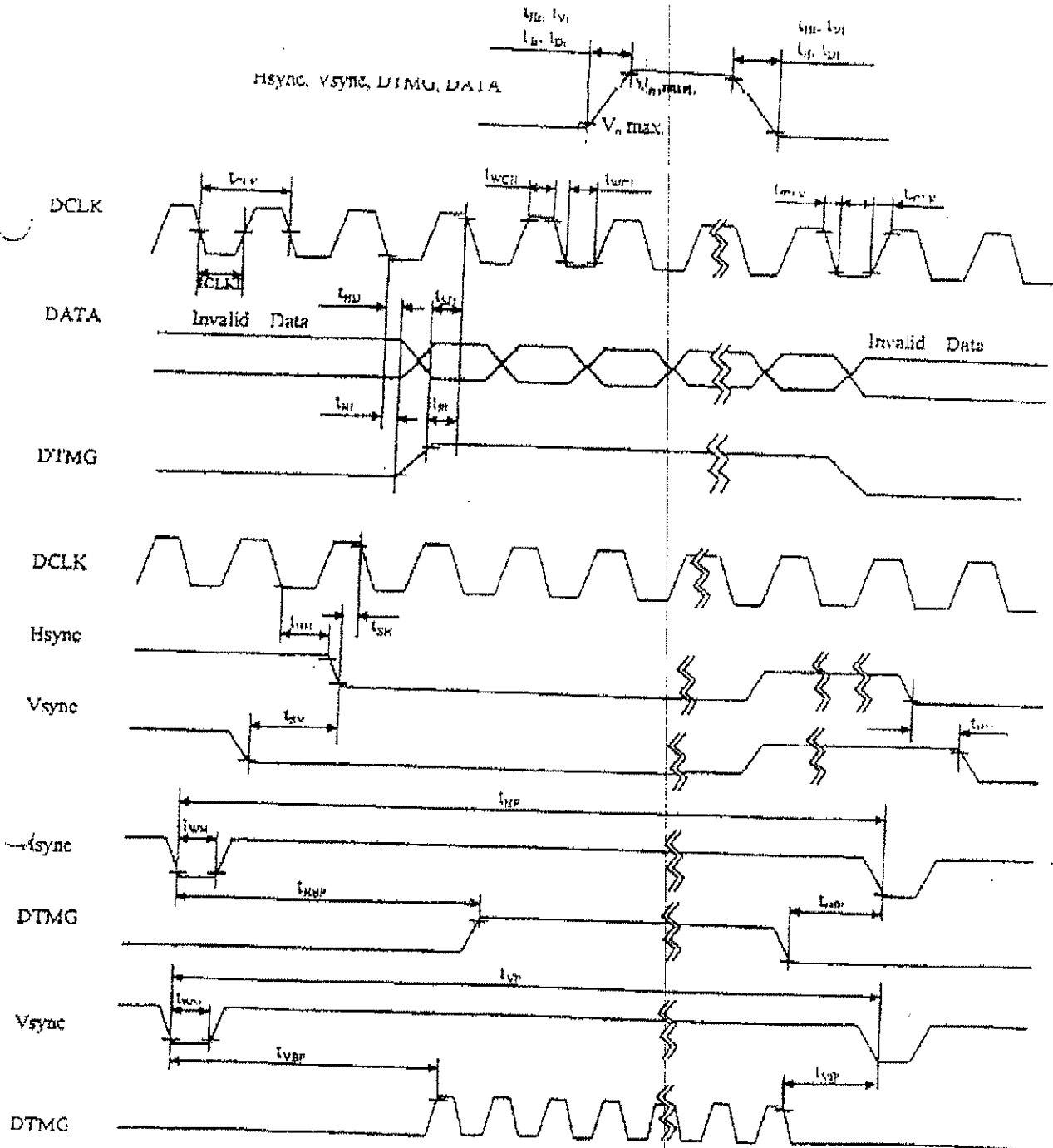
ITEM	Symbol	Value			Units	Notes	
		Min.	Typ.	Max.			
DCLK	Period	tCLK	25	(26)	-	ns	D=tCLKL /tCLK
	Width-Low	tWCL	5	-	-	ns	
	Width-High	tWCH	5	-	-	ns	
	Rise Time	tRCLK	-	-	25	ns	
	Fall Time	tFCLK	-	-	25	ns	
	Duty	D	0.45	0.5	0.55	-	
	Hsync	Set-up Time	tSH	3	-	-	
Hold Time		tHH	8	-	-	ns	
Period		tHP	990	(1024)	1200	tCLK	
Width-Active		tWH	12	-	128	tCLK	
Vsync	Rise/Fall Time	tHr,tHf	-	-	30	ns	for Hsync
	Set-up Time	tSV	0	-	-	tCLK	
	Hold Time	tHV	2	-	-	tCLK	
	Period	tVP	603	(625)	730	tHP	
	Width-Active	tWV	1	-	24	tHP	
DTMG	Rise/Fall Time	tVr,tVf	-	-	50	ns	for DCLK
	Set up Time	tSI	3	-	-	ns	
	Hold Time	tHI	8	-	-	ns	
	Rise/Fall Time	tIr,tIf	-	-	30	ns	
	Horizontal Back Porch	tHBP	32	-	-	tCLK	
	Horizontal Front Porch	tHFP	16	-	-	tCLK	
	Vertical Back Porch	tVBP	0	-	-	tHP	
	Vertical Front Porch	tVFP	3	-	-	tHP	
DATA	Set up Time	tSD	3	-	-	ns	for DCLK
	Hold Time	tHD	8	-	-	ns	
	Rise/Fall Time	tDr,tDf	-	-	25	ns	

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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)



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8. Color Input Data Reference

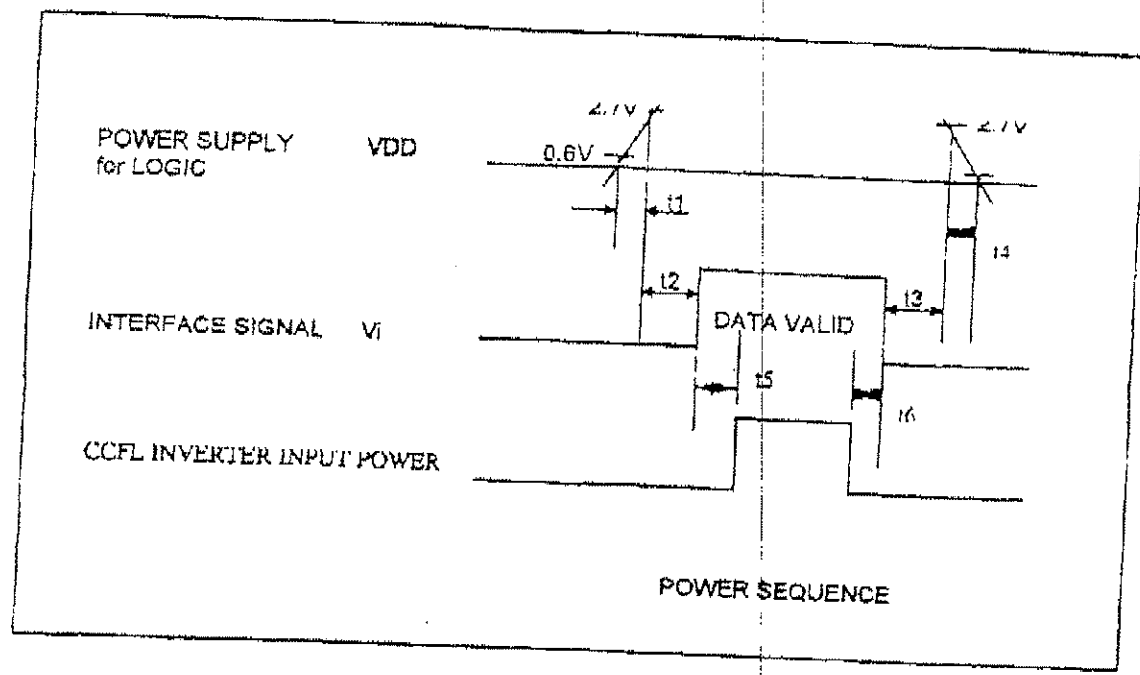
The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 5 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	1	1	1	1	1
	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	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	0	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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	0
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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

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9. Power Sequence



$t1 \leq 40\text{msec}$, $0 < t2 \leq 50\text{msec}$, $0 < t3 \leq 50\text{msec}$, $t4 < 1\text{sec}$, $1 < t5 < 2\text{sec}$, $1 < t6 < 2\text{sec}$

* Set 0 Volt $< Vi(t) \leq V_{DD}(t)$

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.

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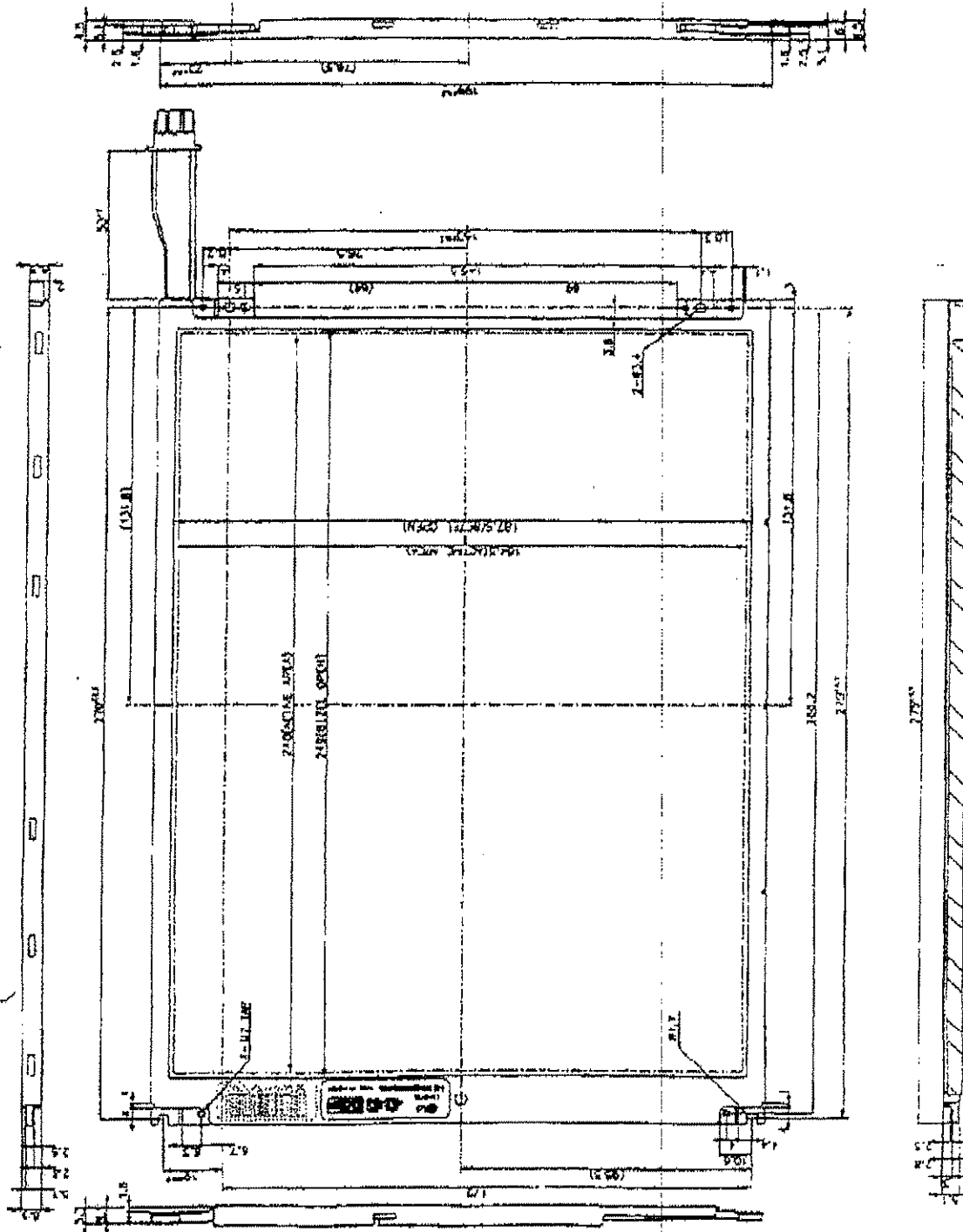
10. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LP121S3-A 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.

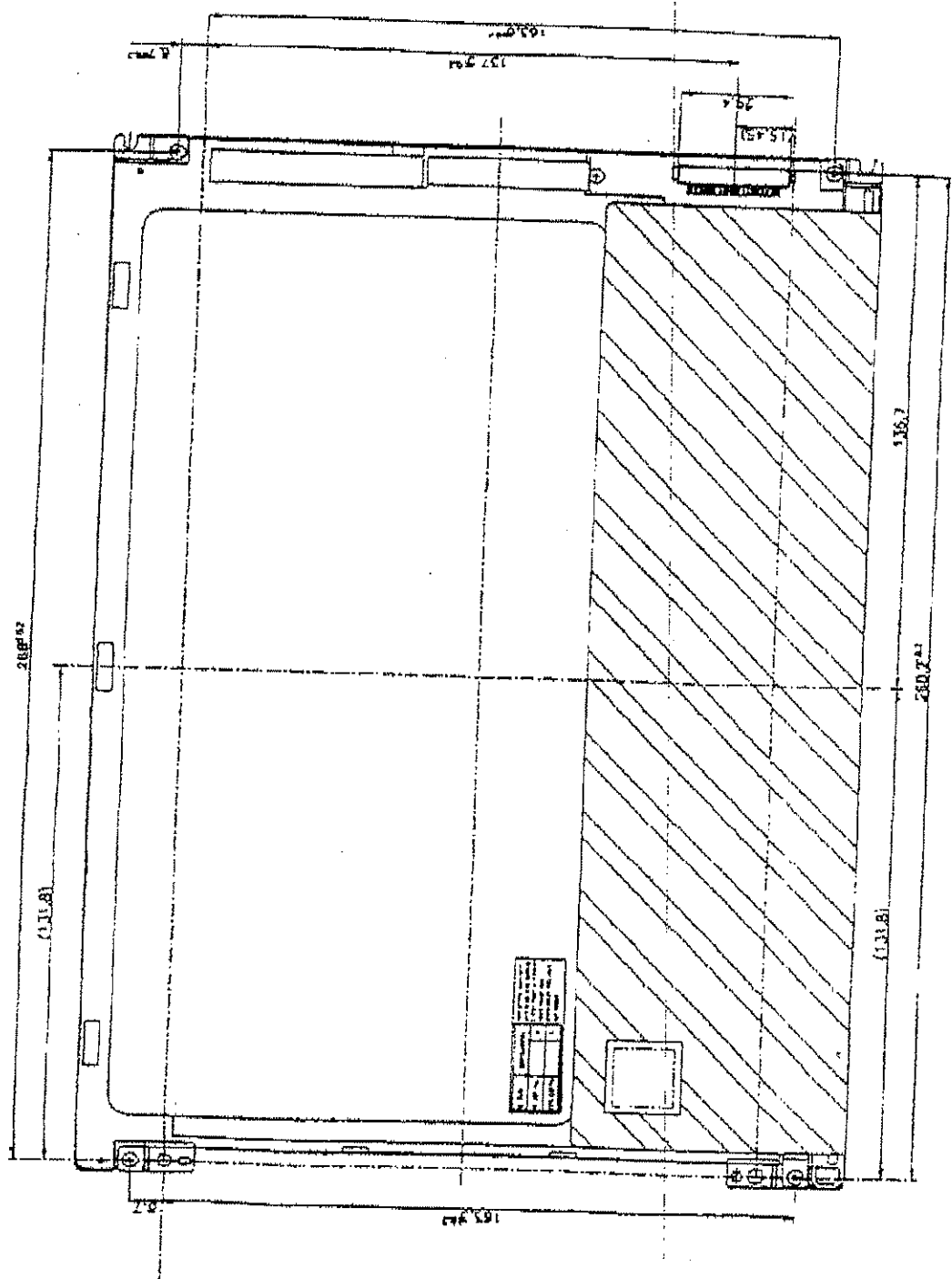
Outside dimensions	Width	275 mm
	Height	199 mm
	Thickness	6.5 mm
Active Display area	Width	246 mm
	Height	184.5 mm
	Diagonal	307.34 mm
Weight (approximate)		450 gram max.



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Product Specification





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11. Reliability

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 60°C 240h
2	Low temperature storage test	Ta = 25°C 240h
3	High temperature & high humidity operation test	Ta = 40°C 95% 240h (no condensation)
4	High temperature operation test	Ta = 50°C 240h
5	Low temperature operation test	Ta = 0°C 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.

Product Specification

<Definition of viewing angle range>

