

SPECIFICATION

For

APPROVAL

(♦) Preliminary Specification

() Final Specification

Title	14.1" XGA TFT LCD
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BUYER NAME	ARIMA
MODEL NAME	

SUPPLIER	LG Electronics Inc.
MODEL NAME	LP141X5-A

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

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Technical Design Guide
for LP141X5-A

Product Name	Mega 14 (14.1" XGA Color TFT LCD Module of LG)
Model Name	LP141X5-A

(Ver 1.1)

This document is preliminary. All of the information in this document are subject to change without notice to improve the specification.
Please contact LG Electronics and confirm before designing your system

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Record of Revision

VERSION & Date	Page	DESCRIPTION
1. 01.Oct.1998 Ver 1.0		Initial Release
2. 09.Dec.1998	10 Page	1. Signal Timing Wave Forms : Add note 1.
Ver 1.1	12 Page	2. Power Up/Down Sequence : Changed Time T1, T2, T3 Add T4, T5, Power On/Off Time and note 3.
	17 Page	3. Changed Lamp Wire Length : 60 mm .105 mm

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 Flat-Link interface, **Mega 14** characteristics provide an excellent quality of display for the office automation products such as the portable computers.

CLK($\pm$)

Y3($\pm$)

Y2($\pm$)

Y1($\pm$)

POWER

VBL

General Display Characteristics

The general feature of the model LP141X5-A are as following

Active display area	14.1 inches Diagonal
Outsize dimensions	298.5(W) $\times$ 227.5 (H) $\times$ 6.9 (T)mm Typ.
Pixel pitch	0.279 mm $\times$ 0.279 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	610 g Typ. $\pm$ 20
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

V_{ss}=0 [V]

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Parameter	Symbol	Values		Units	Notes
		Min.	Max.		
Power Supply Voltage	V_{cc}	-0.3	+4.0	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 40. .
At temperatures greater than 40., the wet bulb temperature must not exceed 39..

3. Electrical Specifications

The LP141X5-A 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	
Logic Power Supply Current	I_{cc}		350	450	mA	
Ripple /Noise (Vcc)	V_r		50		mV	
Differential Impedence	Z_m	90	100	110	ohm	
Surge current (20 mS)	I_r		1. 3	1.7	A	
						2,3
BACKLIGHT Unit:						
Lamp Input voltage	V_{BL}	700	730	840	V_{RMS}	4
Lamp Current	I_{BL}	2.0	5.0	6.0	mA	25±2.
Lamp Kick-Off Voltage	V_{BK}		1100		V_{RMS}	0±2.
			1350		V_{RMS}	
Operating Frequency	F_{BL}	40	55	80	KHz	
Lamp Life time	L_{BL}	10000			Hrs	

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 equivalent.
3. Lamp Turn on delay time : 1 Sec (After input power to the Lamp.)
It is recommended to keep on applying for 1 second.
4. Back light current consumption shown above does not include the loss of external inverter.
5. Back light pin configuration

No	Symbol	Description	Notes
1	HV	Low Power Input	White
2	LV	Ground	Black

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.

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Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		K	Center	100	200	—		* 1
Surface Brightness		Bsf	IBL=5.0mA	100	120	—	cd/m ²	* 2
Response Time	Rising	Tr		—	15	30	ms	* 4
	Falling	Tf		—	25	50	ms	
Viewing Angle	Horizontal	éx	K > 10	≈40			degree	* 5
	Vertical	éyu		10				
		éyd		30				
Color Coordinates		Xw	é = 0.		0.313		≈0.03 Tolerable	
		Yw			0.348			
		XR			0.580			
		YR			0.349			
		XG			0.312			
		YG			0.549			
		XB			0.155			
		YB			0.133			
Brightness Variation		Bv				1.75		* 3

Notes 1. Contrast Ratio is defined mathematically as following

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

- Surface brightness is the average of 5 points measured at a distance of 50cm away from the surface under the full white condition of all pixels in supplying current as conditions.
- The brightness variation B_v is defined as following (Refer to Appendix A-1)

$$\frac{\text{The Maximum value of 13 points luminance}}{\text{The Minimum value of 13 points luminance}}$$
- 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
- 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
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1	Vdd	Power supply 3.3 v	
2	Vdd	Power supply 3.3 v	
3	Vss	Ground	
4	Vss	Ground	
5	Rin0-	Differential input data pairs	
6	Rin0+	Differential input data pairs	
7	Vss	Ground	
8	Rin1-	Differential input data pairs	
9	Rin1+	Differential input data pairs	
10	Vss	Ground	
11	Rin2-	Differential input data pairs	
12	Rin2+	Differential input data pairs	
13	Vss	Ground	
14	CLK-	Clock input data pairs	
15	CLK+	Clock input data pairs	
16	Vss	Ground	
17	NC		
18	NC		
19	Vss	Ground	
20	Vss	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 equivalent.

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 its proper operation.

LP141X5-A with LVDS transmitter recommend to connect the Display Enable, Horizontal sync, Vertical sync, Clock signal from Video signal controller to input of Transmitter simultaneously.

Signal	Parameter	Symbol	Min	Typ	Max	Unit	Remarks
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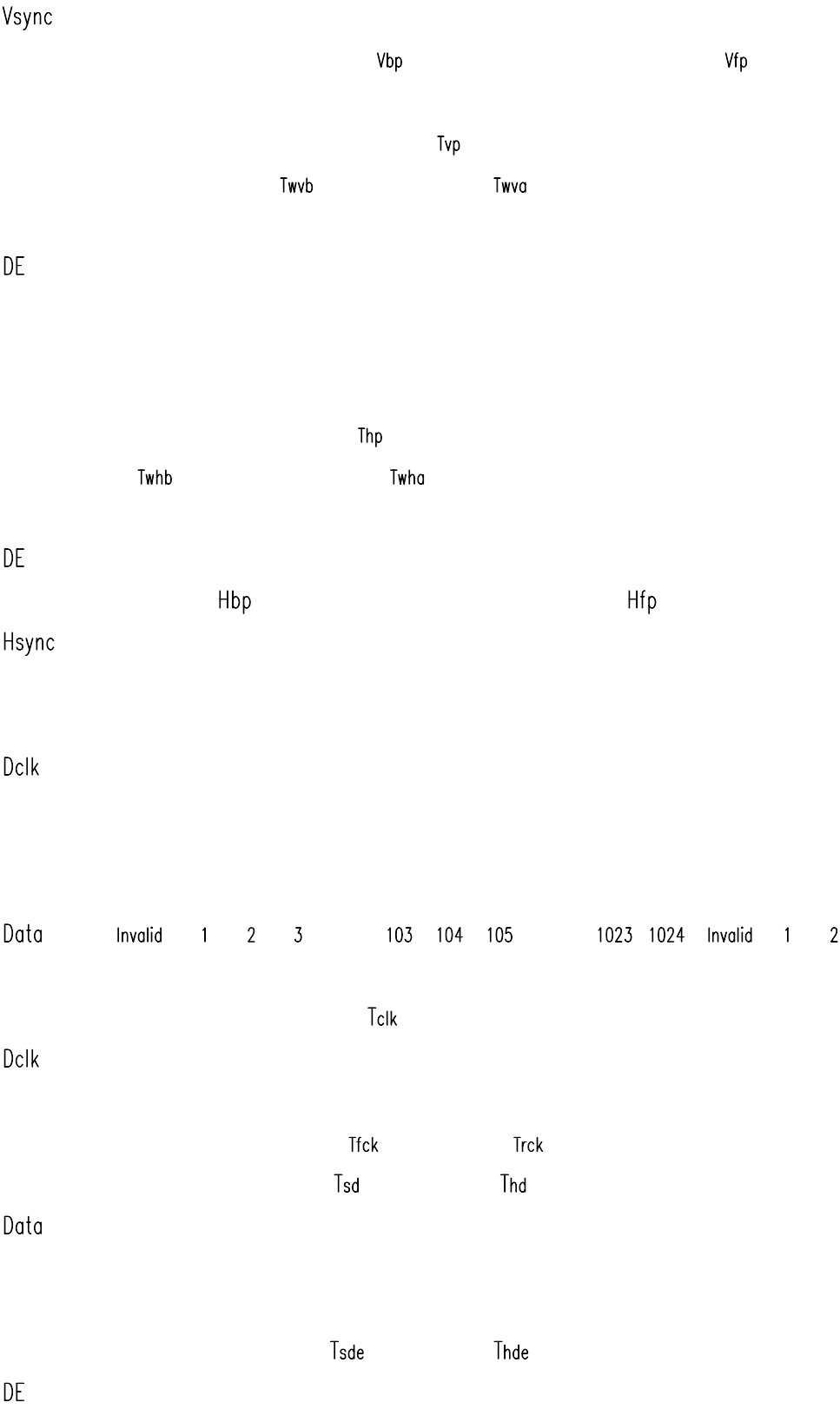
Dclk	Period	Tclk	15	ns	1
	Duty ratio (% high)	Kdr	40	50	60
	Rise Time	Trck	–	4.42	–
	Fall Time	Tfck	–	4.42	–
DE(DTMG)	Setup time	Tsde	2.5	7.6	–
	Hold time	Thde	2.5	3.0	–
	Horizontal Period	Thp	1280	1344	1364
	Horizontal blank Period	Twhb	315	320	325
	Vertical Period	Tvp	801	806	812
	Vertical Blank Period	Twvb	33	38	44
Hsync	Hsync Back porch	Hbp	160	160	160
	Hsync front porch	Hfp	20	24	45
	Horizontal Active Period	Twha	1024	1024	1024
Vsync	Vsync Back porch	Vbp	29	29	29
	Vsync front porch	Vfp	1	3	6
	Vertical Active Period	Twva	768	768	768
Data	Setup Time	Tsd	2.5	4.0	–
	Hold Time	Thd	2.5	4.0	–

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

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7. Signal Timimg Wave forms



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 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) 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

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

9. Power On/Off Sequence

t1640msec, 0.t2664msec, 0.t3664msec, 1.t462sec, 1.t562sec

* Set 0 Volt. $V_i(t) \text{ ó } V_{DD}(t)$

Here $V_i(t)$, $V_{DD}(t)$ indicate the transitive state of V_i , V_{DD} when power supply is turned ON of 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.

3. We need 3sec for main power ON/OFF that is forced.

Otherwise we can guarantee by 200msec as minimum during ID check.

10. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LP141X5-A LCD.

The surface of the LCD has an anti-glare coating to minimize reflection and a 2H hard

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coating to reduce scratching.

Parameters	Specifications	Unit	Notes
Unit Outline dimension	298.5(W) × 227.5(H) × 6.9(T)	mm	Typical
Bezel opening Area	289.8(W) × 218.4(H)	mm	±0.25 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 × 768		
Pixel configuration	RGB vertical stripes		
Weight	610	gram	
Surface treatment	Anti-glare and Hard coating(3H)		

* 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.

Appendix

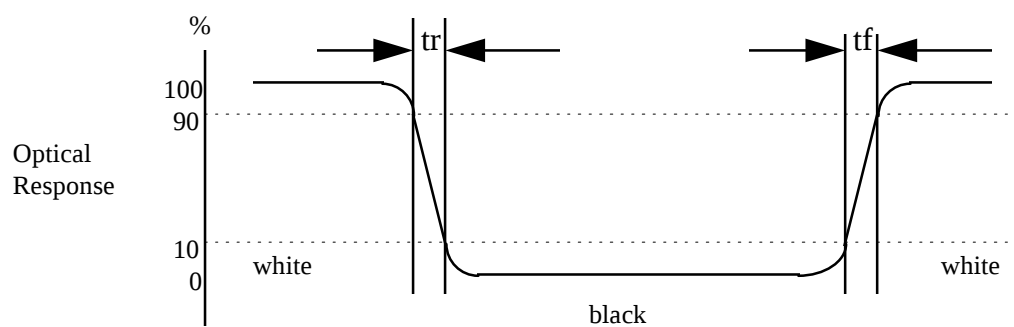
A-1 Brightness

<measuring point> Effective Display Area

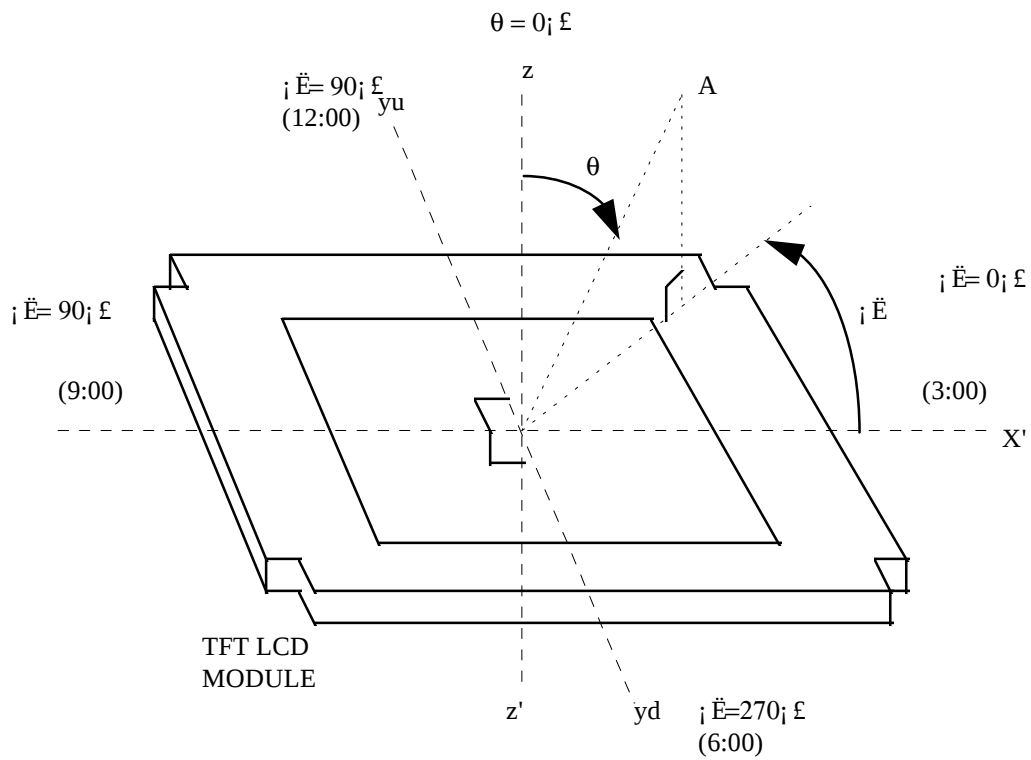
	10mm	Pixel 256	512	768	10mm
10mm	13		12		11
		10		9	
	8		7		6
		5		4	(Lines)
10mm	3		2		1

A-2 RESPONSE TIME

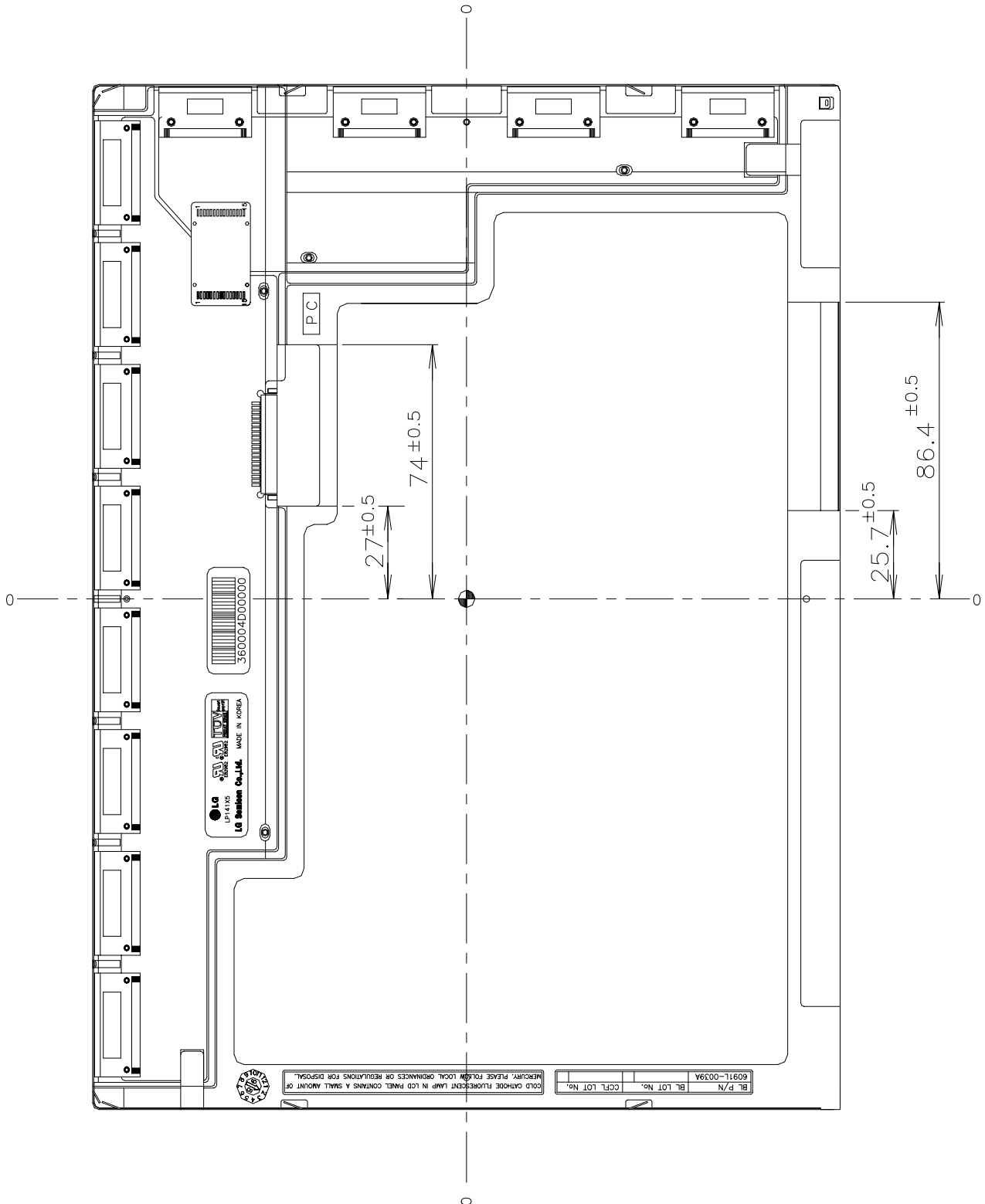
The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.



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	
<i>6 5 5 5 4</i>		<i>S N 7 5 L V D S 8 4</i>				
<i>P i n</i>	<i>D a t a</i>	<i>D a t a</i>	<i>P i n</i>	<i>N o</i>	<i>L V D S 8 4</i>	<i>L V D S 8 6</i>
P0	B0	B0			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	AOP	46	GND
5	GND	11	GND	17	GND	23	VSYN	29	PVCC	35	A2M	41	AOM	47	R2
6	G1	12	G5	18	B3	24	GND	30	PGND	36	GND	42	GND	48	R3