

Model Name: T390HVN01.0

Issue Date : 2012/3/13

()Preliminary Specifications
(*)Final Specifications ver. 2.0

Customer Signature	Date	AUO	Date
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Contents

No		
		CONTENTS
		RECORD OF REVISIONS
1		GENERAL DESCRIPTION
2		ABSOLUTE MAXIMUM RATINGS
3		ELECTRICAL SPECIFICATION
	3-1	ELECTRICAL CHARACTERISTICS
	3-2	INTERFACE CONNECTIONS
	3-3	SIGNAL TIMING SPECIFICATION
	3-4	SIGNAL TIMING WAVEFORM
	3-5	COLOR INPUT DATA REFERENCE
	3-6	POWER SEQUENCE
	3-7	BACKLIGHT POWER SPECIFICATION
4		OPTICAL SPECIFICATION
5		OPEN CELL DRAWING
6		RELIABILITY TEST ITEMS
7		INTERNATIONAL STANDARD
8		PACKING
	8-1	OPEN CELL SHIPPING LABEL
	8-2	PACKING PROCESS
	8-3	PALLET AND SHIPMENT INFORMATION
9		PRECAUTION
	9-1	MOUNTING PRECAUTIONS
	9-2	OPERATING PRECAUTIONS
	9-3	ELECTROSTATIC DISCHARGE CONTROL
	9-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE
	9-5	STORAGE
	9-6	HANDLING PRECAUTIONS FOR PROTECT FILM

1. General Description

This specification applies to the 38.5 inch Color TFT-LCD Module T390HVN01.0. This LCD module has a TFT active matrix type liquid crystal panel 1,920x1,080 pixels, and diagonal size of 38.5 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 8-bit gray scale signal for each dot.

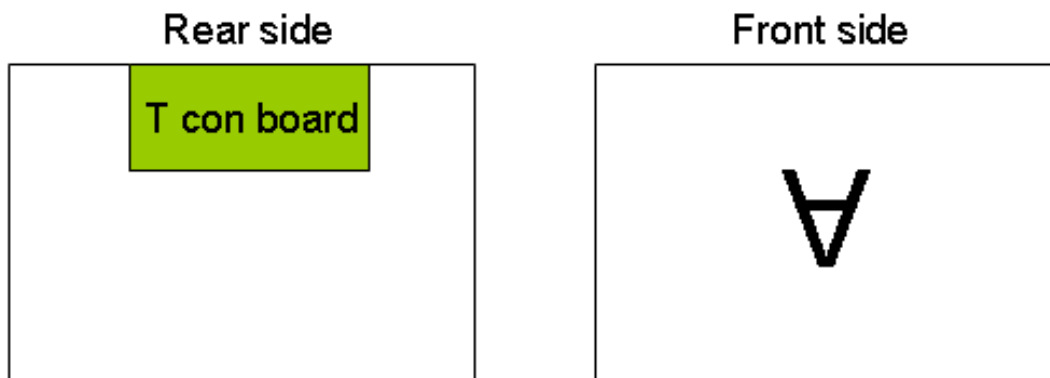
The T390HVN01.0 has been designed to apply the 8-bit 2 channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

General Information

Items	Specification	Unit	Note
Active Screen Size	38.5	inch	
Display Area	853.92 (H) x 480.33 (V)	mm	
Outline Dimension	898.92 (H) x 525.33 (V) x 55.5 (D)	mm	
Driver Element	a-Si TFT active matrix		
Display Colors	8 bit	Colors	
Number of Pixels	1,920x1,080	Pixel	
Pixel Pitch	0.44475 (H) x 0.44475 (W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-Glare, 3H		Haze=2%
Rotate Function	Unachievable		Note 1
Display Orientation	Signal input with "A"		Note 2

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

Note 2: LCD display as below illustrated when signal input with "A".



2. Absolute Maximum Ratings

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

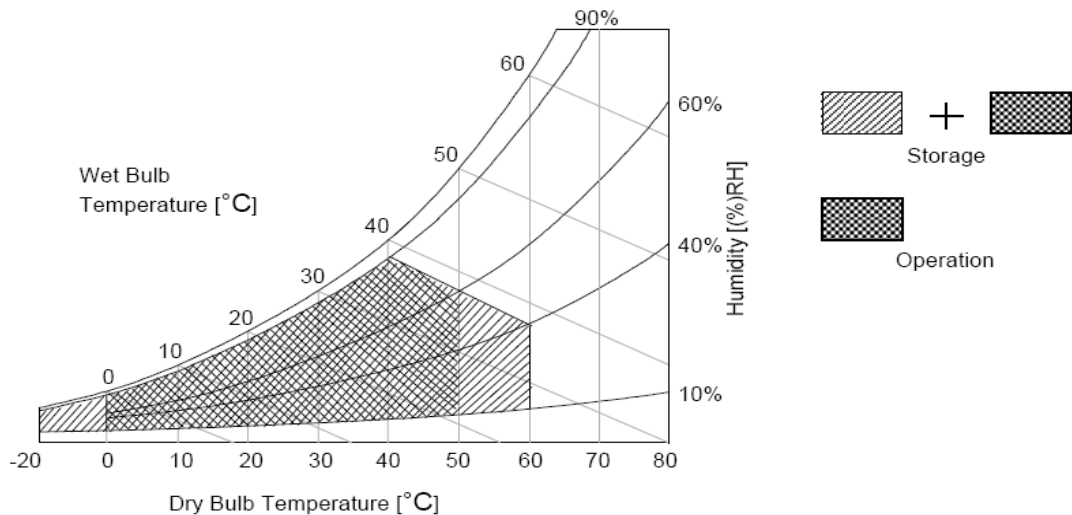
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	V_{DD}	-0.3	14	V_{DC}	Note 1
Input Voltage of Signal	V_{in}	-0.3	4	V_{DC}	Note 1
T-B/B Input Voltage	V_{BB}	-	500	V_{p-p}	Note 2
Supply control Voltage	V_{cc}	-0.3	15	V_{DC}	Note 2
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	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 T390HVN01.0 module 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}	--	0.8	1.3	A	1
Inrush Current		I_{RUSH}	--	--	4	A	2
Permissible Ripple of Power Supply Input Voltage		V_{RP}	--	--	$V_{DD} * 5\%$	mV _{pk-pk}	3
LVDS Interface	Input Differential Voltage	$ V_{ID} $	200	400	600	mV _{DC}	4
	Differential Input High Threshold Voltage	V_{TH}	+100	--	+300	mV _{DC}	4
	Differential Input Low Threshold Voltage	V_{TL}	-300	--	-100	mV _{DC}	4
	Input Common Mode Voltage	V_{ICM}	1.1	1.25	1.4	V_{DC}	4
CMOS Interface	Input High Threshold Voltage	V_{IH} (High)	2.7	--	3.3	V_{DC}	5
	Input Low Threshold Voltage	V_{IL} (Low)	0	--	0.6	V_{DC}	5
Backlight Power Consumption		P_{BL}	105	117	129	Watt	

3-1.2: AC Characteristics

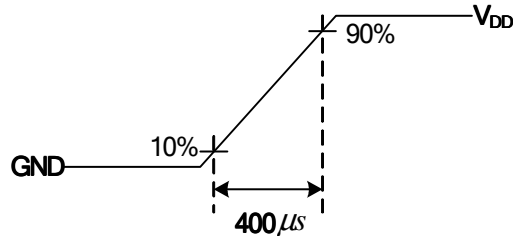
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LVDS Interface	Receiver Clock : Spread Spectrum Modulation range	Fclk_ss	Fclk -3%	--	Fclk +3%	MHz	6
	Receiver Clock : Spread Spectrum Modulation frequency	Fss	30	--	200	KHz	6
	Receiver Data Input Margin Fclk = 85 MHz Fclk = 65 MHz	tRMG	-0.4 -0.5	-- --	0.4 0.5	ns	7

Note :

- Test Condition:
 - $V_{DD} = 12.0V$
 - Fv = Type Timing, 60Hz, 120Hz or Other
 - Fclk= Max freq.

- (4) Temperature = 25 °C
- (5) Typ. Input current : White Pattern
Max. Input current: Heavy loading pattern defined by AUO
>> refer to "Section:3.3 Signal Timing Specification, Typical timing"

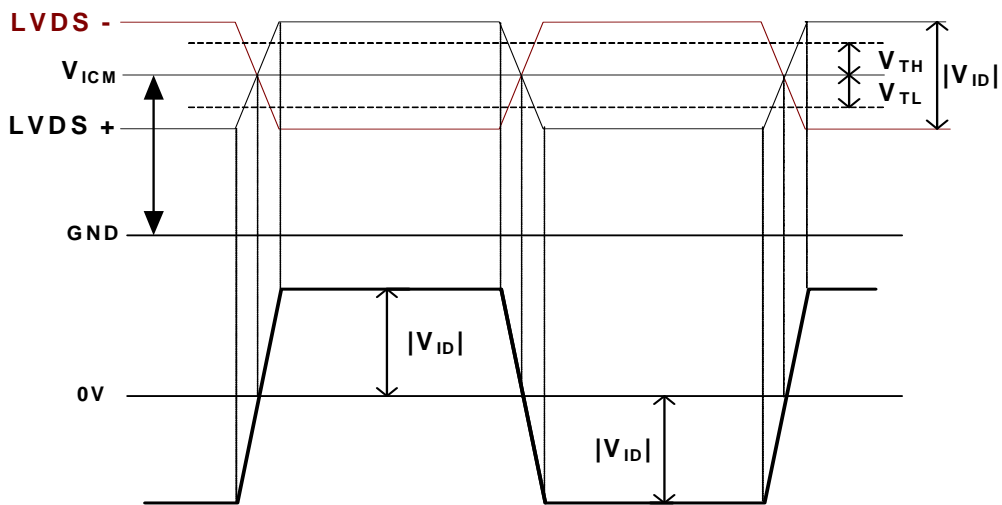
2. Measurement condition : Rising time = 400us



3. Test Condition:

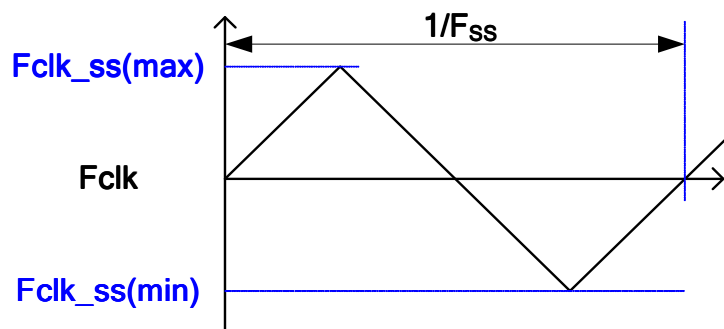
- (1) The measure point of V_{RP} is in LCM side after connecting the System Board and LCM.
- (2) Under Max. Input current spec. condition.

4. $V_{ICM} = 1.25V$



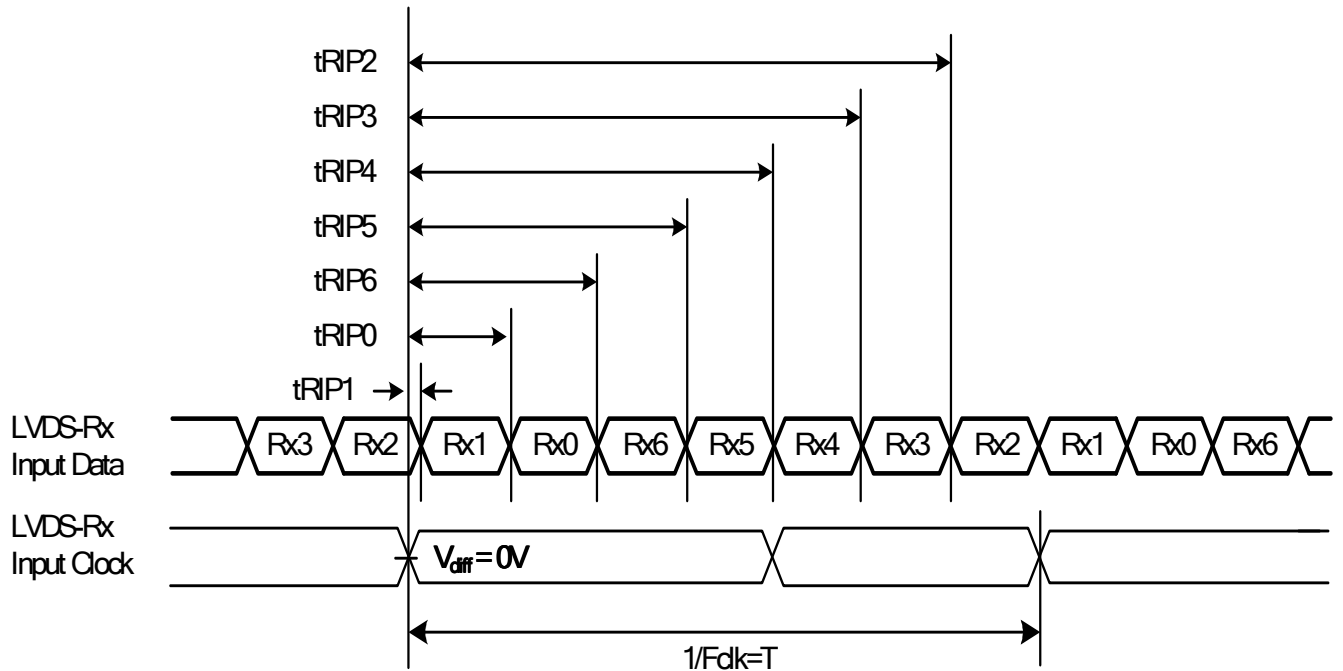
5. The measure points of V_{IH} and V_{IL} are in LCM side after connecting the System Board and LCM.

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	



3-2 Interface Connections

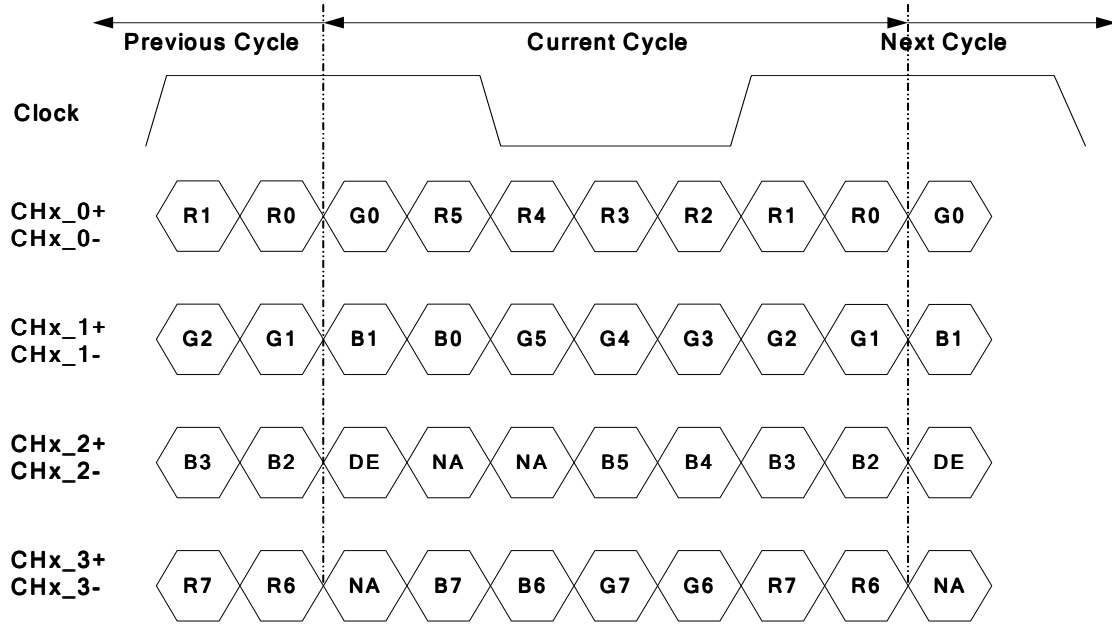
LVDS interface requirement

CN2 : 187059-51221-1 ((P-TWO))

PIN	Symbol	Description	PIN	Symbol	Description
1	N.C.	AUO Internal Use Only	26	N.C.	AUO Internal Use Only
2	N.C.	AUO Internal Use Only	27	N.C.	AUO Internal Use Only
3	N.C.	AUO Internal Use Only	28	CH2_0-	LVDS Channel 2, Signal 0-
4	N.C.	AUO Internal Use Only	29	CH2_0+	LVDS Channel 2, Signal 0+
5	N.C.	AUO Internal Use Only	30	CH2_1-	LVDS Channel 2, Signal 1-
6	N.C.	AUO Internal Use Only	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-	No connection
16	CH1_2-	LVDS Channel 1, Signal 2-	41	CH2_4+	No connection
17	CH1_2+	LVDS Channel 1, Signal 2+	42	N.C.	AUO Internal Use Only
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-	No connection	49	V _{DD}	Power Supply, +12V DC Regulated
25	CH1_4+	No connection	50	V _{DD}	Power Supply, +12V DC Regulated
			51	V _{DD}	Power Supply, +12V DC Regulated

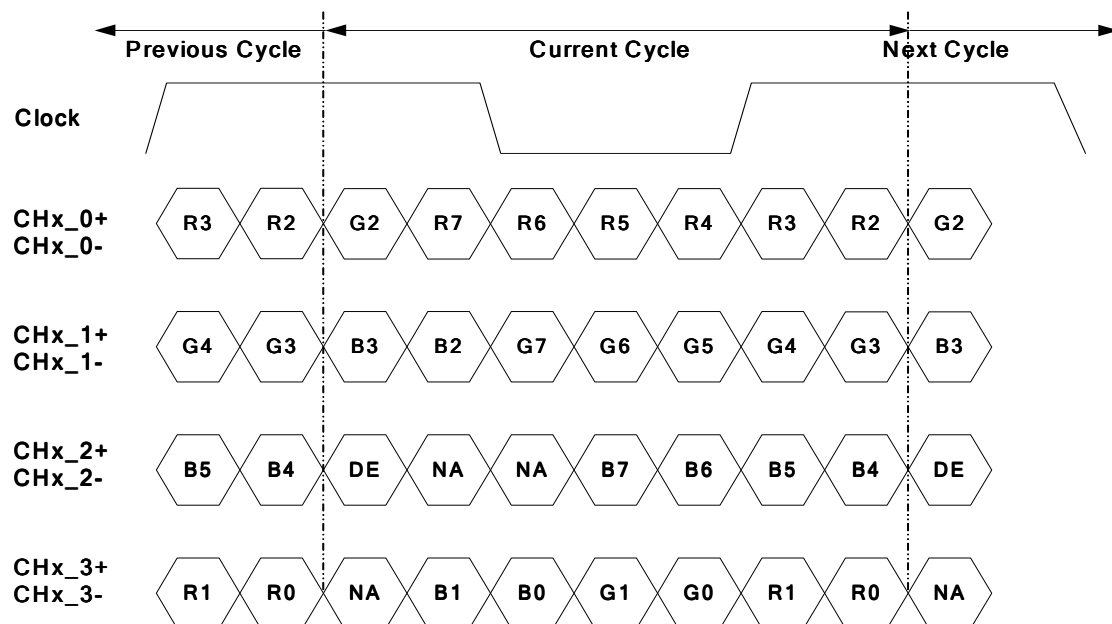
Note: N.C. : please leave this pin unoccupied. It can not be connected by any signal (Low/GND/High).

■ 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	1096	1125	1480	Th
	Active	Tdisp (v)	1080			
	Blanking	Tblk (v)	16	45	400	Th
Horizontal Section	Period	Th	1030	1100	1325	Tclk
	Active	Tdisp (h)	960			
	Blanking	Tblk (h)	70	140	365	Tclk
Clock	Frequency	Fclk=1/Tclk	50	74.25	82	MHz
Vertical Frequency	Frequency	Fv	47	60	63	Hz
Horizontal Frequency	Frequency	Fh	60	67.5	73	KHz

Notes:

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

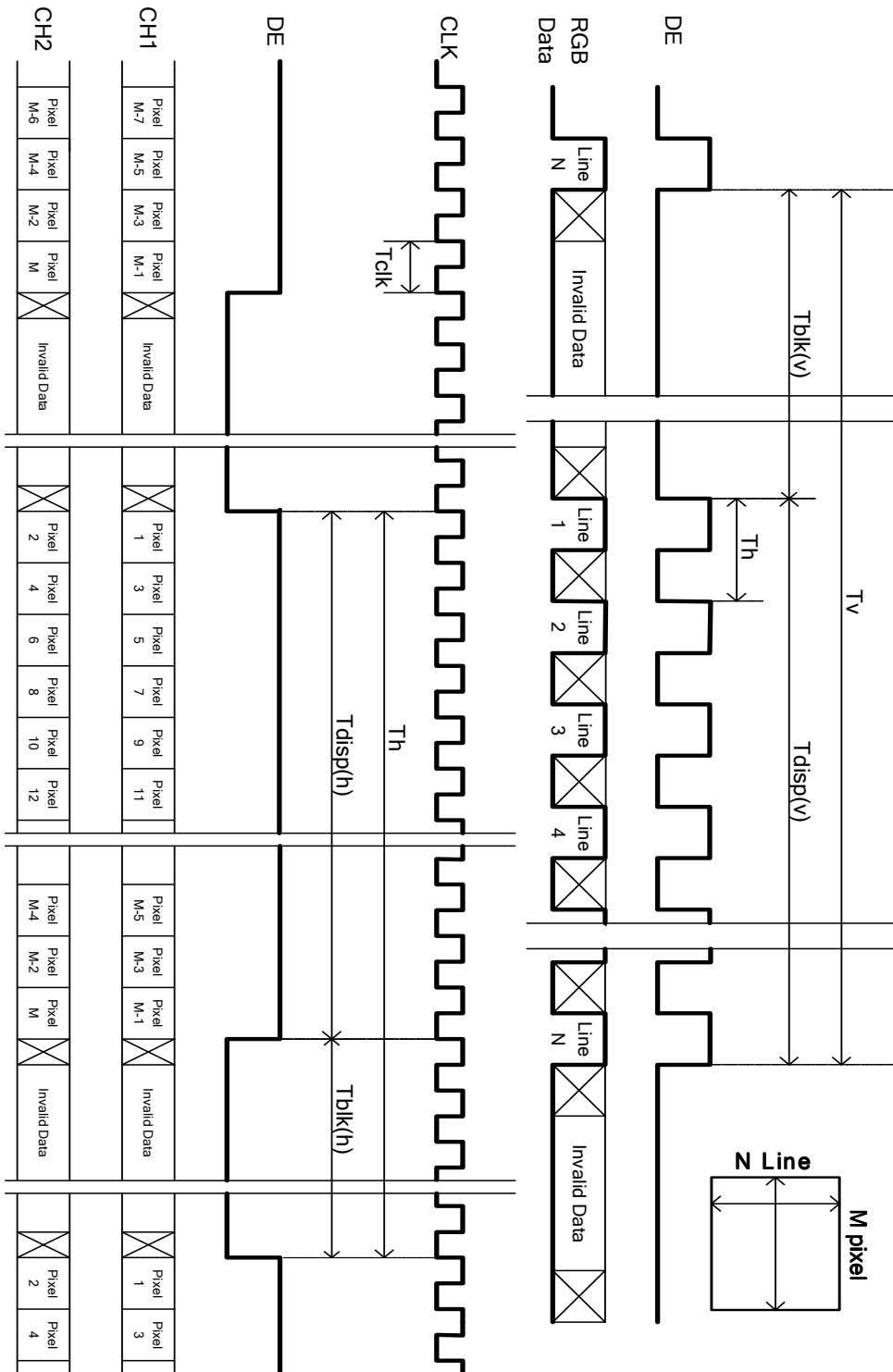
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(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.

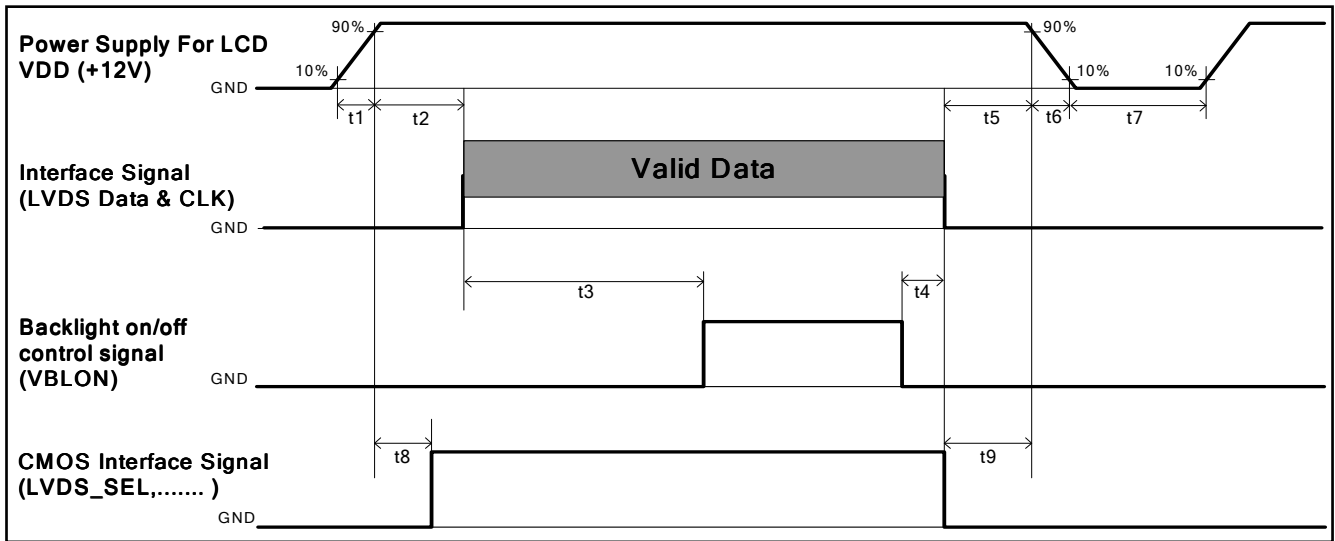
(3) If a period of DE "High" is less than 1920 DCLK or less than 1080 lines, the rest of the screen displays black.

(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



3-6 Power Sequence for LCD



Parameter	Values			Unit Min.
	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 ^{*3}	---	50	ms
t9	0	---	---	ms
Parameter	Values	Unit	---	ms
	Min.	Type.	---	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 signal is N.C. (no connection), opened in Transmitted end, t8 timing spec can be negligible.

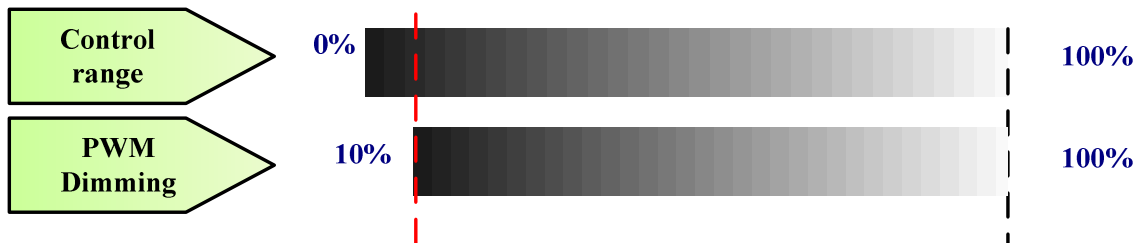
3-7 Backlight Power Specification

3.7.1: Electrical specification

Item	Symbol	Condition	Spec			Unit	Note
			Min	Typ	Max		
Operating Voltage	HIGH (FET)	-	-	+55	-	Vp-p	
	Low (FET)	-	-	-55	-	Vp-p	
Operating Current	Io	-		16.5	17	mArms	
BL Total Power Dissipation	PBL	-	-	117	-	Watt	
Striking Voltage	Vstk	At 0°C	1500	-	2520	Vrms	
Striking Time	Ts	-	1000	1500	2000	msec	
Operating Frequency	fo	-	38	40	42	kHz	
PWM Operating Frequency	F_PWM	-	140	150	160	Hz	
PWM Dimming Duty Ratio	D_PWM	-	10	-	100	%	Note 1&2
Lamp Type			Straight				
Number of Lamps			8			pcs	
Type of current balance			T-balance				

(Ta=25±5°C, Turn on for 45minutes)

Note 1: Dimming range



PWM Dimming : include Internal and External PWM Dimming

Note 2: Low dimming ratio operation

When PWM dimming duty ratio is operated lower than recommended value, feedback signal and all protection functions should be confirmed by LIPS design. Display performance should also be confirmed by customer's implement.

3.7.2: Input Pin Assignment

CN1: CI0112M1HRL-NH(CviLux)

Pin No	Signal name	Feature
1	VBL+	+55 V Sine Wave
2	VBL+	+55 V Sine Wave
3	N.C	No Connect
4	VBL-	-55 V Sine Wave
5	VBL-	-55 V Sine Wave
6	N.C	No Connect
7	SGND	Signal GND
8	VCC	5V
9	CNT	+5V
10	PT	+2V
11	FB1	Lamp current feedback 1
12	FB2	Lamp current feedback 2

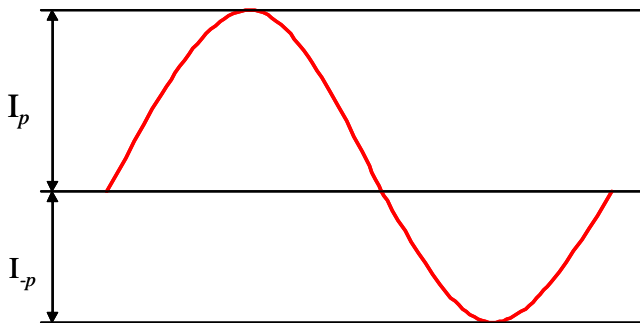
3.7.3: Lamp specification

Item	Symbol	Condition	Spec			Unit	Note
			Min	Typ	Max		
Lamp voltage	VL		673	748	823	Vrms	
Lamp current	IL		-	16.5	17	mArms	
Lamp frequency	fL		35	-	80	kHz	
Starting voltage	Vs	At 0°C	-	-	1485	Vrms	
		At 25°C	-	-	1188	Vrms	
Delayed discharge time	TD		-	-	1.0	sec	
Life time	TL		50K	-	-	hr	
Unsymmetrical ratio	UR		-	-	10%	-	Note 1.
Crest factor	C.F.		$\sqrt{2} - 10\%$	$\sqrt{2}$	$\sqrt{2} + 10\%$	-	

The above characteristics are measured under the conditions:
Ambient temperature: 25±2°C, Relative Humidity: 65±20%RH.

Note 1: Waveform definition

Please light on the lamp with symmetrical voltage and current waveform (unsymmetrical ratio is less than 10%, crest factor within $\sqrt{2} \pm 10\%$).



Unsymmetrical Ratio = $|I_p - I_{-p}| / I_{rms} * 100\%$

Crest Factor = I_p (or I_{-p}) / I_{rms}

I_p : High side peak value

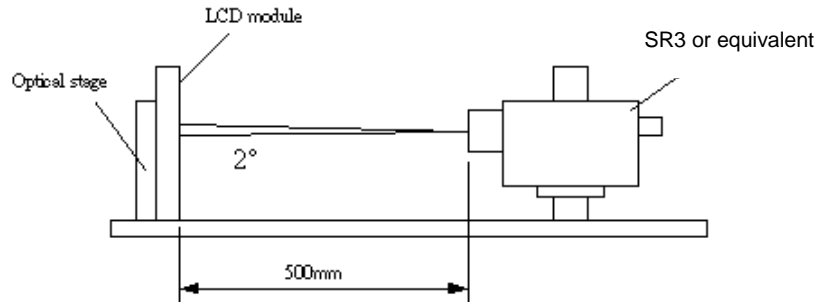
I_{-p} : Low side peak value

I_{rms} : Root mean square value

4. Optical Specification

Optical characteristics are determined after the BLU 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	Condition	Values			Unit	Notes			
			Min.	Typ.	Max					
Contrast Ratio	CR	With AUO Module	2400	3000	--		1,2			
Surface Luminance (White)	L_{WH}		280	350	--	cd/m ²	1,3			
Luminance Variation	$\delta_{WHITE(9P)}$		--	--	1.33		1,4			
Response Time (G to G)	T_{γ}		--	6.5	--	Ms	5			
Color Gamut	NTSC				72	%				
Color Chromaticity		With CS-1000T Standard light source "C"	Typ.-0.03		Typ.+0.03		6			
Red	R_x			0.640						
	R_y			0.330						
Green	G_x			0.300						
	G_y			0.600						
Blue	B_x			0.144						
	B_y			0.060						
White	W_x			0.280						
	W_y	0.290								
Viewing Angle		With AUO Module					7			
x axis, right($\phi=0^\circ$)	θ_r						--	89	--	degree
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

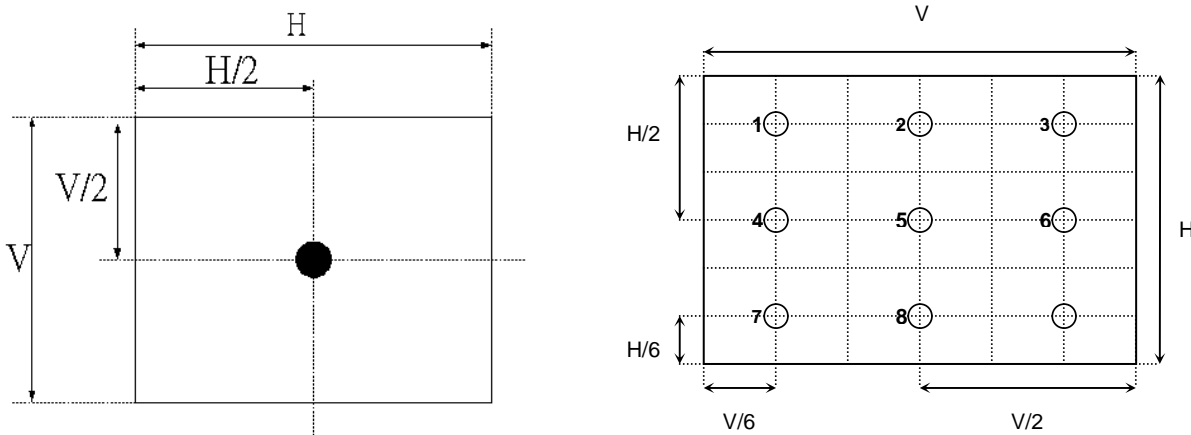
Note:

1. Light source here is the BLU of AUO T390HVN01.0 module.
2. Contrast Ratio (CR) is defined mathematically as:

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

3. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2. $L_{WH} = L_{on5}$ where L_{on5} is the luminance with all pixels displaying white at center 5 location.

FIG. 2 Luminance



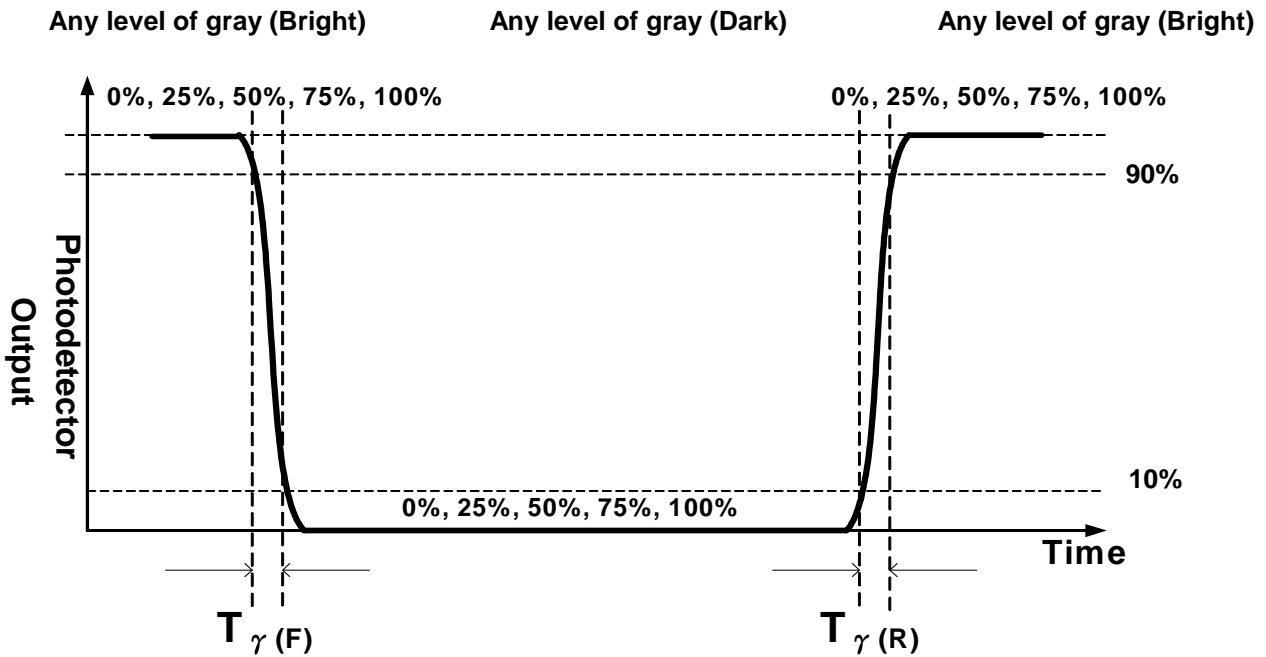
4. The variation in surface luminance, δ_{WHITE} is defined (center of Screen) as:

$$\delta_{WHITE(SP)} = \frac{\text{Maximum}(L_{on1}, L_{on2}, \dots, L_{on9})}{\text{Minimum}(L_{on1}, L_{on2}, \dots, L_{on9})}$$
5. 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 $F_v = 60\text{Hz}$ 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%	

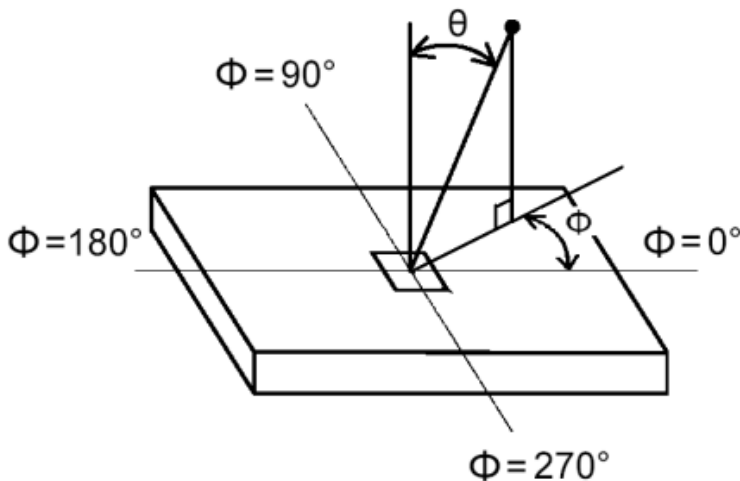
The response time is defined as the following figure and shall be measured by switching the input signal for “any level of grey(bright)” and “any level of grey(dark)”.

FIG.3 Response Time



6. Light source here is the standard light source "C" which is defined by CIE and driving voltages are based on suitable gamma voltages. The calculating method is as following :
 - A. Measure the "Module" and "BLU" optical spectrums (W, R, G, B) of AUO T390HVN01.0
 - B. Calculate cell spectrum from "Module" and "BLU" spectrums.
 - C. Calculate color chromaticity by using cell spectrum and the spectrum of standard light source "C".
7. 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 FIG4.

FIG.4 Viewing Angle

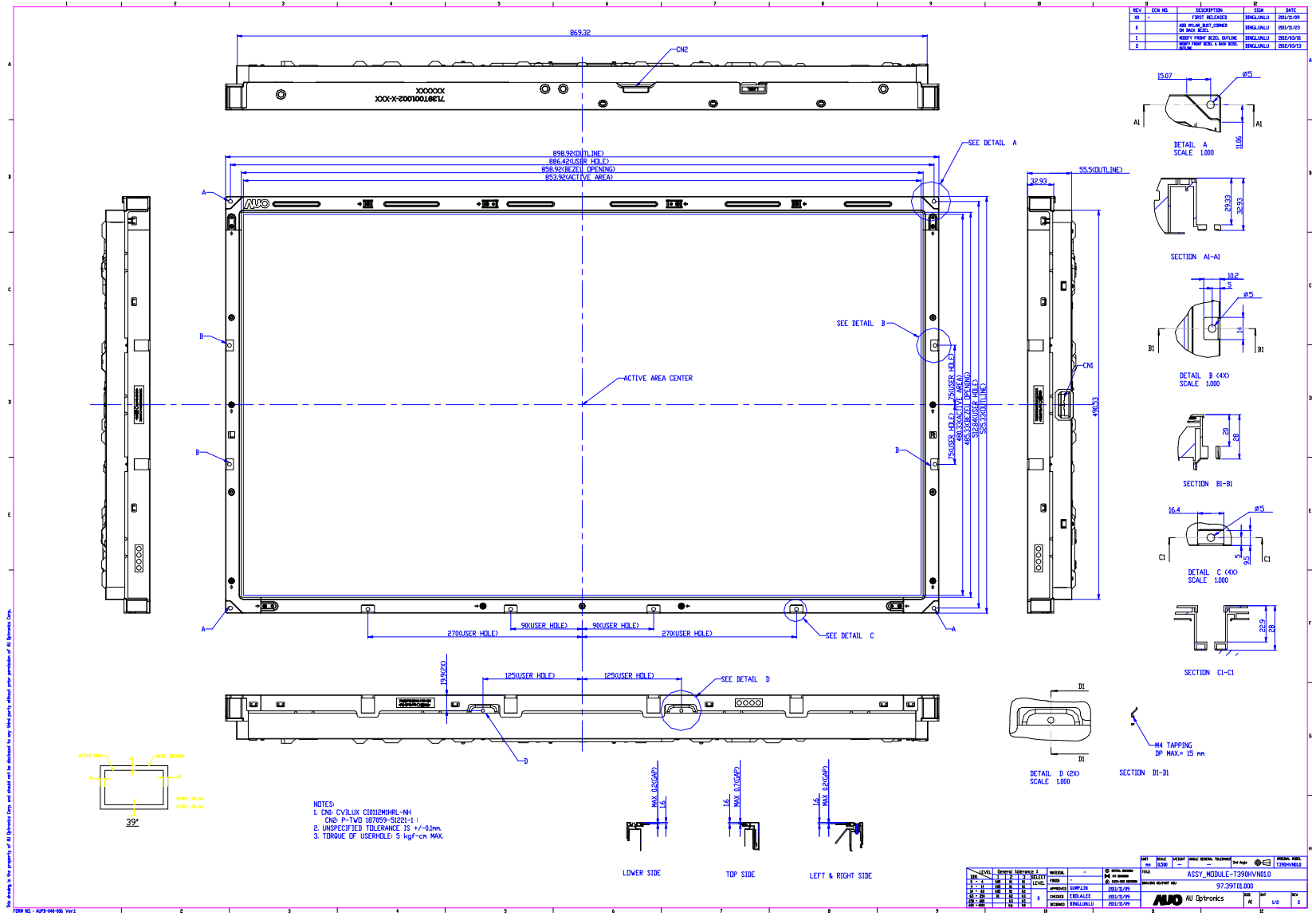


5. Mechanical Characteristics

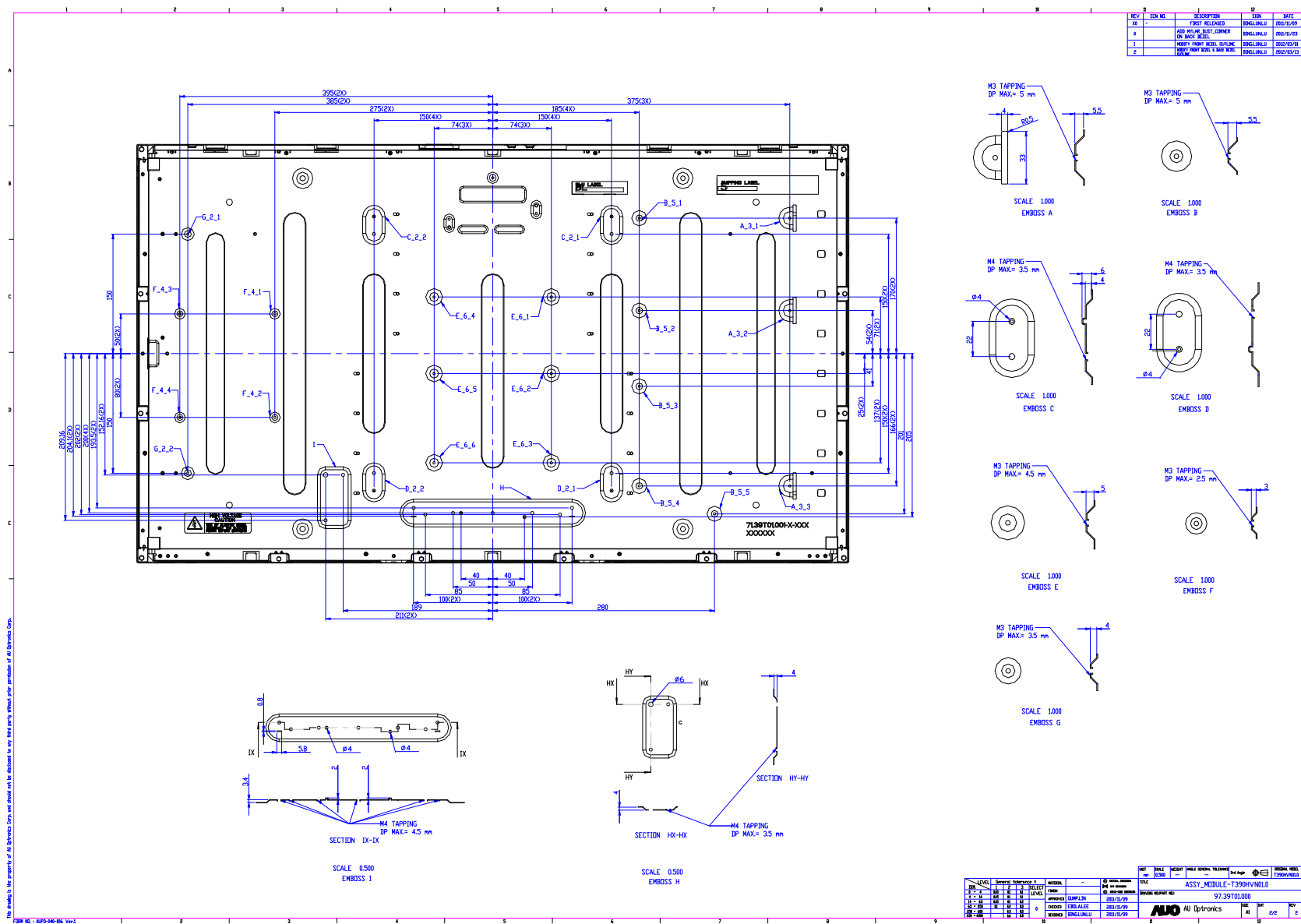
The contents provide general mechanical characteristics for the model T390HVN01.0. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	898.92	mm	
	Vertical	525.33	mm	
	Depth (Dmin)	32.93	mm	
	Depth (Dmax)	55.5	mm	
Weight	6500		g	

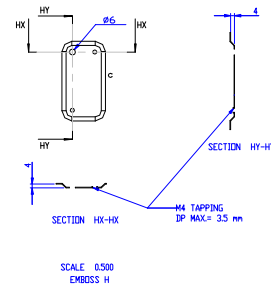
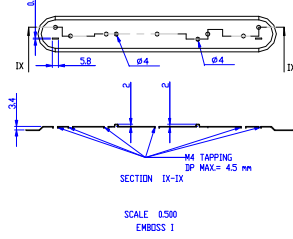
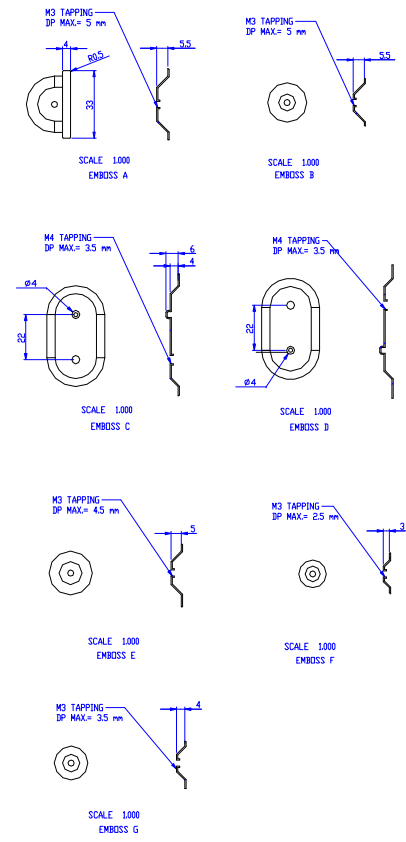
Front View



Back View



REV	EDW NO	DESCRIPTION	DATE
1	-	FIRST RELEASED	08/15/09
2	-	ADD PLATING DET CORNER ON BACK OF DET.	08/15/09
1	-	VERIFY FRONT PANEL QUALITY	08/15/09
2	-	VERIFY FRONT PANEL DET WORK	08/15/09



REV	EDW NO	DESCRIPTION	DATE
1	-	FIRST RELEASED	08/15/09
2	-	ADD PLATING DET CORNER ON BACK OF DET.	08/15/09
1	-	VERIFY FRONT PANEL QUALITY	08/15/09
2	-	VERIFY FRONT PANEL DET WORK	08/15/09

ASSY_MODULE-T390HVN01.0
 97.39701.000
 AUO AU Optronics

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 (non-operation)	3	Wave form: random Vibration level : 1.0G RMS Bandwidth : 10-300Hz Duration : X,Y,Z 10min per axis X,Y,Z: Horizontal, face up
6	Shock test (non-operation)	3	Shock level 50G ,20ms ±X,Y,Z axis Waveform: half sine wave Direction: One time each direction
7	Vibration test (With carton)	6	Random wave (1.5Grms 10~200Hz) Duration : X,Y,Z 30min per axes
8	Drop test (With carton)	6	Height: 30.5cm (ASTMD4169-I) Front flat→ rear flat→ left flat→ right flat → bottom flat→ bottom flat (2 nd time) (refer ASTM D 5276)

7. International Standard

7.1 Safety

- (1) UL 60950-1, UL 60065; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
- (2) IEC 60950-1 : 2001, IEC 60065:2001 ; Standard for Safety of International Electrotechnical Commission
- (3) EN 60950 : 2001+A11, EN 60065:2002+A1:2006; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7.2 EMC

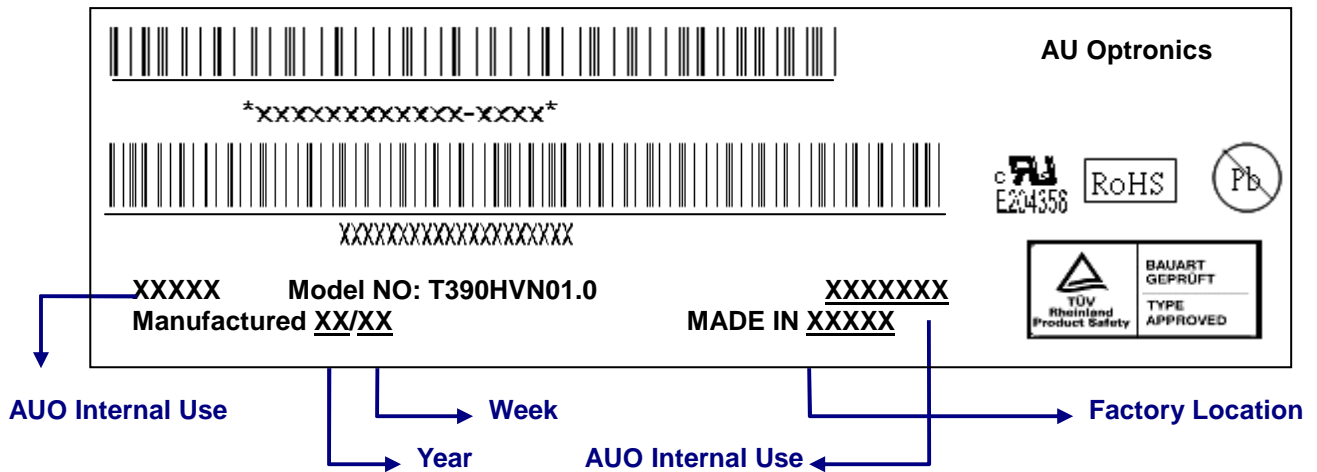
- (1) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992
- (2) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (3) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC),

1998



8. Packing

8-1 DEFINITION OF LABEL:

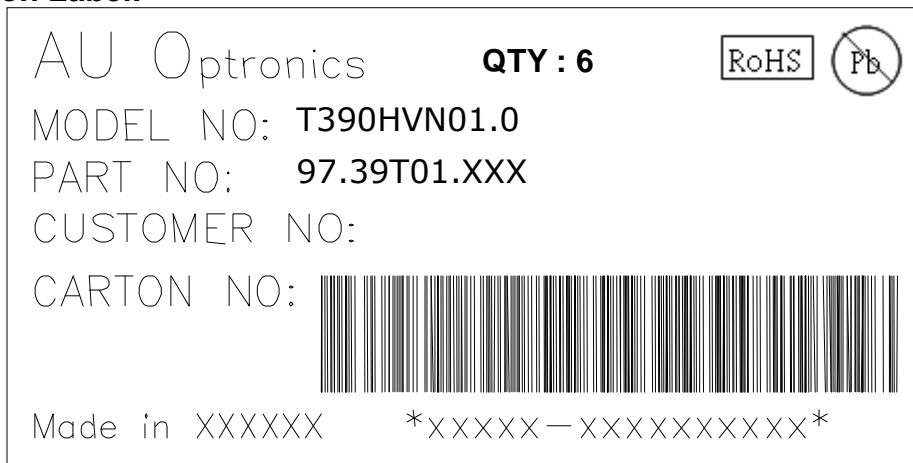
A. Panel Label:



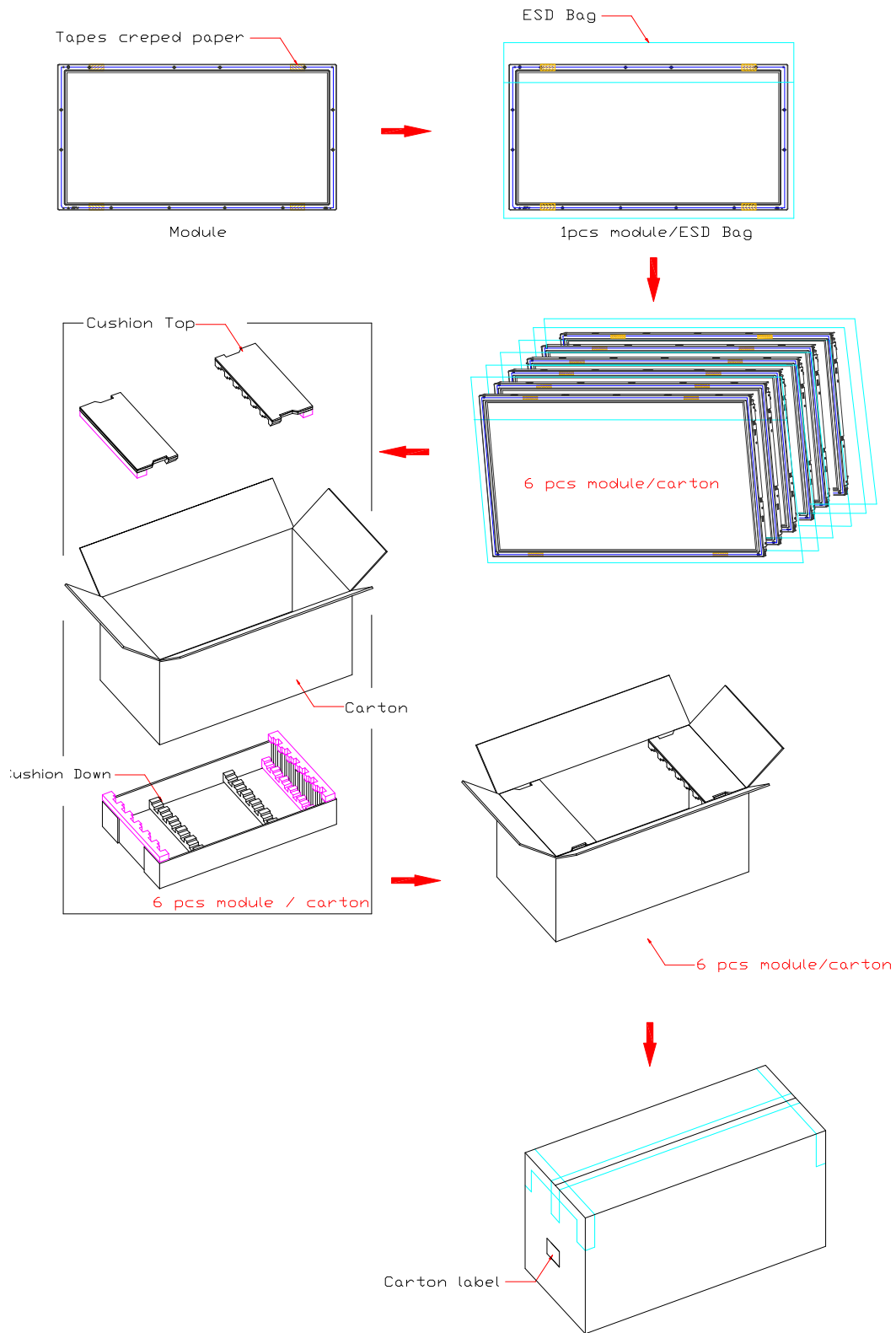
Green mark description

- (1) For Pb Free Product, AUO will add  for identification.
 - (2) For RoHs compatible products, AUO will add  for identification.
- Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

B. Carton Label:

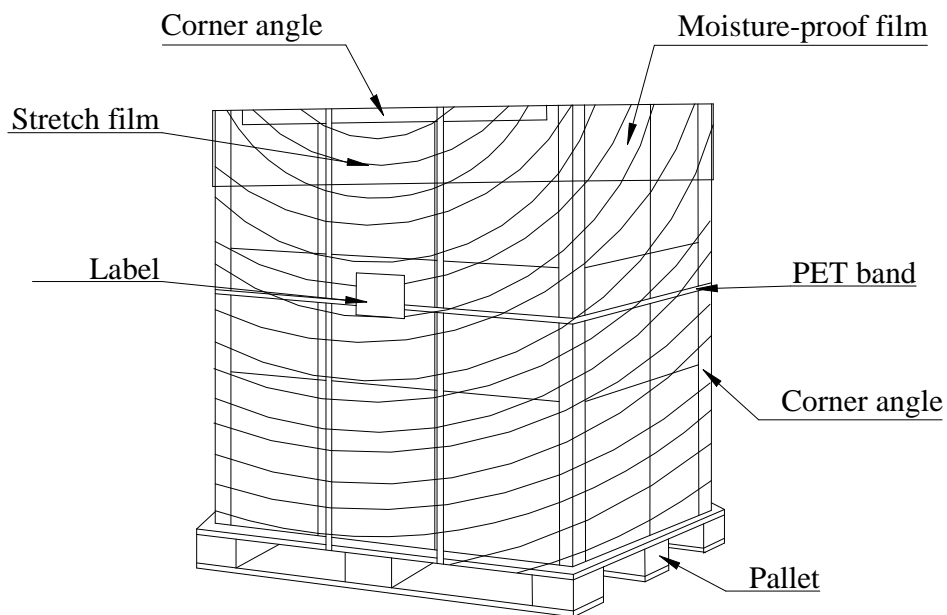


8-2 PACKING METHODS:



8-3 Pallet and Shipment Information (TBD)

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing BOX	6pcs/box	970(L)*560(W)*605(H)	43	Box = 2.7kg Cushion=1.76kg
2	Pallet	1	1150(L)*980(W)*132(H)	14.2	
3	Boxes per Pallet	2 boxes/pallet			
4	Panels per Pallet	12 pcs/pallet			
	Pallet after packing	N/A	1150(L)mm*980(W)mm*1474(H)mm	115	



9. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

9-1 MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) 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.
- (3) 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.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) 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.
- (6) 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.)
- (7) 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.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2 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.

9-3 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.

9-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5 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.

9-6 HANDLING PRECAUTIONS FOR PROTECTION FILM OF POLARIZER

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. 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.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.