Specification
for
Approval

( ) Preliminary Specification

(o) Final Specification

Product Name	Mega 14 (14.1 inch XGA Color TFT LCD Module of LG)
Model Name	LP141X2-B

Please return 1 copy for our confirmation
with your signature.

This document is preliminary. All of the informations in this document are subject to change
without notice to improve the specification.

Contents

Record of Revision

VERSION & Date	DESCRIPTION
1. Ver 1.0 : 97/08/25	Original
2. Ver 1.1 : 97/10/29	Update Drawing and Error
3. Ver 1.2 : 97/11/13	Add B/L Inverter power sequence

1. General Description

This product, Mega 14 , is a color active matrix LCD module. The LCD module employs an amorphous silicon TFTs as an active element for displaying. The module is composed of TFT LCD panel , Back light unit , driving circuitry including drive IC and the power supply circuit .

Information is being displayed on the screen of XGA resolution with the diagonal measurement of 14.1 inch.

The LCD module also can realize the number of 262,144 colors by supplying 18 bits of data signals .

In addition to the data signal , some timing control signals and power supply voltage for the circuit are required for the LC (liquid crystal) and the back light unit , respectively.

Mega 14 is intended to support applications where the low power consumption, light weight and thickness are required . In combination with the Panel-Link interface, Mega 14 characteristics provide an excellent quality of display for the office automation products such as the portable computers.

DC-AC inverter for the back light driving unit is not built in to this module.

CLK(±)

Y3(±)

Y2(±)

Y1(±)

POWER

VBL

General Display Characteristics

The general feature of the model LP141X2-B are as following

Active display area	14.1 inches Diagonal
Outsize dimensions	298.5(W)×227.0(H)×8.7(D)mm Typ. (0.5 Tolerable)
Pixel pitch	0.28 mm × 0.28 mm
Pixel format	768 Vert. by 1024 Hori. pixels
	RGB vertical stripe arrangement
Color depth	6-bit, 262K colors
Display operating mode	Transmissive mode, normally white
Weight	650 g Typ.
Surface treatments	Hard coating(3H) and anti-glare treatment

2.Maximum Rating

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

Table 1 ABSOLUTE MAXIMUM RATINGS

Vss=0

Parameter	Symbol	Values		Units	Notes
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	Vdc	at 25
	V_{AA}	-0.3	+6.0	Vdc	
Operating Temperature	T_{OP}	0	50		1
Storage Temperature	T_{ST}	-20	60		1

Note: 1. The Relative Humidity must not exceed 95% non-condensing at temperatures of 40 . At temperatures greater than 40, the wet bulb temperature must not exceed 39.

3. Electrical Specifications

The LP141X2-B requires two kinds of external power inputs. one is to power the drive circuit.

The other ,is to power the backlight CCFT, which is typically generated by an inverter .

Table 2 ELECTRICAL CHARACTERISTICS:

Parameter	Sym.	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE :						1
Logic Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	
	I_{CC}		(430)	(500)	mA	
Logic Power Supply Current	Zm	90	100	110	ohm	
Defferential Impedence						2
	V_{BL}	(650)	690	750	V_{RMS}	
BACKLIGHT Unit:	I_{BL}	(2.0)	3.2	5.0	mA	
Lamp Input voltage	V_{BK}		1100		V_{RMS}	252
Lamp Current			1300		V_{RMS}	02
Lamp Kick-Off Voltage	F_{BL}	(40)	55	(60)	KHz	
	LBL	10000			Hrs	
Operating Frequency						
Lamp Life time						

Notes:

1. Operating Temp. range : 0 ~ 50
2. The used connector : BHSR-02VS-1 (JST)
   Mating connector : SM02(4.0)B-BHSS-1-TB (JST) or equavalent.

4. Optical Specifications

Optical characteristics are determined after the unit has been turned 'ON' and stable for approximately 30 minutes in a dark environment at 25. The values specified are at an approximate distance of 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.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		K	Center	150	300	-		* 1
Surface Brightness		Bsf	IBL=3.0mA	50	70	-	cd/m	* 2
			IBL=4.5mA	70	90	-		
Response Time	Rising	Tr		-	15	30	ms	* 4
	Falling	Tf		-	25	50	ms	
Viewing Angle	Horizontal	x	K > 10	40			degree	* 5
	Vertical	yu		10				
		yd		30				
Chromaticity		Xw	= 0		0.330			0.03
		Yw			0.330			
		X_R			0.590			
		Y_R			0.340			
		X_G			0.330			
		Y_G			0.530			
		X_B			0.150			
		Y_B			0.110			
Brightness Variation		B_V				1.45		* 3

Notes 1. Contrast Ratio is defined mathematically as following

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

2. Surface brightness is the average of 9 points measured at a distance of 50cm away from the surface under the full white condition of all pixels in supplying current as conditions.

3. The brightness variation B_V is defined as following (Refer to Appendix A-1)

$$\frac{\text{The Maximum value of 9 points luminance}}{\text{The Minimum value of 9 points luminance}}$$

4. Response time is required for the display to transition from white to black (Rise Time, Tr_R) and from black to white (Decay Time, Tr_D). Please refer to Appendix A-2

5. Viewing angle is the angle at which the contrast ratio is greater than 10. Please refer to Appendix A-3

5.Interface Pin configuration

The electronics interface connector is a model FI-SEB20P-HF , manufactured by JAE
The mating connector part number is FI-S20S (JAE) or equivalent.
The pin configuration for the interface are shown in the table below.

INTERFACE PIN CONFIGURATION

Pin	Symbol	Description	Notes
1	Vcc	Logic Power supply voltage	3.3V
2	Vcc	Logic Power supply voltage	
3	Vcc	Logic Power supply voltage	
4	Vcc	Logic Power supply voltage	
5	DGND	Ground	
6	DGND	Ground	
7	DGND	Ground	
8	DGND	Ground	
9	Y1M	Differential input data pairs	R0~R5,G0
10	Y1P	Differential input data pairs	
11	DGND	Ground	
12	Y2M	Differential input data pairs	G1~G5,B0,B1
13	Y2P	Differential input data pairs	
14	DGND	Ground	
15	Y3M	Differential input data pairs	B2~B5,H,V,E
16	Y3P	Differential input data pairs	
17	DGND	Ground	
18	CLKM	Differential input clock pairs	
19	CLKP	Differential input clock pairs	
20	DGND	Ground	

6. Signal Timing Specification

This is the signal timing required at the input of the control Asic concerned with LVDS as
a Flat link or equaivalant.
All of the interface signal timing should be satisfied with the following specifications
based on the VESA timing guideline (1024 x 768 @ 60 Hz) for it's proper operation.
LP141X2-B with LVDS transmitter recommend to connect the Display Enable,Horizontal sync,Vertical

sync, Clock signal from Vedio signal controller to input of Transmitter simultaneously.

Signal	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Dclk	Period	Tclk	15	15	15	ns	1
	Duty ratio (% high)	Kdr	40	50	60	%	
	Rise Time	Trck	1.6	2.0	2.3	ns	
	Fall Time	Tfck	0.9	1.1	1.4	ns	
DE(DTMG)	Setup time	Tsde	4	-	-	ns	
	Hold time	Thde	5	-	-	ns	
	Horizontal Period	Thp	1280	1344	1364	Tclk	
	Horizontal blank Period	Twhp	315	320	325	Tclk	
	Vertical Period	Tvp	33	38	44	Thp	
	Vertical Blank Period	Twvp	801	806	812	Thp	
Hsync	Hsync Back porch	Hbp	160	160	160	Tclk	
	Hsync front porch	Hfp	20	24	45	Tclk	
	Horizontal Active Period	Twha	1024	1024	1024	Tclk	
Vsync	Vsync Back porch	Vbp	29	29	29	Thp	
	Vsync front porch	Vfp	1	3	6	Thp	
	Vertical Active Period	Twva	768	768	768	Thp	
Data	Setup Time	Tsd	3.5	4	-	ns	
	Hold Time	Thd	3.5	4	-	ns	
	Rise	Trd	3.2	3.9	4.5	ns	
	Fall Time	Tfd	1.4	1.7	2.1	ns	

Notes: 1. Dclk values are required for LVDS applications
Dclk jitter requirement for transmitter : max. 2.0 ns
LVDS used for Rx : SN75LVDS86 or equivalant (Tx : SN75LVDS84 or equivalant)

7. Signal Timimg Wave forms

Vsync

Vbp

Vfp

Tvp

Twvb

Twva

DE

Thp

Twhb

Twha

DE

Hbp

Hfp

Hsync

Dclk

Data Invalid 1 2 3 103 104 105 1023 1024 Invalid 1 2

Tclk

Dclk

Tfck

Trck

Trd

Tsd

Thd

Tfd

Data

Tsde

Thde

DE

. 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 provide a reference for the color versus the data input.

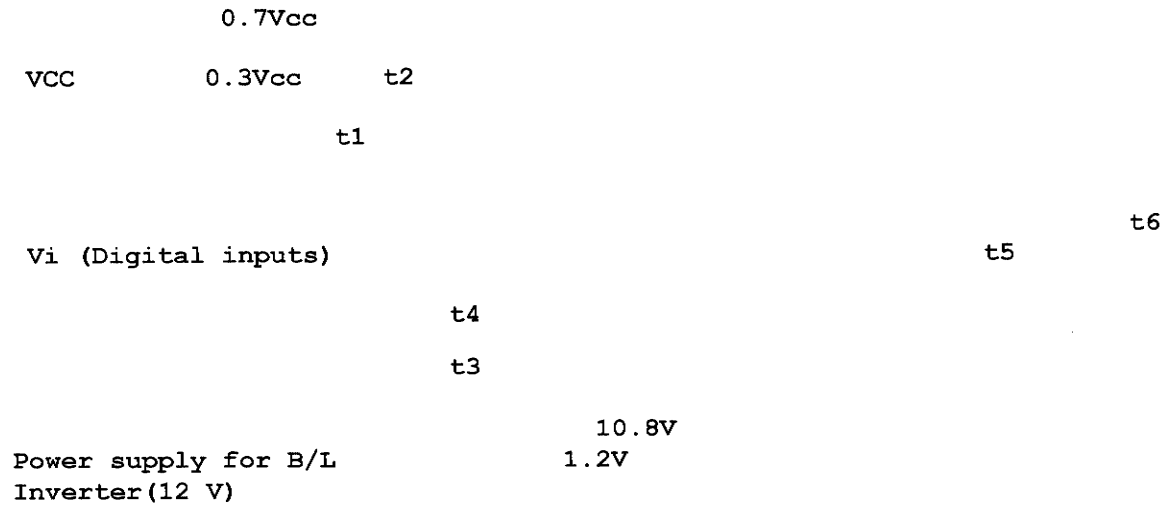
Table 5 COLOR DATA REFERENCE

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	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)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(61)	0	0	0	0	0	0	:	:	:	:	:	:	0	0	0	0	0	0
	:	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(02)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(01)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Green(00)																		
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

Note : Gray scale L(0) is the darkest and L(63) is the brightest.

9. Power Up/Down Sequence

The supplies must be powered up and down as indicated or the device may be damaged permanently.



* Turn on sequence : GND - V_{CC} - Digital inputs
  Turn off sequence : Digital inputs - V_{CC} - GND
  - t1 : 10 ns ~ 1 ms
  - t2 : 5 us ~ 30 ms
  - t3, t4 : 10 ms ~ 50 ms
  - t5, t6 : 5 ms ~ 35 ms
* Set 0 Volt < Vi(t) < V_{CC}(t)
  Here Vi(t), V_{CC}(t) indicate the transitive state of Vi, V_{CC} when power 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 V_{CC} to 0 V.
3. Back light inverter power must be turn on after power supply for logic and interface signal are valid.
Back light inverter power must be turn off before power supply for logic and interface signal are valid.

10. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LP141X2-B LCD.
The surface of the LCD has an anti-glare coating to minimize reflection and a 2H hard

coating to reduce scratching.

Parameters	Specifications	Unit	Notes
Unit Outline dimension	298.5(W) × 227.0(H) × 8.7(D)	mm	0.5 tolerable
Bezel opening Area	289.7(W) × 217.3(H)	mm	0.5 Tolerable
Display part			
Effective Display Area	285.7(W) × 214.3(H)	mm	
Screen size	14.1	inch	
Pixel pitch	0.279	mm	
Number of pixels	1024 × R,G,B x 768		
Pixel configuration	RGB vertical stripes		
Back light part			
Lamp wire length	120	cm	
Weight	650	gram	
Surface treatment	Anti-glare and Hard coating(2H)		

* Consider 0.5 mm of pivot height on the left side in horizontal axis .

11. precautions

11-1 Handling

1) Be sure to turn off the power when connecting or disconnecting the circuit.

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

3) Clean the LCD surface with a soft material (ie.cotton ball) should the surface become dirty.

4) Protect the module from the ESD as it may damage the electronic circuit (C-MOS). Make certain that the treatment person's body is grounded through the 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 is not to be exposed direct sunlight.

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

11-2 Safety

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

2) As back light unit has high voltage circuit internally, do not disassemble the module and do not insert the foreign materials into the module.

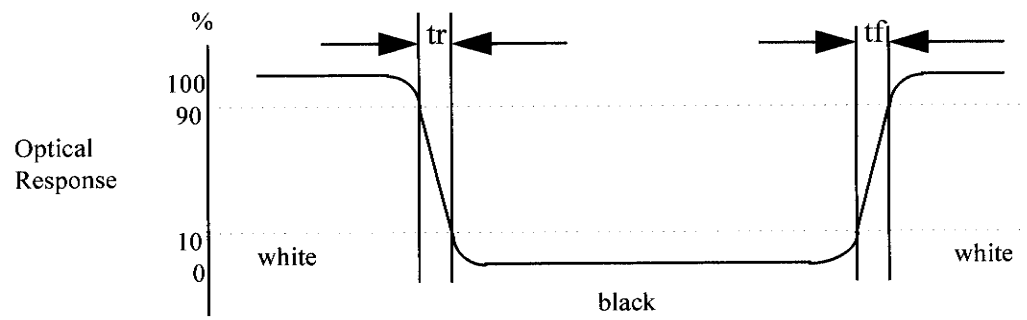
A-1 Brightness

<measuring point> Effective Display Area

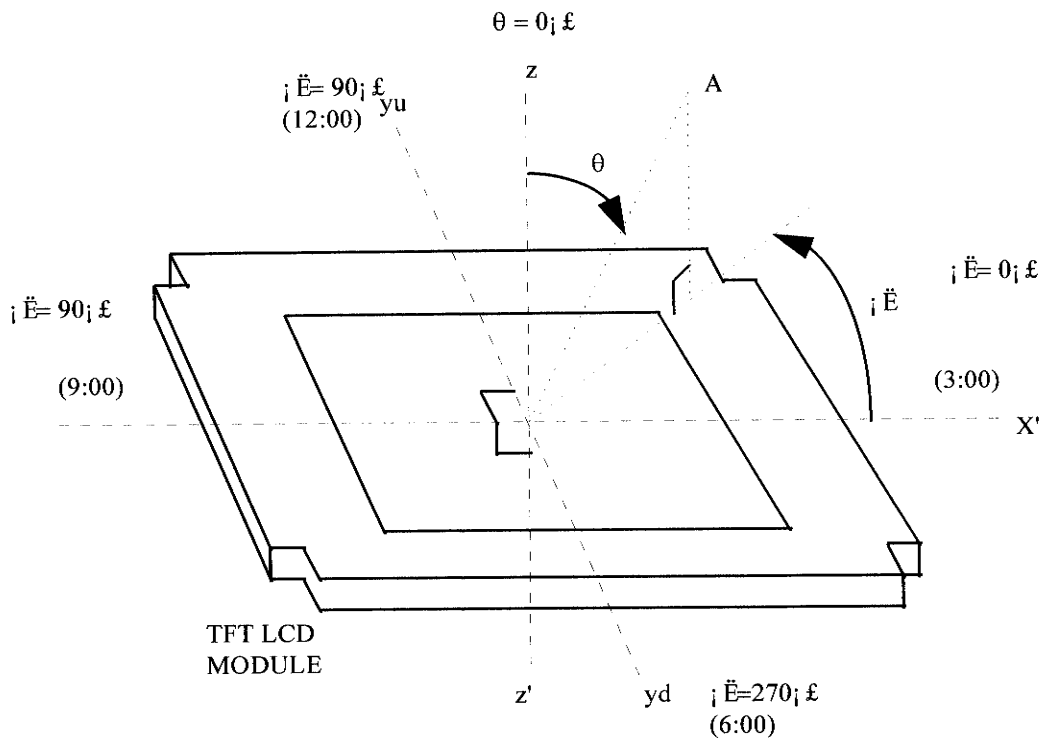
1/4	2/4	3/4	
1	2	3	1/4
4	5	6	2/4
7	8	9	3/4

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 Definition of viewing angle range



A-4.Outline Drawing

A-5 Data Map of Flat link with 65554

Pin connection between 65554 - Tx					Interface between Tx - Rx	
65554		*SN74LVDS84*				
Pin	*Data*	*Data*	*Pin*	*No*	*LVDS84*	*LVDS86*
P0	B0	BO			CLKP	CLKP
P1	B1	B1			CLKM	CLKM
P2	B2 (B0)	B2 (B0)	D12		Y3P	A3P
P3	B3 (B1)	B3 (B1)	D13		Y3M	A3M
P4	B4 (B2)	B4 (B2)	D14		Y2P	A2P
P5	B5 (B3)	B5 (B3)	D15		Y2M	A2M
P6	B6 (B4)	B6 (B4)	D16		Y1P	A1P
P7	B7 (B5)	B7 (B5)	D17		Y1M	A1M
P8	G0	G0			BLANK	
P9	G1	G1				
P10	G2 (G0)	G2 (G0)	D6			
P11	G3 (G1)	G3 (G1)	D7			
P12	G4 (G2)	G4 (G2)	D8			
P13	G5 (G3)	G5 (G3)	D9			
P14	G6 (G4)	G6 (G4)	D10			
P15	G7 (G5)	G7 (G5)	D11			
P16	R0	R0				
P17	R1	R1				
P18	R2 (R0)	R2 (R0)	D0			
P19	R3 (R1)	R3 (R1)	D1			
P20	R4 (R2)	R4 (R2)	D2			
P21	R5 (R3)	R5 (R3)	D3			
P22	R6 (R4)	R6 (R4)	D4			
P23	R7 (R5)	R7 (R5)	D5			
SHFCLK	SHTCLK	SHTCLK	IDCK			
FLM	VSYNC	VSYNC	D19			
LP	HSYNC	HSYNC	D18			
DE	DE	DE	D20			

Transmitter Pin Config

No	Sig	No	Sig	No	Sig	No	Sig	No	Sig	No	Sig	No	Sig	No	Sig
1	R4	7	G2	13	B0	19	B4	25	ENAB	31	LGND	37	LVCC	43	NC
2	Vcc	8	Vcc	14	Vcc	20	B5	26	MCLK	32	CLKP	38	A1P	44	R0
3	R5	9	G3	15	B1	21	Vcc	27	Vcc	33	CLKM	39	A1M	45	R1
4	G0	10	G4	16	B2	22	HSYN	28	PGND	34	A2P	40	A0P	46	GND
5	GND	11	GND	17	GND	23	VSYN	29	PVCC	35	A2M	41	A0M	47	R2
6	G1	12	G5	18	B3	24	GND	30	PGND	36	GND	42	GND	48	R3