



LITEMAX AU2011

Sunlight Readable 20.1" LCD Display

(1st Edition 8/30/2007)

All information is subject to change without notice.

Approved by	Checked by	Prepared by
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Record Revision

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Handling Precautions

- 1) Since front polarizer is easily damaged, be extremely careful when handling panel.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connectors.
- 3) Wipe off water immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on a hard surface.
- 6) Since CMOS LSI is used in this module, be careful of static electricity by grounding those handling the display.
- 7) Do not open nor modify the module assembly.
- 8) Do not press or touch the panel surface with hands or tools.
- 9) Do not press or move the reflector sheet at the back of the module in any direction.
- 10) In case the module has to be put back into the packing container slot from where it was taken, do not press the center of the CCFL reflector edge. Instead, press at the far ends of the CCFL reflector edge softly. Otherwise the TFT module may be damaged.
- 11) **At the insertion or removal of the signal Interface Connector, be sure not to rotate nor tilt the interface connector of the TFT module.
- 12) After installation of the TFT module into an enclosure (Desktop monitor Bezel, for example), do not twist nor bend the TFT Module even momentarily. Design the enclosure so that no bending/twisting forces are applied to the TFT module. Otherwise the TFT module may be damaged.

General Description

AU2011 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD panel, a driver circuit, and a backlight system. The screen format is intended to support the SVGA 800(H) x 600(V) screen and 16.7M colors (RGB 6-bits + HiFRC data). All input signals are TTL interface compatible. Inverter card of backlight is not included. AU2011 is designed for a display unit of personal computer.

Display Characteristics

NO.	Item	Specification	Remark
1	Display resolution(pixel)	800x3(H)x600(V)	
2	Display Mode	TN Type, Normally White + SWV Film	
3	Active area (mm)	408(H)x306(V)	
4	Screen size (inch)	20.1(Diagonal)	
5	Pixel pitch (mm)	0.51(H)x0.51(V)	
6	Color configuration	R. G. B. Vertical stripe	
7	Display Color	16.2M (6 bit + FRC)	
8	Typical white Luminance	1000 nit (typ.)	
9	Contrast ratio	700:1	
10	Color Gamut	72% typ. of NTSC coverage	
11	Response Time	16ms typ. (Tr+Tf)	
12	Electrical Interface	TTL 1 port	
13	Overall dimension (mm)	448(W)x347(H)x27(D)(max.)	Note 1
14	Weight (g)	4000	
15	Surface Treatment	Anti-Glare type	
16	RoHS	RoHS compliance	

Note 1: Refer to Fig. 1.

Electrical specifications

1.Pin assignment

P/N	Symbol	Function		P/N	Symbol	Function
1	NC			26	R0	Red Data
2	NC			27	GND	Ground
3	NC			28	G7	Green Data
4	GND	Ground		29	G6	
5	GND	Ground		30	G5	
6	Vcc	Power Input (+5.0V)		31	G4	
7	Vcc			32	GND	Ground
8	Vcc			33	G3	Green Data
9	Vcc			34	G2	
10	GND			35	G1	
11	HSYNC	Horizontal Sync.	Active	36		G0
12	VSYNC	Vertical Sync.	Low	37	GND	Ground
13	GND			38	B7	Blue Data
14	DE	Data Enable		39	B6	
15	GND			40	B5	
16	DCLK	Dot Clock		41	B4	
17	GND	Ground		42	GND	Ground
18	R7	Red Data (R7 :MSB)		43	B3	Blue Data
19	R6			44	B2	
20	R5			45	B1	
21	R4			46	B0	
22	GND	Ground		47	GND	Ground
23	R3	Red Data		48	GND	Ground
24	R2			49	NC	
25	R1			50	NC	

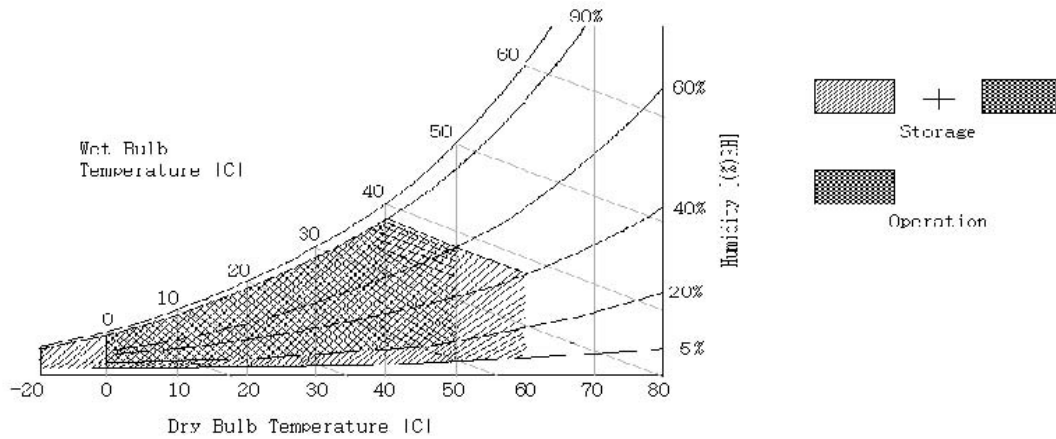
CN1 (50P) connector: Compatible with P-Two AF7501-N2G1Z

2. Absolute maximum ratings (GND = 0 V)

Parameter	Symbol	Values		Unit	Remark
		Min.		Max.	
Power voltage	V _{CC}	-0.3	5.5	V _{DC}	At 25°C
Input signal voltage	V _{LH}	-0.3	3.6	V _{DC}	At 25°C
Operating temperature	T _{OP}	0	+50	°C	Note 1
Storage temperature	T _{ST}	-20	+70	°C	Note 1

Note (1) The relative humidity must not exceed 90% *non-condensing* at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C. When operate at low temperatures, the brightness of CCFL will drop and the lifetime of CCFL will be reduced.

Note (2) The unit should not be exposed to corrosive chemicals.



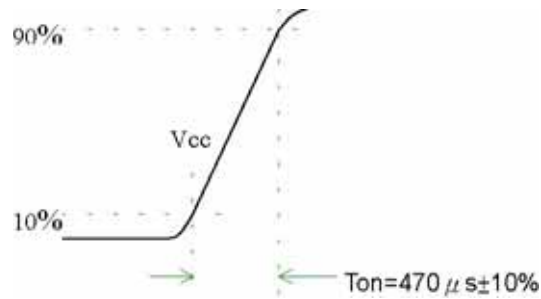
Electrical characteristics

Typical operating conditions

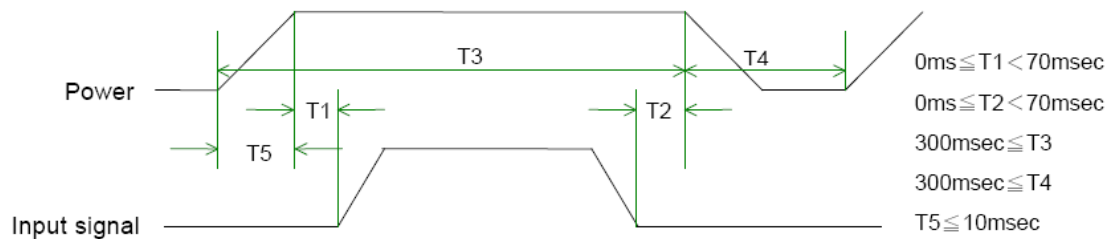
Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
Power supply voltage	Input voltage	V_{CC}	4.75	5.0	5.25	V	
	Current consumption	I_A	-	0.8	1.0	Arms	Note 1
	Inrush current	I_{RUSH}	-	-	3.0	Apeak	Note 2
	Power ripple voltage	V_{RP}	-	-	100	mVp-p	
Internal logic	Low voltage	V_{IL}	0	-	1.0	V	
	High voltage	V_{IH}	2.3	-	3.3	V	

Note 1: Effective value (mArms) at $V_{CC} = 5\text{ V}/25^\circ\text{C}$.

Note 2: Refer to the following power-on condition.



Sequence of Power-on/off and signal-on/off



Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

Caution

The above on/off sequence should be applied to avoid abnormal function in the display. In case of handling: Make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

b. Display color v.s. input data signals

Display colors		Data signal (0 : Low level, 1: High level)																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↕																								
	bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	↕																								
	bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	↕																								
	bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0

Note: Each basic color can be displayed in 256 gray scales using the 8 bit data signals. By combining the 24-bit data signals(R, G, B), the 16777216 colors can be achieved on the display.

Input signal timing

Timing diagrams of input signal are shown in Fig 2.

(1). Timing characteristics of input signals

DE mode

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Clock frequency	Fck	38	40	50	MHz	
Horizontal blanking	Thb1	235	256	500	Clk	
Horizontal display period	Thd	-	800	-	Clk	
Horizontal sync. period	Th	1035	1056	1300	Clk	
Vertical frequency	-	46	60	76	Hz	
Vertical blanking	Tvb1	20	28	150	Th	
Vertical display width	Tvd	-	600	-	Th	
Vertical sync. period	Tv	620	628	750	Th	

H/V mode

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Clock frequency	Fck	38	40	50	MHz	
Horizontal display period	Thd	1030	1056	1060	Clk	
Hsync front porch	Thf	184	210	214	Clk	
Hsync width+back porch	Thw+Thb	46	46	46	Clk	
Hsync blanking	Thb1	230	256	260	Clk	
Vsync period	Tv	628	628	628	Th	
Vsync front porch	Tvf	1	1	1	Th	
Vsync blanking	Tvb1	28	28	28	Th	

Item	Symbol	Value	Unit	Description
Horizontal display start	The	46	Clk	After falling edge of Hsync, counting 46 clk, then getting valid data from 47th clk 's data.
Vertical display start	Tve	27	Th	After falling edge of Vsync, counting 27T h, then getting 28th Th's data.

Note 1:Clock falling edge latch the data.

Note 2:H/V is negative polarity.

Display position

D(1,1)	D(2,1 )	.....	D(X,1 )	.....	D(799,1)	D(800,1)
D(1,2)	D(2,2 )	.....	D(X,2 )	.....	D(799,2)	D(800,2)
⋮		⋮	⋮	⋮
D(1,Y)	D(2,Y )	.....	D(X,Y )	.....	D(799,Y)	D(800,Y)
⋮		⋮	⋮	⋮
D(1,599)	D(2,599 )	.....	D(X,599 )	.....	D(799,599)	D(800,599)
D(1,600)	D(2,600 )	.....	D(X,600 )	.....	D(799,600)	D(800,600)

Backlight unit

The backlight system is an edge-lighting type with a CCFT (Cold Cathode Fluorescent Tube). The characteristics of a single lamp are shown in the following tables.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp voltage	V_L	720	800	880	Vrms	Note 1
Lamp current	I_L	4	6.5	7	mArms	Note 1
Power consumption	P_L	-	5.2x6	-	W	Note 2
Lamp starting voltage	V_s	-	-	1500(T=0°C)	Vrms	Note 3
				1150(T=25°C)		
Frequency	F_L	40	52	60	KHz	Note 4
Lamp life time	L_L	50000	-	-	Hr	Note 1, 5

Note (1) T= 25°C

Note (2) Inverter should be designed with the characteristic of lamp. When you are designing the inverter, the output voltage of the inverter should comply with the following conditions.

- (a) The area under the positive and negative cycles of the waveform of the lamp current and lamp voltage should be area symmetric (the symmetric ratio should be larger than 90%).
- (b) There should not be any spikes in the waveform.
- (c) The waveform should be sine wave as possible.
- (d) Lamp current should not exceed the maximum value within the operating temperature (It is prohibited to over the maximum lamp current even if operated in the non-guaranteed temperature). When lamp current over the maximum value for a long time, it may cause fire. Therefore, it is recommend that the inverter should have the current limited circuit.

Note (3) The inverter open voltage should be designed larger than the lamp starting voltage at T=0°C, otherwise backlight may be blinking for a moment after turning on or not be able to turn on. The open voltage should be measured after ballast capacitor. If an inverter has shutdown function it should keep its open voltage for longer than 1 second even if lamp connector is open.

Note (4) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note (5) Brightness ($I_L= 6.5\text{mA}$) to be decrease to the 50% of the initial value.

Note (6) CN2 connector (backlight): BHSR-02VS-1 (JST)
Mating connector: SM02B-BHS-1-TB (JST)

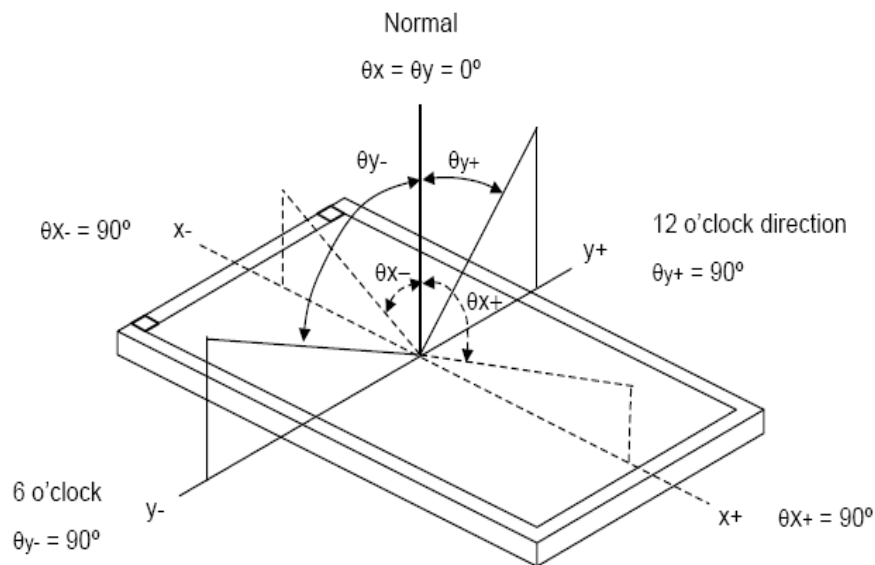
Pin no.	Symbol	Function	Remark
1	H	CCFL power supply (H.V.)	Cable color: Pink (central); Dark Gray others)
2	L	CCFL power supply (GND)	Cable color: White

Optical specifications

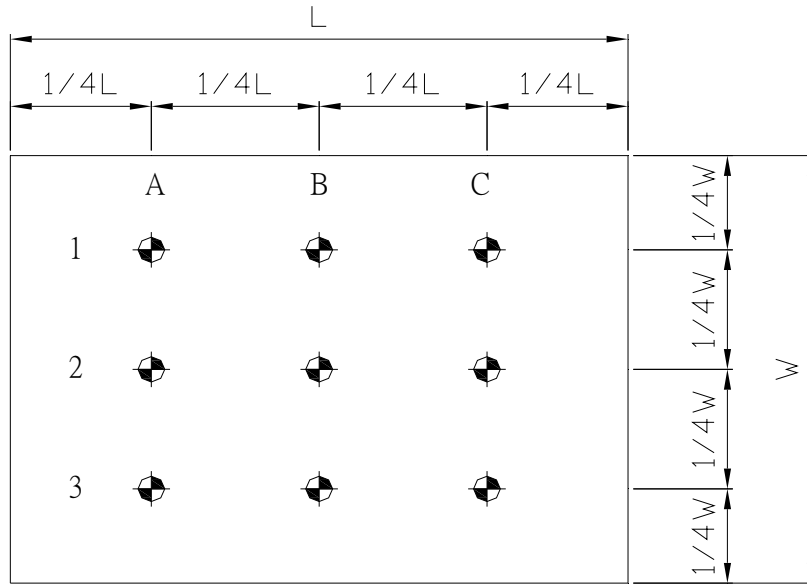
Item	Symbol	Condition	Data	Unit	Note
Color chromaticity	Red	Rx	0.642	-	Test Mode : (1) (2) (3)
		Ry	0.346	-	
	Green	Gx	0.292	-	
		Gy	0.632	-	
	Blue	Bx	0.142	-	
		By	0.075	-	
	White	Wx	0.342	-	
		Wy	0.339	-	
	Center Luminance of White	Lc		976		cd/m^{2}
Average	La		935.8	cd/m ²	
Uniform	Lu		90.75	%	
Contrast Ratio	CR	$\theta_x=0$ $\theta_y=0$ BM-7	662.9	-	est Mode : (1) (4)
Color Saturation	NTSC	$\theta_x=0$ $\theta_y=0$ Klein K-10	80	%	
Viewing Angle	Horizontal	θ_{x+}	70	Deg	Test Mode : (1) (3)
		θ_{x-}	-65		
	Vertical	θ_{y+}	55		
		θ_{y-}	-60		

Test Mode :

Note (1) Definition of Viewing Angle (θ_x, θ_y) :

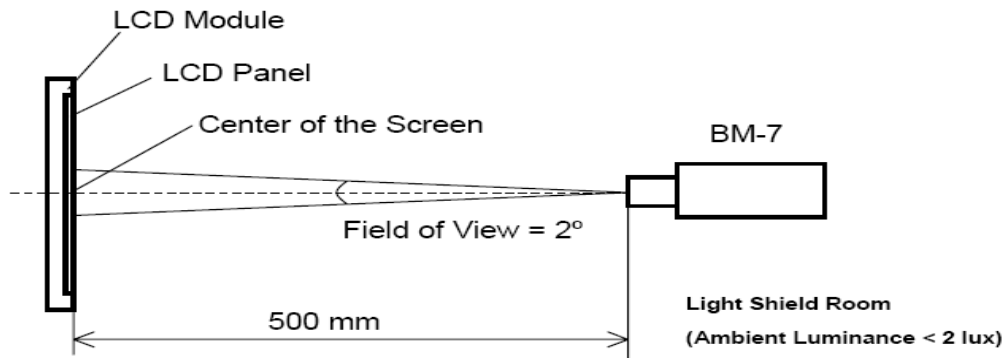


Note (2) Definition of Test Point :

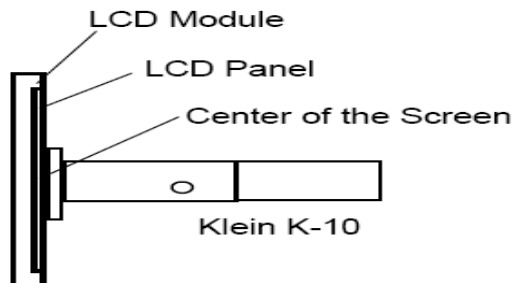


Active Area

Note (3) BM-7 Measurement Setup:



Note (4) Klein K-10 Measurement Setup:



Test tem	Test Condition	Remark
High temperature storage	60°C, 240Hrs	Note 1, 2, 3
Low temperature storage	-20°C, 240Hrs	Note 1, 2, 3
High temperature operation	50°C, 240Hrs	Note 1, 2, 3
Low temperature operation	0°C, 240Hrs	Note 1, 2, 3
Temperature cycling (non-operation)	-20°C~60°C 1H, 10mins, 1H, 5cycles	Note 1, 2, 3
Electrostatic discharge (non-operation)	150 pF,150Ω,10kV,1 second, 9 position on the panel, 10 times each place	Note 3
Vibration (non-operation)	Sweep:1G, 10Hz~ 500Hz~ 10Hz/2.5min 2 hours for each direction X, Y, Z (6 Hrs in total)	Note 1, 2, 3
Mechanical shock (non-operation)	50G/11ms, 200G/2ms, ±X, ±Y, ±Z once for each direction	Note 1, 2, 3

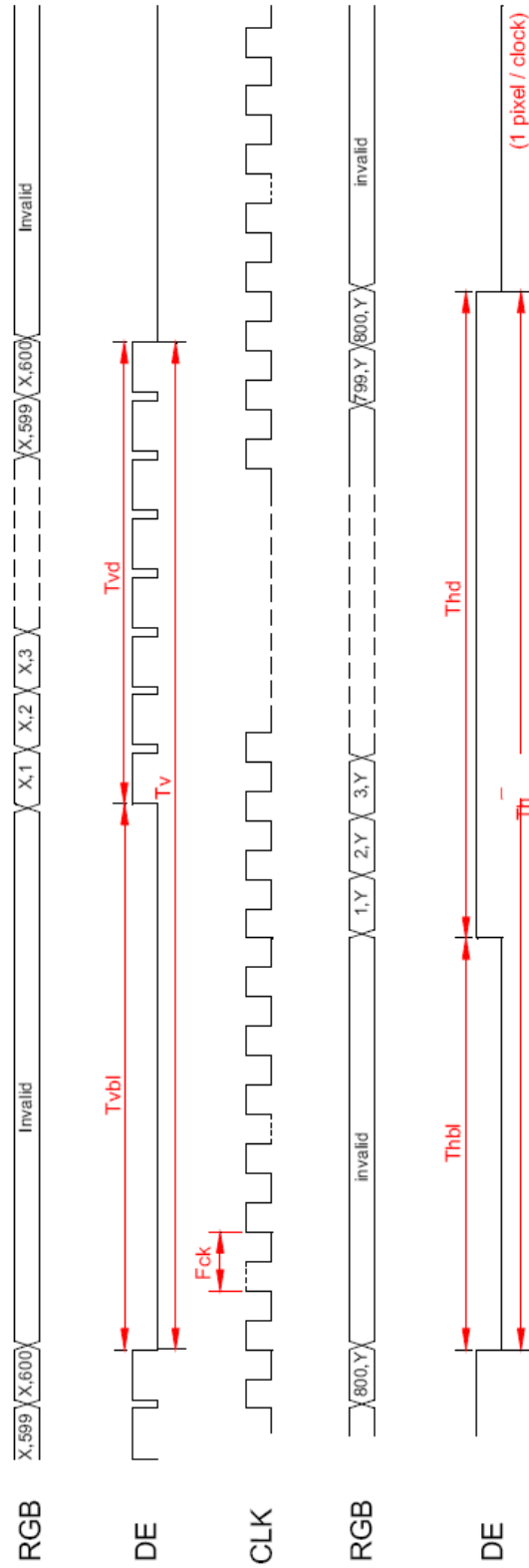
Note (1) Evaluation should be tested after storage at room temperature for one hour.

Note (2) here should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

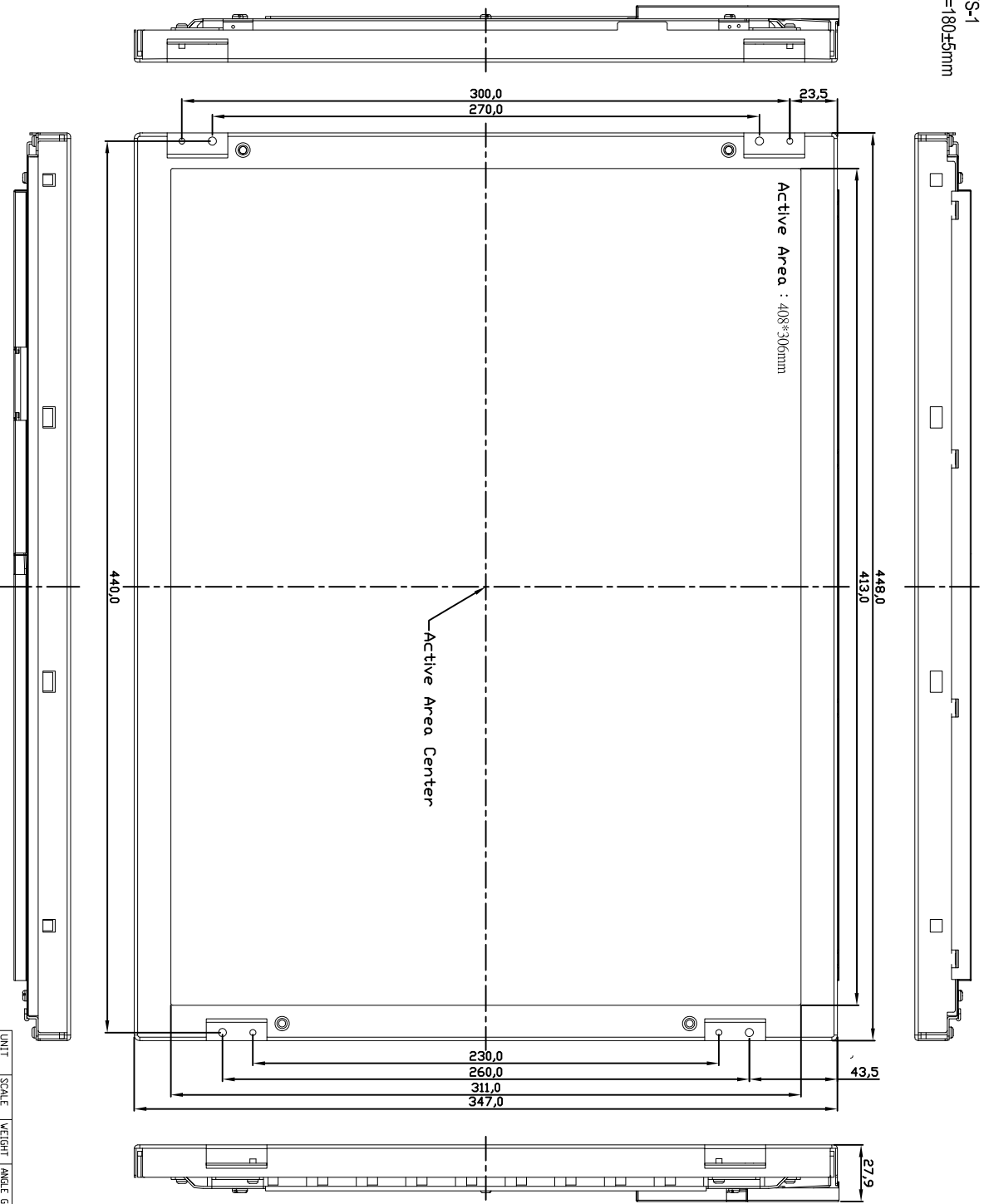
Note (3) Judgment:

- 1.Function OK.
- 2.No serious image quality degradation.

Timing Chart



- Note :
- 1.Outline Tolerance : 0.5mm
 - 2.Lamp Connector : JST BHR-03VS-1
 - 3.Lamp Cable : U13239 AWG22 L=180±5mm



REV	ECN NO.	DESCRIPTION	SIGN	DATE
Δ	ECN-	Design Drawing	Penney_Chou	2007/08/14

APPROVED	CHECKED	DESIGNED	LEVEL	General tolerance ±	SELECT LEVEL	MATERIAL	FINISH	CRITICAL DIMENSION	SPEC DIMENSION
		Penney_Chou	DIM.	1	2	3			
			0 ~ 4	0.05	0.1	0.2			
			4 ~ 14	0.05	0.2	0.3			
			14 ~ 63	0.1	0.3	0.5			
			63 ~ 250	0.2	0.6	1.2			
			250 ~ 600	0.3	0.8	2			
			600 ~ 4000	0.5	1.2	3			

UNIT: mm SCALE: 1:1 WEIGHT: — ANGLE GENERAL TOLERANCE: 3rd Angle ORIGINAL FILE: AU2011

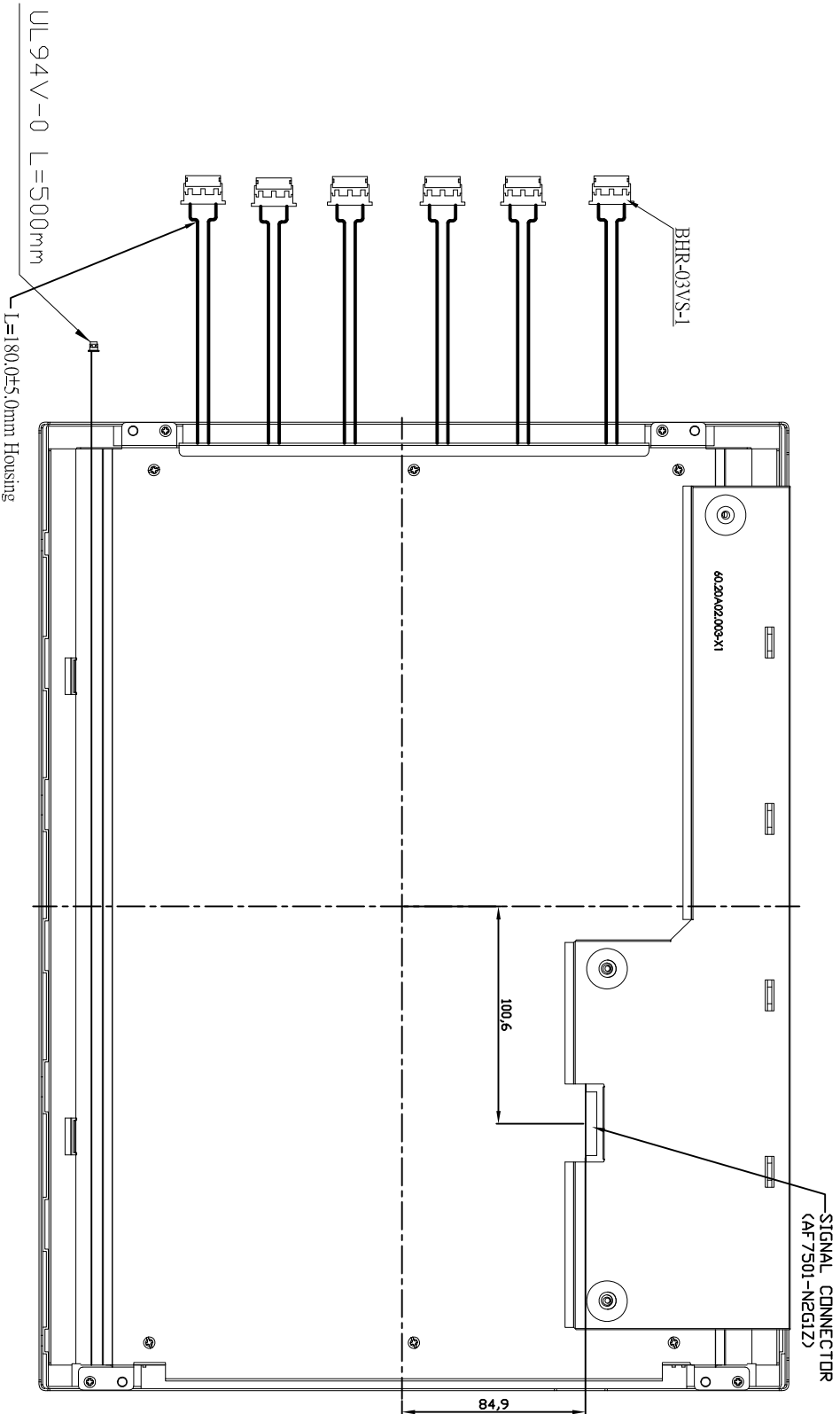
TITLE: ASSY_MODULE_AU2011 (A201SN02 V5)

DRAWING NO(PART NO):

DESCRIPTION:

LiteMax LiteMax Electronic Inc. SIZE: A4 SH: 1-1 REV: V0

- Note :
- 1.Outline Tolerance : 0.5mm
 - 2.Lamp Connector : JST BHR-03VS-1
 - 3.Lamp Cable : U13239 AWG22 L=180±5mm



REV	ECN NO.	DESCRIPTION	SIGN	DATE
Δ	ECN-	Design Drawing	Penney_Chou	2007/08/14

APPROVED	CHECKED	DESIGNED	LEVEL	General tolerance ±	MATERIAL	CRITICAL DIMENSION
		Penney_Chou	DIM.	1		▶
			0 ~ 4	0.05		
			4 ~ 14	0.05		
			14 ~ 63	0.1		
			63 ~ 250	0.2		
			250 ~ 600	0.3		
			600 ~ 4000	0.5		
				2		
				3		

UNIT: mm SCALE: 1:1 WEIGHT: — ANGLE GENERAL TOLERANCE: 3rd Angle
 TITLE: ASSY_MODULE_AU2011 (A201SN02 V5) ORIGINAL MATERIAL: AU2011
 DRAWING NO:PART NO: Litemax Electronic Inc. SIZE: A4 SH: 1-1 REV: V0
 DESCRIPTION: