

TFT-LCD SKD Panel

Model Name: T315HW07 V9

Issue Date : 2011/01/24

() Preliminary Specifications

(*) Final Specifications

Customer Signature	Date	AUO	Date
Approved By		Approval By PM Director Yen Ting Chiu	
Note		Reviewed By RD Director Eugene CC Chen	
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1. General Description

This specification applies to the 32.0 inch Color TFT-LCD SKD T315HW07 V9. This LCD Open Cell Unit has a TFT active matrix type liquid crystal panel 1,920x1,080 pixels, and diagonal size of 32.0 inch. This module supports 1,920x1,080 mode. 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 10-bit gray scale signal for each dot.

The T315HW07 V9 has been designed to apply the 10-bit 4 channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

* General Information

Items	Specification	Unit	Note
Active Screen Size	32.00	inch	
Display Area	698.40(H) x 392.85(V)	mm	
Cell Outline Dimension			
Driver Element	a-Si TFT active matrix		
Display Colors	10 bit, 1073.7M	Colors	
Number of Pixels	1,920x1,080	Pixel	
Pixel Pitch	0.36375 (H) x 0.36375 (W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-Glare, 3H		Haze=2%
Rotate Function	Achievable/Unachievable		Note 1

Note 1: Rotate Function refers to LCD display could be able to rotate.

2. Absolute Maximum Ratings

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

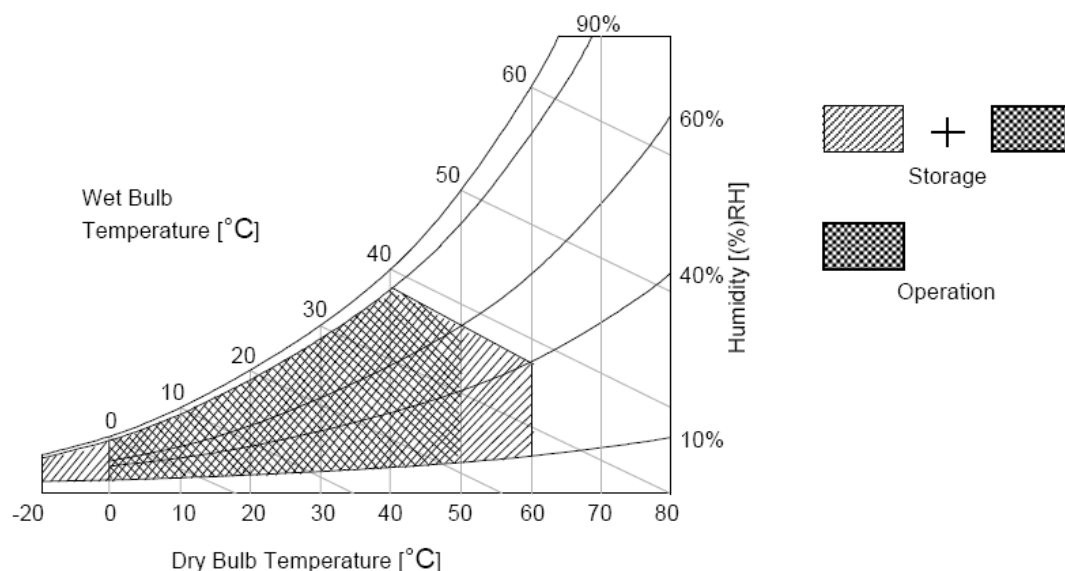
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST		65	[°C]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39°C and No condensation.

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.

Note 3: Surface temperature is measured at 50°C Dry condition



3. Electrical Specification

The T315HW07 V9 Open Cell Unit requires power input which is employed to power the LCD electronics and to drive the TFT array and liquid crystal..

3.1 Electrical Characteristics

3.1.1: DC Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LCD							
Power Supply Input Voltage		V_{DD}	10.8	12	13.2	V_{DC}	
Power Supply Input Current		I_{DD}	-	0.36	0.79	A	1
Power Consumption		P_C	--	4.32	10.428	Watt	1
Inrush Current		I_{RUSH}	--	--	4	A	2
LVDS Interface	Input Differential Voltage	$ V_{ID} $	200	400	600	mV_{DC}	3
	Differential Input High Threshold Voltage	V_{TH}	+100	--	+300	mV_{DC}	3
	Differential Input Low Threshold Voltage	V_{TL}	-300	--	-100	mV_{DC}	3
	Input Common Mode Voltage	V_{ICM}	1.1	1.25	1.4	V_{DC}	3
CMOS Interface	Input High Threshold Voltage	V_{IH} (High)	2.7	--	3.3	V_{DC}	4
	Input Low Threshold Voltage	V_{IL} (Low)	0	--	0.6	V_{DC}	4

3.1.2: AC Characteristics

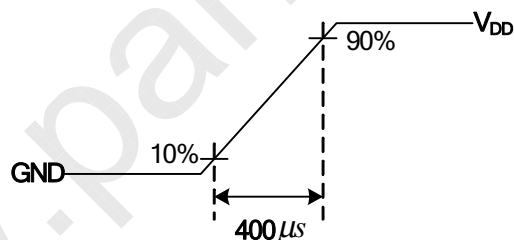
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max		
Input Channel Pair Skew Margin	$t_{\text{SKEW (CP)}}$	-500	--	+500	ps	5
Receiver Clock : Spread Spectrum Modulation range	Fclk_ss	Fclk -3%	--	Fclk +3%	MHz	6
Receiver Clock : Spread Spectrum Modulation frequency	Fss	30	--	200	KHz	6
Receiver Data Input Margin Fclk = 85 MHz Fclk = 65 MHz	tRMG	-0.4 -0.5	-- --	0.4 0.5	ns	7

Note :

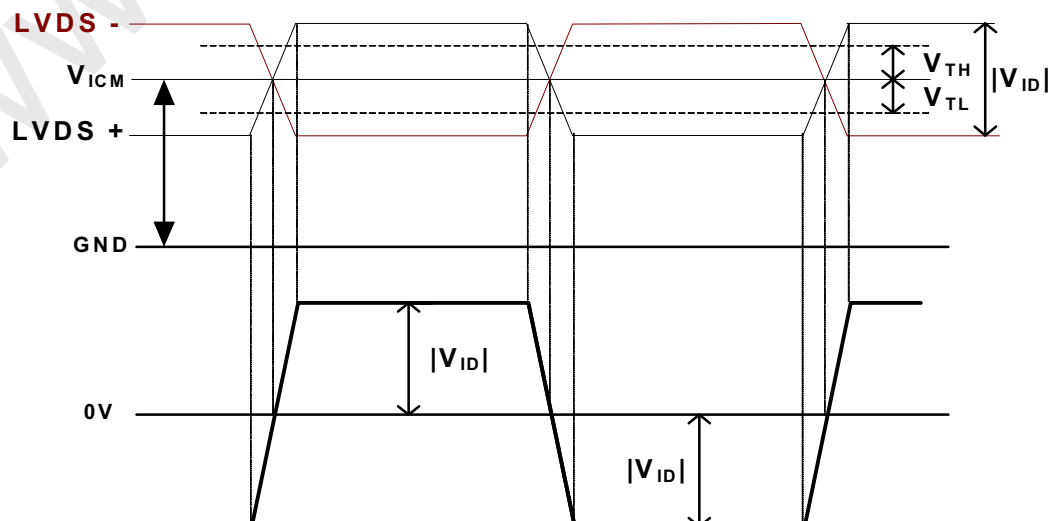
1. Test Condition:

- (1) $V_{\text{DD}} = 12.0\text{V}$
- (2) $F_v = \text{Type Timing, } 120\text{Hz}$
- (3) Fclk= Max freq.
- (4) Temperature = 25 °C
- (5) Typ. Input current : White Pattern
Max. Input current: Heavy loading pattern defined by AUO

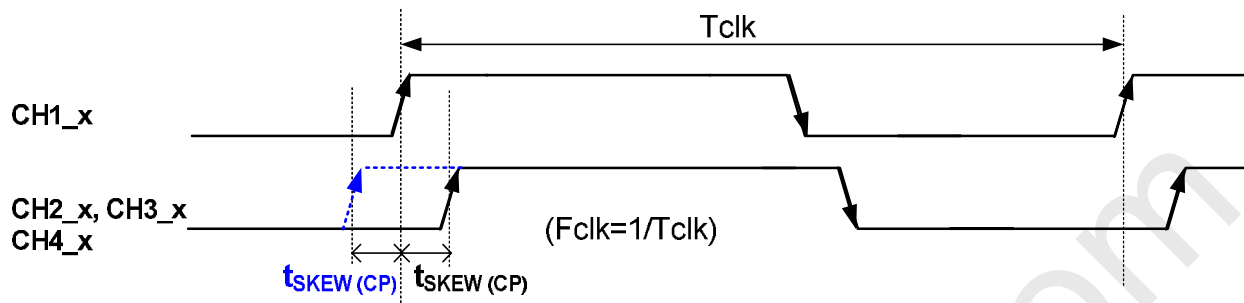
2. Measurement condition : Rising time = 400us



3. $V_{\text{ICM}} = 1.25\text{V}$

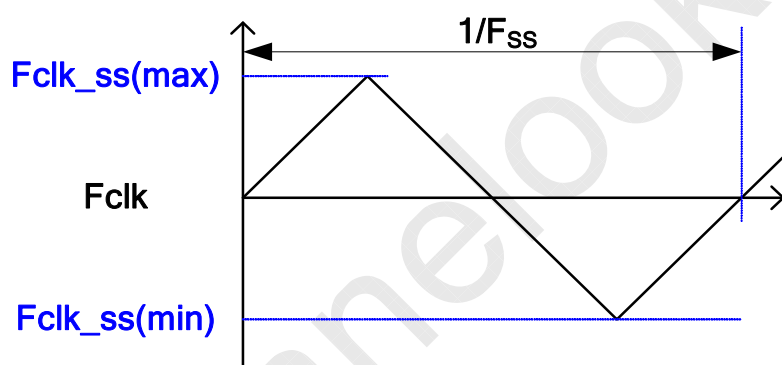


4. The measure points of V_{IH} and V_{IL} are in LCM side after connecting the System Board and LCM.
5. Input Channel Pair Skew Margin



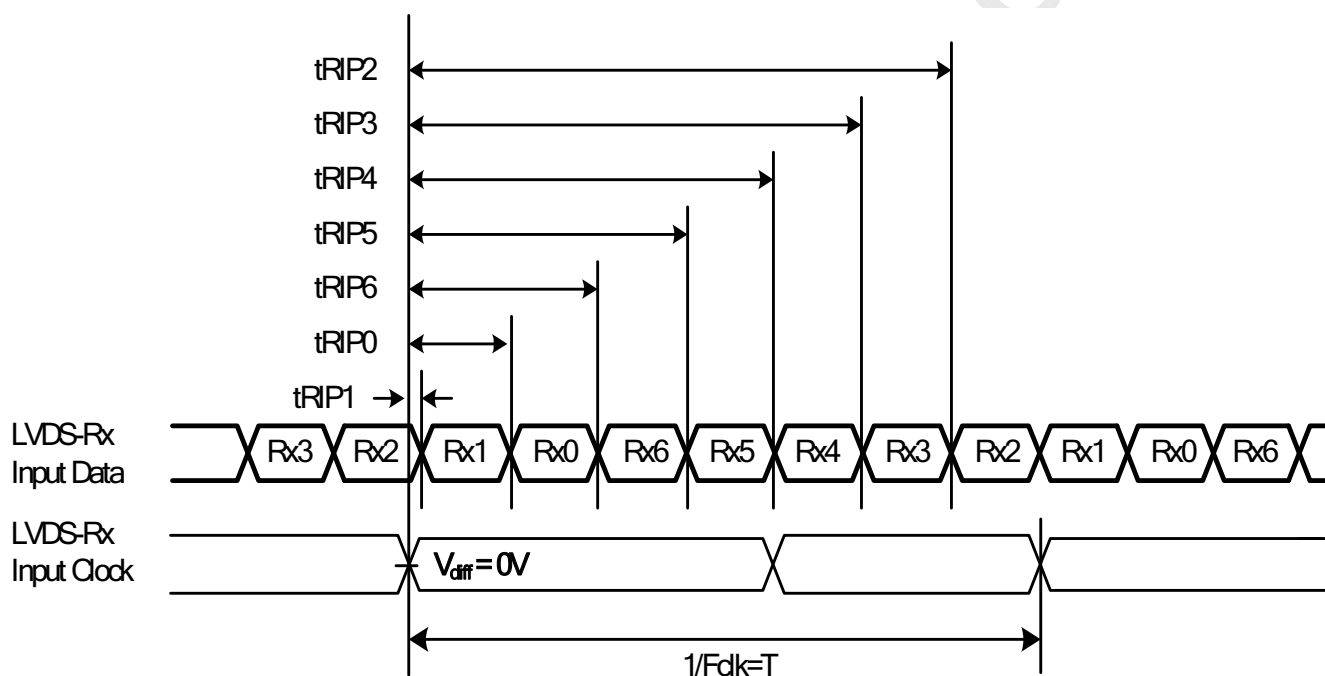
Note: $x = 0, 1, 2, 3, 4$

6. LVDS Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures



7. Receiver Data Input Margin

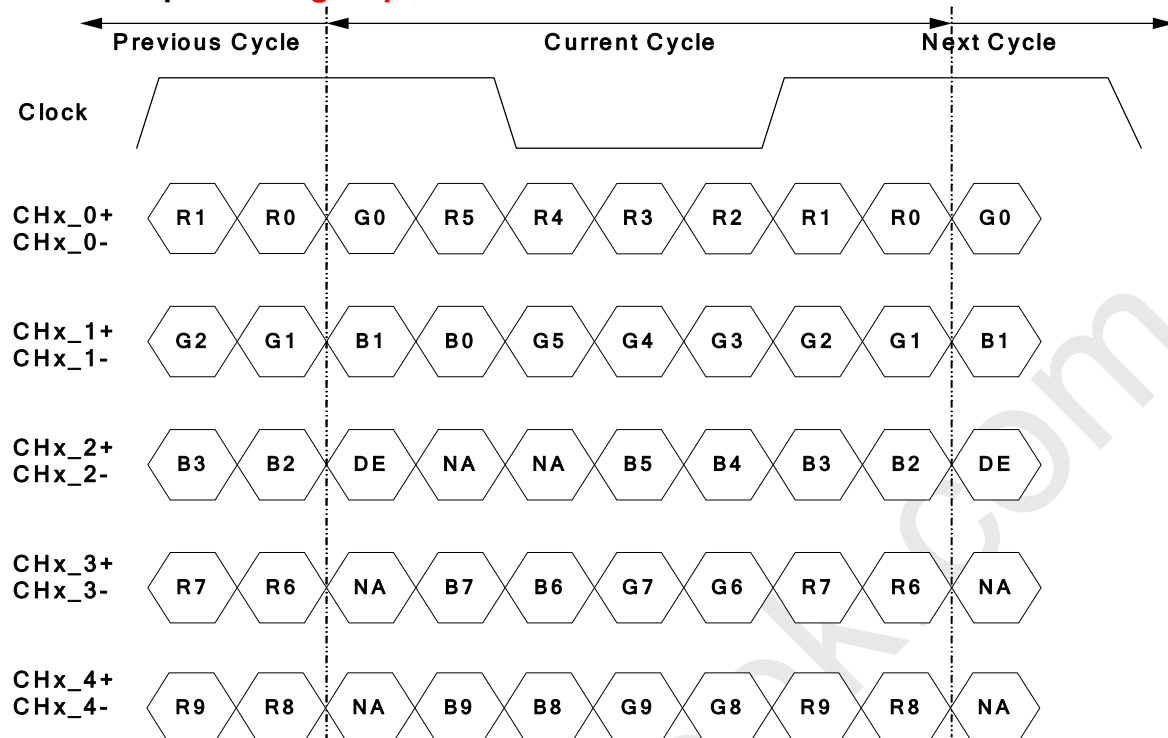
Parameter	Symbol	Rating			Unit	Note
		Min	Type	Max		
Input Clock Frequency	Fclk	Fclk (min)	--	Fclk (max)	MHz	$T=1/Fclk$
Input Data Position0	tRIP1	- tRMG	0	tRMG	ns	
Input Data Position1	tRIP0	$T/7- tRMG $	$T/7$	$T/7+ tRMG $	ns	
Input Data Position2	tRIP6	$2T/7- tRMG $	$2T/7$	$2T/7+ tRMG $	ns	
Input Data Position3	tRIP5	$3T/7- tRMG $	$3T/7$	$3T/7+ tRMG $	ns	
Input Data Position4	tRIP4	$4T/7- tRMG $	$4T/7$	$4T/7+ tRMG $	ns	
Input Data Position5	tRIP3	$5T/7- tRMG $	$5T/7$	$5T/7+ tRMG $	ns	
Input Data Position6	tRIP2	$6T/7- tRMG $	$6T/7$	$6T/7+ tRMG $	ns	



PIN	Symbol	Description	PIN	Symbol	Description
1	N.C.	No connection	26	N.C.	No connection
2	N.C.	No connection	27	N.C.	No connection
3	N.C.	No connection	28	CH2_0-	LVDS Channel 2, Signal 0-
4	N.C.	No connection	29	CH2_0+	LVDS Channel 2, Signal 0+
5	N.C.	No connection	30	CH2_1-	LVDS Channel 2, Signal 1-
6	N.C.	No connection	31	CH2_1+	LVDS Channel 2, Signal 1+
7	LVDS_SEL	Open/High(3.3V) for NS, Low(GND) for JEIDA	32	CH2_2-	LVDS Channel 2, Signal 2-
8	N.C.	No connection	33	CH2_2+	LVDS Channel 2, Signal 2+
9	N.C.	No connection	34	GND	Ground
10	N.C.	No connection	35	CH2_CLK-	LVDS Channel 2, Clock -
11	GND	Ground	36	CH2_CLK+	LVDS Channel 2, Clock +
12	CH1_0-	LVDS Channel 1, Signal 0-	37	GND	Ground
13	CH1_0+	LVDS Channel 1, Signal 0+	38	CH2_3-	LVDS Channel 2, Signal 3-
14	CH1_1-	LVDS Channel 1, Signal 1-	39	CH2_3+	LVDS Channel 2, Signal 3+
15	CH1_1+	LVDS Channel 1, Signal 1+	40	CH2_4-	LVDS Channel 2, Signal 4-
16	CH1_2-	LVDS Channel 1, Signal 2-	41	CH2_4+	LVDS Channel 2, Signal 4+
17	CH1_2+	LVDS Channel 1, Signal 2+	42	N.C.	No connection
18	GND	Ground	43	N.C.	No connection
19	CH1_CLK-	LVDS Channel 1, Clock -	44	GND	Ground
20	CH1_CLK+	LVDS Channel 1, Clock +	45	GND	Ground
21	GND	Ground	46	GND	Ground
22	CH1_3-	LVDS Channel 1, Signal 3-	47	N.C.	No connection
23	CH1_3+	LVDS Channel 1, Signal 3+	48	V _{DD}	Power Supply, +12V DC Regulated
24	CH1_4-	LVDS Channel 1, Signal 4-	49	V _{DD}	Power Supply, +12V DC Regulated
25	CH1_4+	LVDS Channel 1, Signal 4+	50	V _{DD}	Power Supply, +12V DC Regulated
			51	V _{DD}	Power Supply, +12V DC Regulated

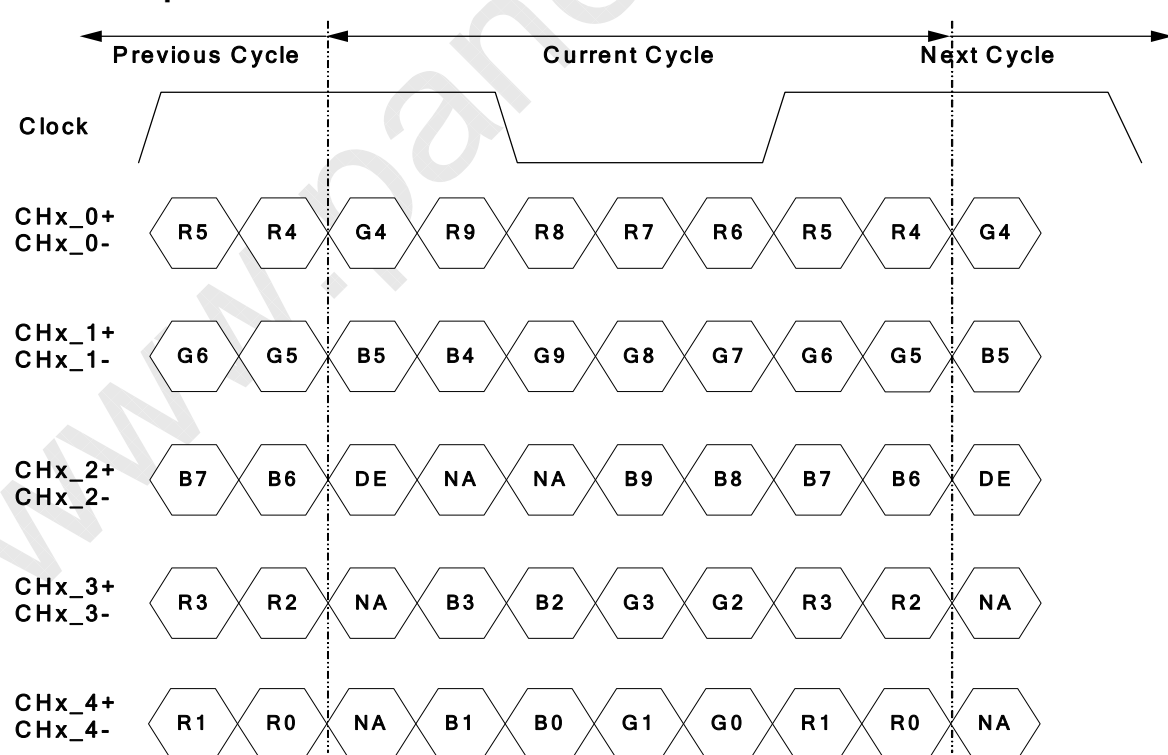
Note: N.C. : please leave this pin unoccupied. It can not be connected by any signal (Low/GND/High).

■ LVDS Option = **High/Open**→NS



Note: x = 1, 2, 3, 4...

■ LVDS Option = **Low**→JEIDA



Note: x = 1, 2, 3, 4...

3.3 Signal Timing Specification

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

Timing Table (DE only Mode)

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	1090	1130	1392	Th
	Active	Tdisp (v)	1080			Th
	Blanking	Tblk (v)	10	50	312	Th
Horizontal Section	Period	Th	540	570	580	Tclk
	Active	Tdisp (h)	480			Tclk
	Blanking	Tblk (h)	60	90	100	Tclk
Clock	Frequency	Fclk=1/Tclk	64.8	77.29	80.74	MHz
Vertical Frequency	Frequency	Fv	94	120	122	Hz
Horizontal Frequency	Frequency	Fh	120	135.6	139.2	KHz

Notes:

(1) Display position is specific by the rise of DE signal only.

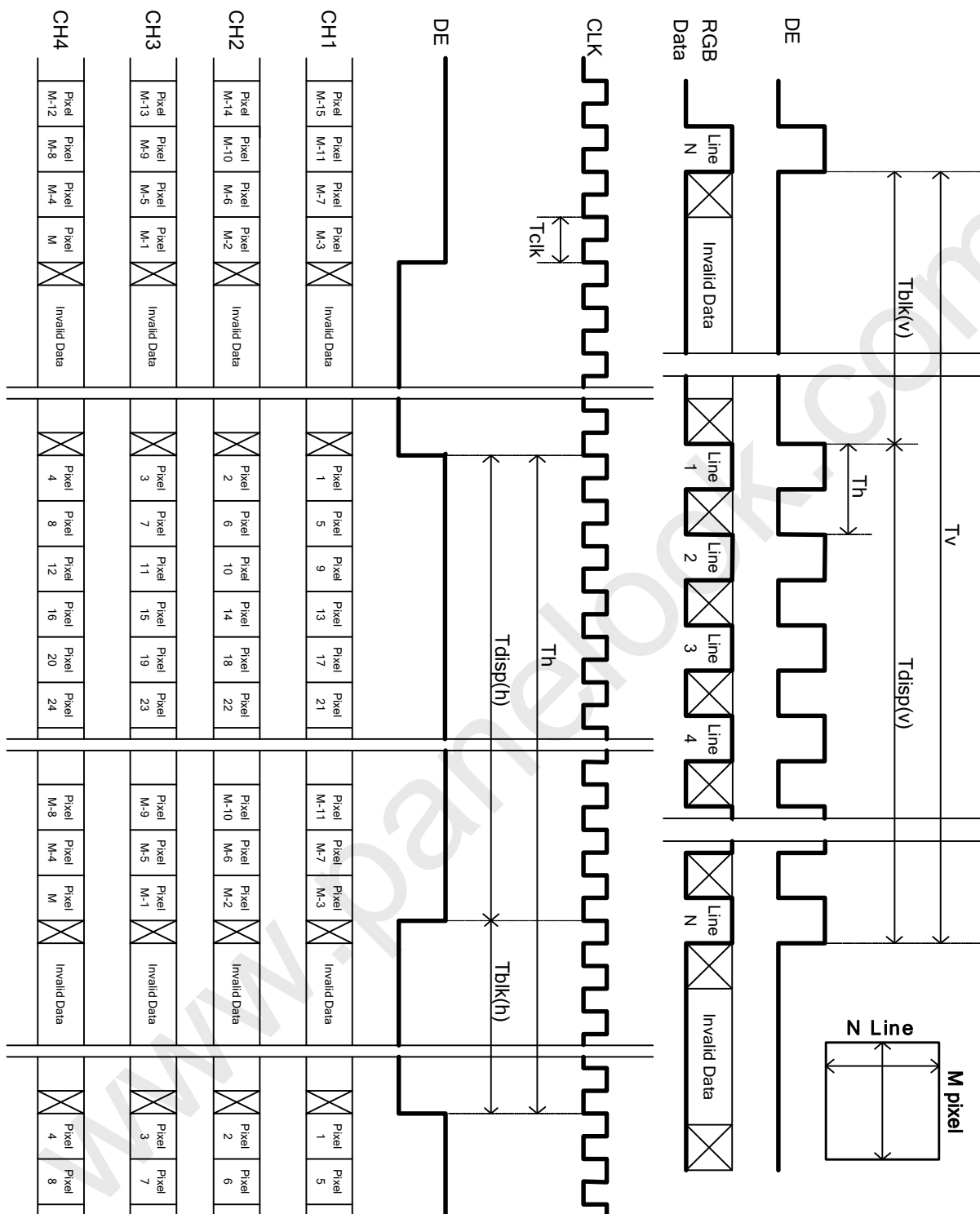
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(2) Vertical display position is specified by the rise of DE after a "Low" level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen.

(3) If a period of DE "High" is less than 1920 DCLK or less than 1080 lines, the rest of the screen displays black.

(4) The display position does not fit to the screen if a period of DE "High" and the effective data period do not synchronize with each other.

3.4 Signal Timing Waveforms





3.5 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 10 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.

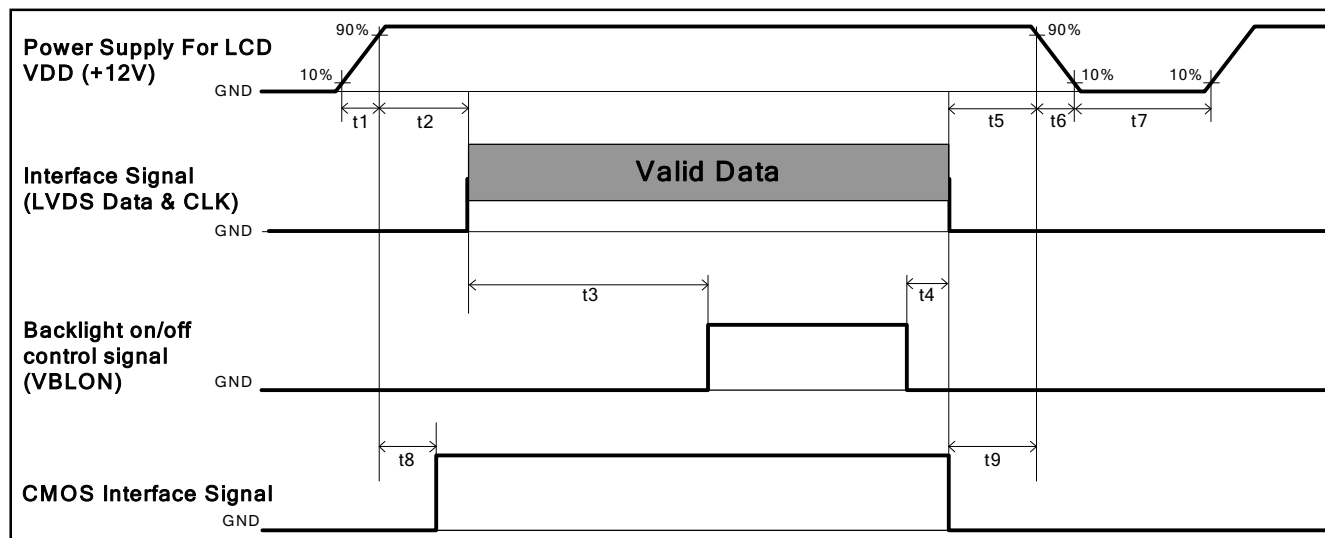
COLOR DATA REFERENCE

Color		Input Color Data																													
		RED										GREEN										BLUE									
		MSB					LSB					MSB					LSB					MSB		LSB							
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	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	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	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	1	1	1	1	0	0	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	1	1	1	1	1	1
R	RED(000)	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	0	0	0	
	RED(001)	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	0	

	RED(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RED(1023)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	GREEN(000)	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	0	0	0	
	GREEN(001)	0	0	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	

	GREEN(1022)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
GREEN(1023)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0		
B	BLUE(000)	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	0	0	0	
	BLUE(001)	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	0	0	1	

	BLUE(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	
	BLUE(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	

Power Sequence for LCD


Parameter	Values			Unit
	Min.	Type.	Max.	
t1	0.4	---	30	ms
t2	0.1	---	50	ms
t3	450	---	---	ms
t4	0 ^{*1}	---	---	ms
t5	0	---	---	ms
t6	---	---	--- ^{*2}	ms
t7	500	---	---	ms
t8	10	---	50	ms
t9	0	---	---	ms

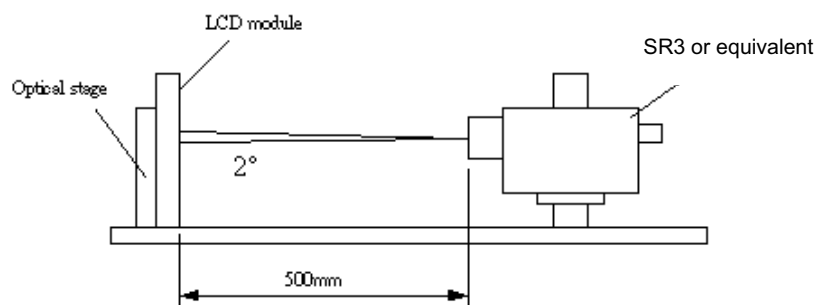
Note:

- (1) t4=0 : concern for residual pattern before BLU turn off.
- (2) t6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)
- (3) When CMOS Interface is N.C. (no connection), opened in Transmitted end, T8 timing spec can be negligible

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' (note 1) and stable for approximately 45 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°.

Fig.1 presents additional information concerning the measurement equipment and method.



Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max		
Contrast Ratio	CR	3200	4000	--		2
Surface Luminance (White)	L _{WH}	320	400	--	cd/m ²	3
Luminance Variation	$\delta_{\text{WHITE}(9P)}$	--	--	1.33		4
Response Time (G to G)	T _Y	--	5.5	--	Ms	5
Color Gamut	NTSC		72		%	
Color Coordinates						
Red	R _X	Typ.-0.03	0.630	Typ.+0.03		
	R _Y		0.330			
Green	G _X		0.320			
	G _Y		0.620			
Blue	B _X		0.150			
	B _Y		0.040			
White	W _X		0.280			
	W _Y		0.290			
Viewing Angle						
x axis, right($\phi=0^\circ$)	θ_r	--	89	--	degree	6
x axis, left($\phi=180^\circ$)	θ_l	--	89	--	degree	
y axis, up($\phi=90^\circ$)	θ_u	--	89	--	degree	
y axis, down ($\phi=270^\circ$)	θ_d	--	89	--	degree	

Note:

- All above optical specifications are defined by T400HW04 V0 module basis. (If no module, refer to most similar model.)

The central Luminance of Chromaticity of AUO's BLU

Item	Typical	Units	Note
Luminance	6300	nits	100% dimming
Chromaticity	x	0.268	CIE1931
	y	0.248	

- Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{\text{on5}}}{\text{Surface Luminance of } L_{\text{off5}}}$$

- Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. When LED current I_F = typical value (without driver board), LED input $V_{\text{DDB}} = 24\text{V}$, I_{DDB} = Typical value (with driver board), $L_{\text{WH}} = L_{\text{on5}}$ where L_{on5} is the luminance with all pixels displaying white at center 5 location.
- The variation in surface luminance, δ_{WHITE} is defined (center of Screen) as:

$$\delta_{\text{WHITE(9P)}} = \text{Maximum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on9}}) / \text{Minimum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on9}})$$
- Response time T_γ is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on $F_v = 120\text{Hz}$ to optimize.

Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

The response time is defined as the following figure and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".

Any level of gray (Bright)

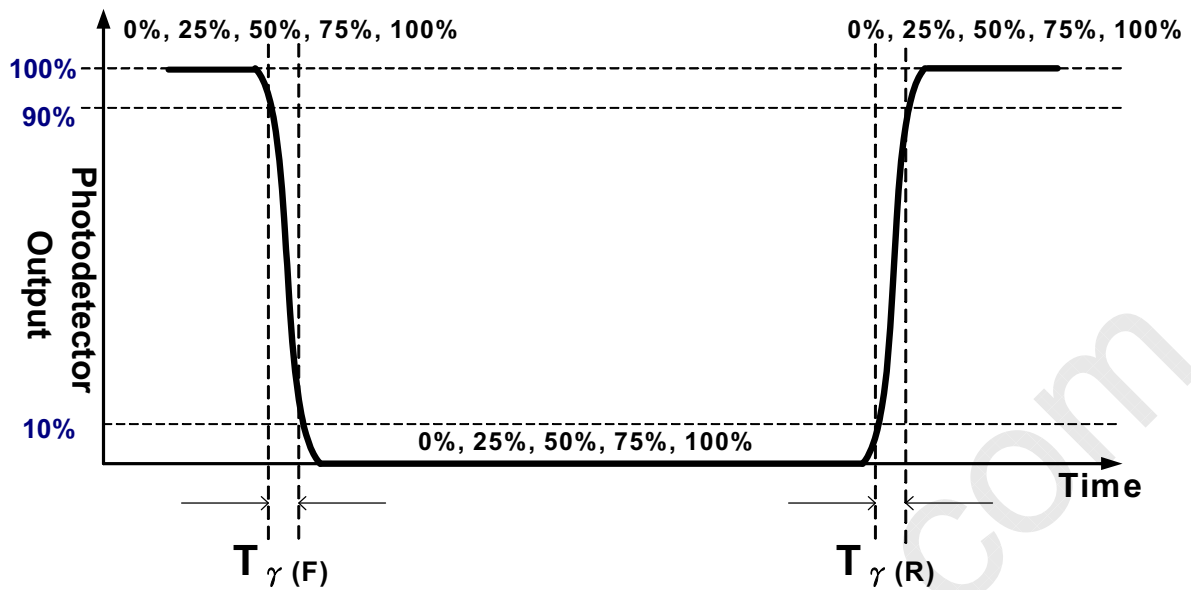
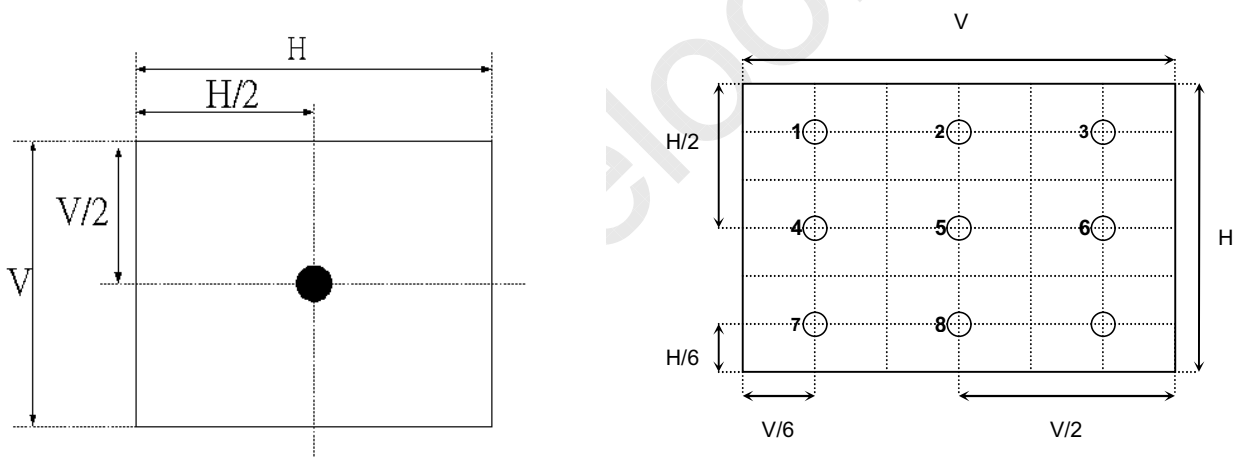
Any level of gray (Dark)

Any level of gray (Bright)

Any level of gray (Bright)

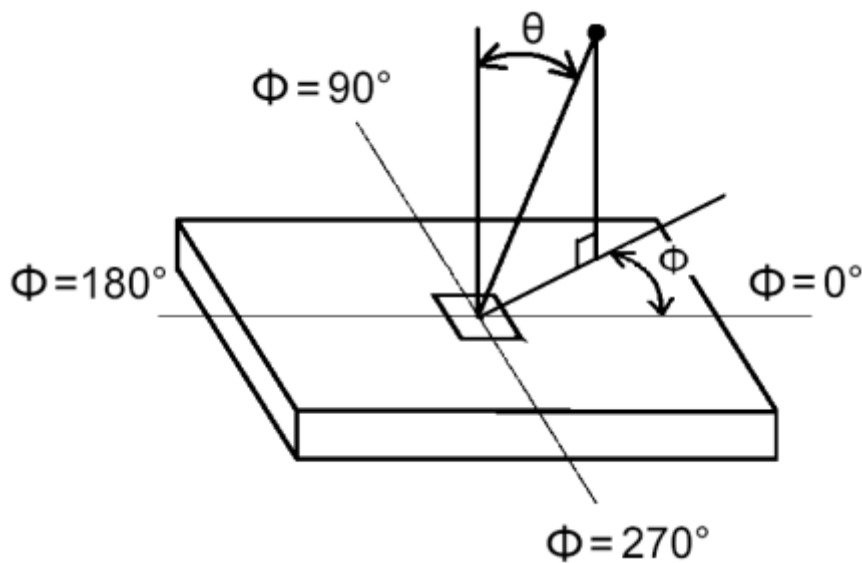
Any level of gray (Dark)

Any level of gray (Bright)


FIG. 2 Luminance


6. 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 FIG3.

FIG.3 Viewing Angle



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6. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C, 300hrs
2	Low temperature storage test	3	-20°C, 300hrs
3	High temperature operation test	3	50°C, 300hrs
4	Low temperature operation test	3	-5°C, 300hrs
5	Vibration test (With carton)	5	Random wave (1.05Grms 10~200Hz) Duration : X,Y,Z 10min per axis
6	Drop test (With carton)	5	Height: 30.5cm (ASTMD4169-I) 1 corner, 3 edges, 6 surfaces (refer ASTM D 5276)

7. Packing

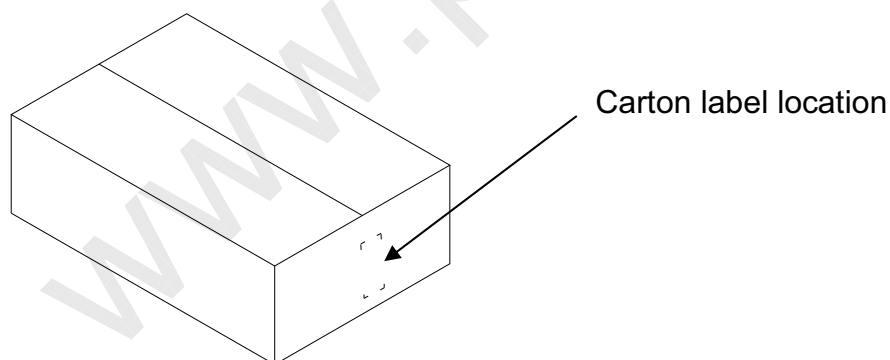
7-1 Open cell shipping label (35*7mm)



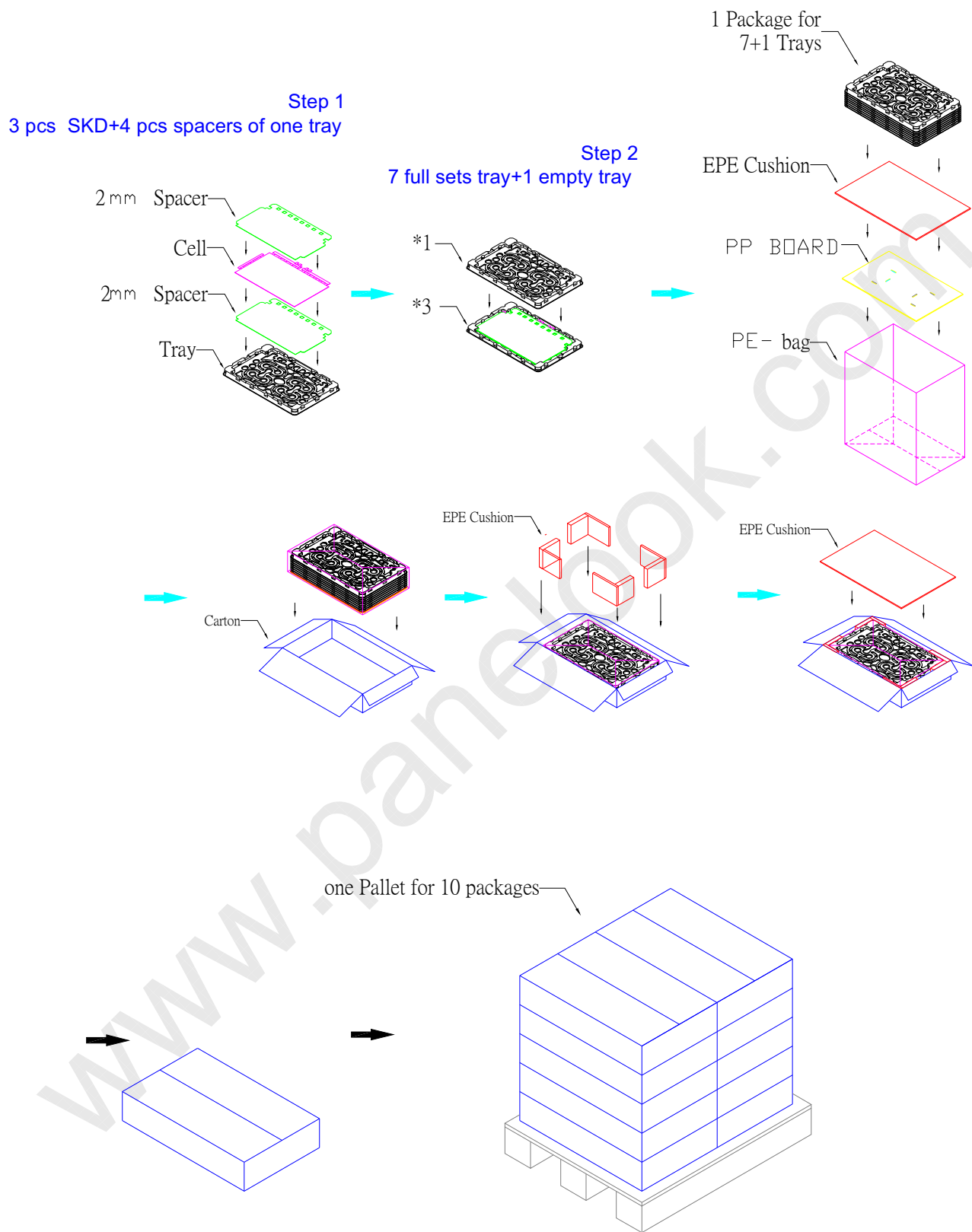
1. S/N Number
2. Grade
3. Manufacture Fab.
4. Manufactured date
5. Model name

Carton Label:

AU Optronics	RoHS	Pb
MODEL NO: T315HW07 V9		
PART NO: 91.31T14.9XX		
CUSTOMER NO:		
CARTON NO:		
Made in XXXXXX	*XXXXXXXX-XXXXXXXXXXXX*	



7-2 PACKING METHODS:



Carton : 970(L)mm*588(W)mm*280(H)mm

Pallet : 1180mm*980mm*132mm

8-3 Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension (mm)	Weight (kg)	
1	Packing BOX	21pcs/box	970(L)*588(W)*280(H)	37	
2	Pallet	1	1180(L)*980(W)*132(H)	15	
3	Boxes per Pallet	10 boxes/pallet			
4	Panels per Pallet	210pcs/pallet			
	Pallet after packing	210	1180(L)*980(W)*1532(H)	385	

8. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Open Cell unit.

8-1 MOUNTING PRECAUTIONS

- (1) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the cell. And the frame on which a cell is mounted should have sufficient strength so that external force is not transmitted directly to the cell.
- (2) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (3) You should adopt radiation structure to satisfy the temperature specification.
- (3) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (4) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.

8-2 OPERATING PRECAUTIONS

- (1) The open cell unit listed in the product specification sheets was designed and manufactured for TV application
- (2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (4) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (5) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (6) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (7) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

8-3 ELECTROSTATIC DISCHARGE CONTROL

Since a open cell unit is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

8-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

8-5 STORAGE

When storing open cell units as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the open cell unit to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C 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.

8-6 HANDLING PRECAUTIONS FOR PROTECTION FILM OF POLARIZER

The protection film of polarizer is still attached on the surface as you receive open cell units. When the protection film is peeled off, static electricity is easily generated on the polarizer surface. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.