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Product Specifications

40” WXGA Color TFT-LCD Module
Model Name: T400XW01 V5

() Preliminary Specifications
(*) Final Specifications

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Record of Revision

Version	Date	No	Old Description	New Description	Remark
0.0	11/27/07		First release		
0.05	12/17/07		Align spec format with other models		
1.0	12/26/07		Final spec.		

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1. General Description

This specification applies to the 40.0 inch Color TFT-LCD Module T400XW01 V5. This LCD module has a TFT active matrix type liquid crystal panel 1366x768 pixels, and diagonal size of 40.0 inch. This module supports 1366x768 HD-Ready 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 T400XW01 V5 has been designed to apply the 8-bit 1 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.
The T400XW01 V5 model is RoHS verified which can be distinguished on panel label.

*** General Information**

Items	Specification	Unit	Note
Active Screen Size	40.00	inch	
Display Area	885.168(H) x 497.66(V)	mm	
Outline Dimension	952.0(H) x 551.0 (V) x 53.2(D)	mm	With Balance board cover
Driver Element	a-Si TFT active matrix		
Display Colors	8 bit, 16.7M	Colors	
Number of Pixels	1366 x 768	Pixel	
Pixel Pitch	0.648(H) x 0.648(W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	3H, Total Haze = 11%		
RoHS	RoHS compliance		

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2. Absolute Maximum Ratings

The following are maximum values that, if exceeded, may cause permanent damage to the device.

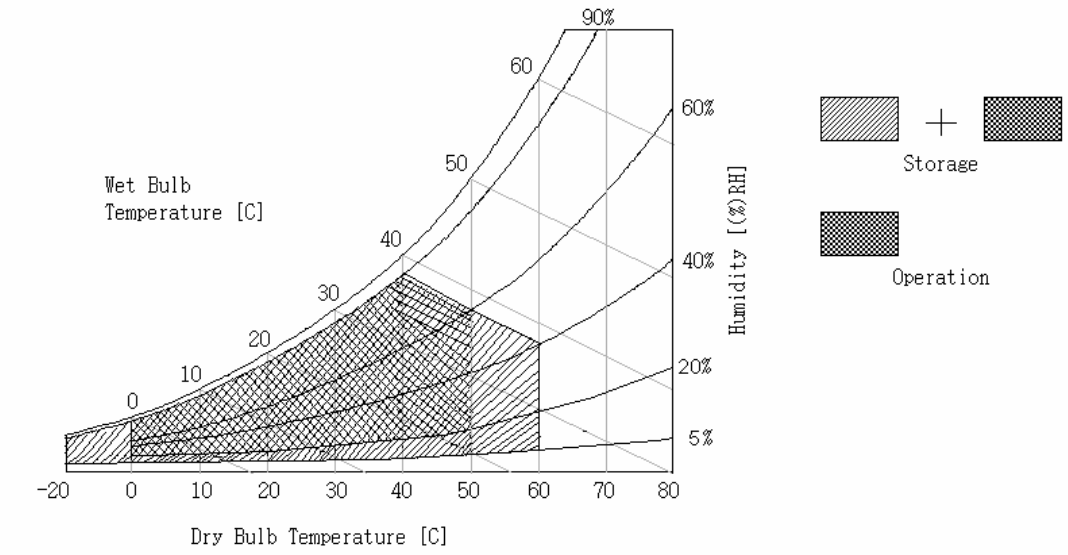
Item	Symbol	Min	Max	Unit	Note
Logic/LCD Drive Voltage	Vcc	-0.3	14	[Volt]	[1]
Input Voltage of Signal	Vin	-0.3	3.6	[Volt]	[1]
Operating Temperature	TOP	0	50	[°C]	[2]
Operating Humidity	HOP	10	90	[%RH]	[2]
Storage Temperature	TST	-20	60	[°C]	[2]
Storage Humidity	HST	10	90	[%RH]	[2]
Panel Surface Temperature	PST		65	[°C]	

Note 1: Duration = 50msec

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

Temperature and relative humidity range is shown below

A. Humidity 90%RH Max (Ta ≤ 40°C)
B. Wet-bulb temperature ≤ 39℃.(Ta > 40°C)
C. No condensation



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3. Electrical Specification

The T400XW01 V5 requires two power inputs.

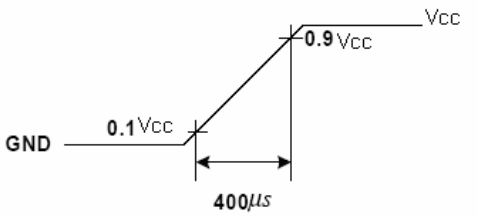
1. 1st input power: for TFT-LCD Module driving.
2. 2nd input power: for the BLU driving, (powered inverter)

3-1 Electrical Characteristics (Ta=25±2°C)

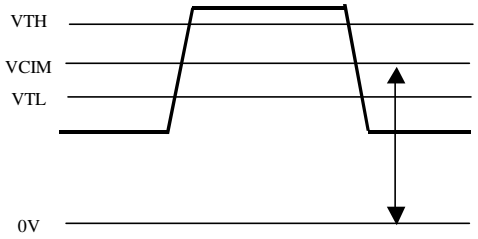
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Power Supply Input Voltage		Vcc		12		Vdc	[1]
Power Supply Input Current		Icc	-	0.55		A	[2]
Power Consumption		Pc	-	6.6		Watt	[2]
Inrush Current		I_{RUSH}	-		3	Apeak	[3]
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}			100	mV	[4]
	Differential Input Low Threshold Voltage	V_{TL}	-100			mV	
	Common Input Voltage	V_{ICM}	1.0	1.2	1.5	V	
CMOS Interface	Input High Threshold Voltage	V_{IH} (High)	2.7		3.3	Vdc	
	Input Low Threshold Voltage	V_{IL} (Low)	0		0.6	Vdc	
Backlight Power Consumption		PDDB	160	170	180	Watt	[5]
Life Time		LL	50000			Hours	[6]

Note:

1. The ripple voltage should be controlled under 10% of Vcc.
2. Vcc=12.0V, f_v =60Hz, fCLK=81.5Mhz , 25℃, Test pattern : White pattern.
3. Measurement conditions, duration = 400 μs



4. VCIM = 1.2 V



5. The measured data is without boost function.
6. Lifetime of lamp is defined and judged at maximum brightness under following conditions:
   Total input current: 187mA, Inverter frequency: 55KHz

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3-2 Interface connections

- LCD connector: JAE FI-E30S-HF

Pin No	Symbol	Y2008 SEC Standard : All HD,60Hz model
1	AGING	No Connect (AUO Aging Only)
2	SCL	EEPROM Serial Clock
3	SDA	EEPROM Serial Data
4	GND	Ground
5	R_0-	LVDS Channel, Signal 0-
6	R_0+	LVDS Channel, Signal 0+
7	GND	Ground
8	R_1-	LVDS Channel, Signal 1-
9	R_1+	LVDS Channel, Signal 1+
10	GND	Ground
11	R_2-	LVDS Channel, Signal 2-
12	R_2+	LVDS Channel, Signal 2+
13	GND	Ground
14	R_CLK-	LVDS Channel, Clock -
15	R_CLK+	LVDS Channel, Clock +
16	GND	Ground
17	R_3-	LVDS Channel, Signal 3-
18	R_3+	LVDS Channel, Signal 3+
19	GND	Ground
20	NC	No Connect (AUO Internal Use Only)
21	LVDS_SEL	Open/High(3.3V) for NS, Low(GND) for JEIDA
22	WP	EEPROM Write Protection
23	GND	Ground
24	GND	Ground
25	GND	Ground
26	V_{DD}	Operating Voltage Supply, +5/12V DC Regulated
27	V_{DD}	Operating Voltage Supply, +5/12V DC Regulated
28	V_{DD}	Operating Voltage Supply, +5/12V DC Regulated
29	V_{DD}	Operating Voltage Supply, +5/12V DC Regulated
30	V_{DD}	Operating Voltage Supply, +5/12V DC Regulated

Note:

- Note 1: All GND (ground) pins should be connected together and should also be connected to the LCD's metal frame.
- Note 2: All VDD (power input) pins should be connected together.
- Note 3: All NC (no connection) pins should be open without voltage input.

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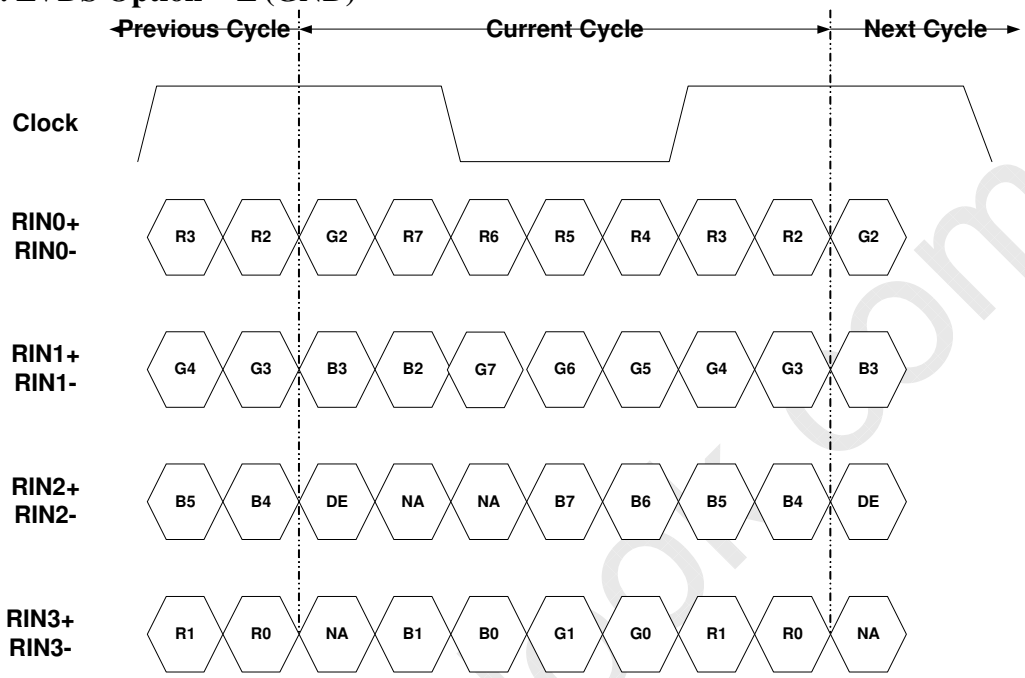
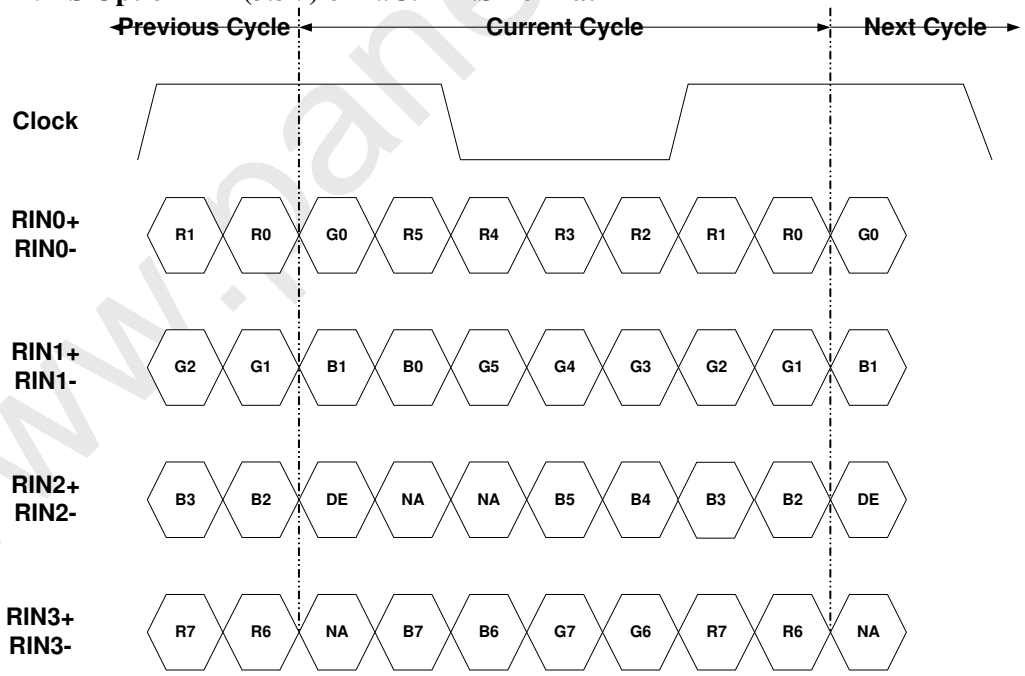
- **LVDS DATA FORMAT**

1. LVDS Option = L (GND)



2. LVDS Option = H (3.3V) or N.C.➔ NS Format



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BACKLIGHT CONNECTOR PIN CONFIGURATION

3-3 Balance board UNITS

3-3-1. Hot Board unit

High voltage connector

CN119 type: **130001WR-02E** (**YeonHo**)

Connector	PIN	SYMBOL	Description	I/O
CN119	2	HV+	+High Voltage	Input
	1	HV-	-High Voltage	Input

Feedback connector

CN213 TYPE：**KN30-7P-1.25H(Hirose Elec.)**

PIN	SYMBOL	FUNCTION
1	VCC	Power Supply for Protection Circuit
2	IFB	Lamp Current Detected signal(Full wave current)
3	IFB	Lamp Current Detected signal(Full wave current)
4	GND	Signal Ground
5	GND	Signal Ground
6	PROT	CCFL Connector Open & Non-lighting signal
7	PROT	CCFL Connector Open & Non-lighting signal

Lamp connector

CHN1~CHN10(at HOT & Cold board): **CP042EP1MFA-LF(Civilux)**

Connector	PIN	SYMBOL	Description	I/O
CHN1~10	**1**	HV+	High Voltage	Output
	2	HV+	High Voltage	Output

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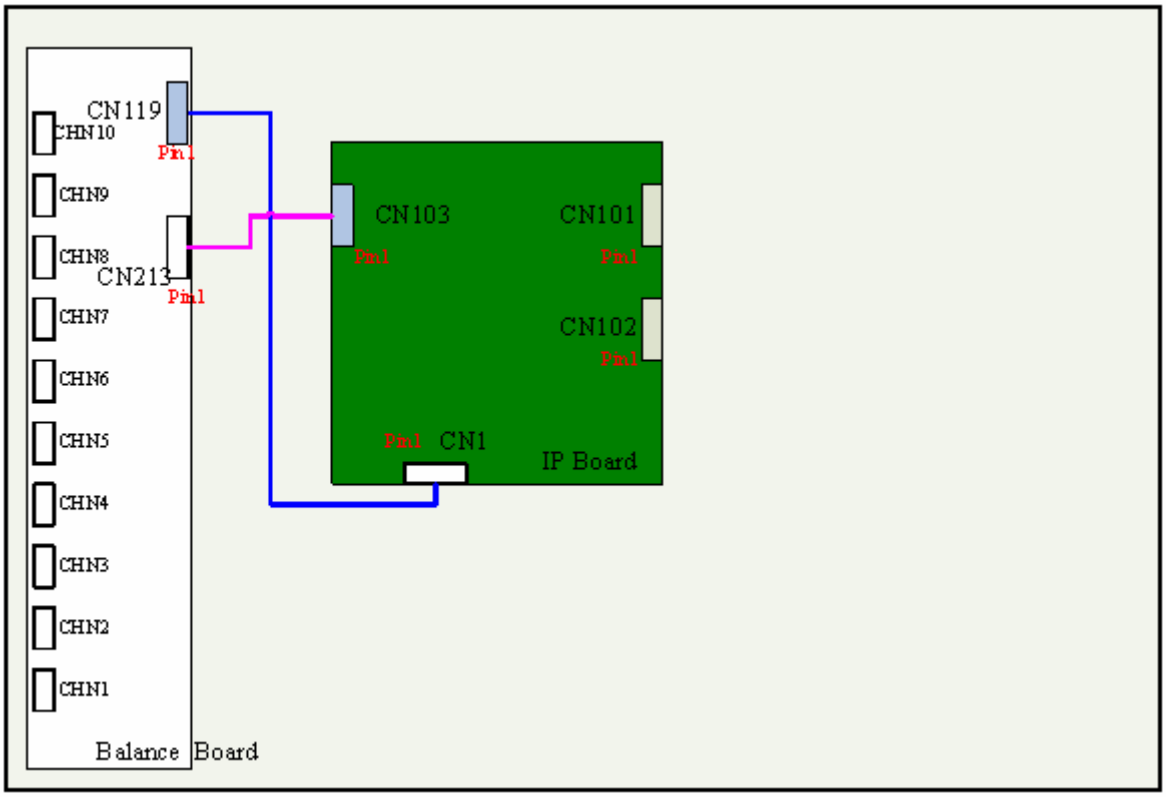

3-3-2 Recommend operation condition (Ta=25±2°C)

	ITEM	Symbol	Min	Typ	Max	UNIT	Note
1	Working Voltage	Vwork		1210		V	At 8.5mA
2	Striking Voltage	Vstrike	1940	2140	2340	Vrms	(at 0±2°C)
3	Striking Voltage	Vstrike	1615	1815	2015	Vrms	(at 25±2°C)
4	Total input current	IT	176	187	198	mA	
5	Output current	IL	8	8.5	9	mA	Hot current
6	Inverter Frequency	FOP		46		kHz	

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3-3-3 Feedback Signal Specification

These operation conditions are recommended for operating the balance board.

(Ta=25±2°C)

Feedback I/O specification (For Darfon JIG Board)

No	Item	SYMBOL	MIN	TYP	MAX	UNIT	Note
1	Lamp detected	LD	0	-	0.8	V	At abnormal condition
			11.4	12	12.6	V	At normal condition
2	Current feedback signal	FB	2.1	2.3	2.5	V	At IT=120mA
3	Supply voltage	VDD	11.4	12	12.6	V	At recommended Load condition

3-4 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 it's proper operation.

Timing Table (DE only Mode)

Vertical Frequency:

Signal	Item	Symbol	MIN	TYP	MAX	Unit
Vertical Section	Period	Tv	785	810	1000	Th
	Active	Tdisp(v)		768		Th
	Blanking	Tblk(v)	17	42	232	Th
Horizontal Section	Period	Th	1440	1648	1900	Tclk
	Active	Tdisp(h)		1366		Tclk
	Blanking	Tblk(h)	74	282	534	Tclk
Vertical Frequency	Frequency	Fv	57	60	63	Hz
Horizontal Frequency	Frequency	Fh	43	48	53	KHz
LVDS Clock	Frequency	FCLK	60	80	85	MHz

1.) Display position is specific by the rise of DE signal only.
Horizontal display position is specified by the falling edge of 1st DCLK right after the rise of 1st DE, is displayed on the left edge of the screen.
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 the of DE is displayed at the top line of screen.
2.) If a period of DE "High" is less than 1366 DCLK or less than 768 lines, the rest of the screen displays black.
3.) 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.

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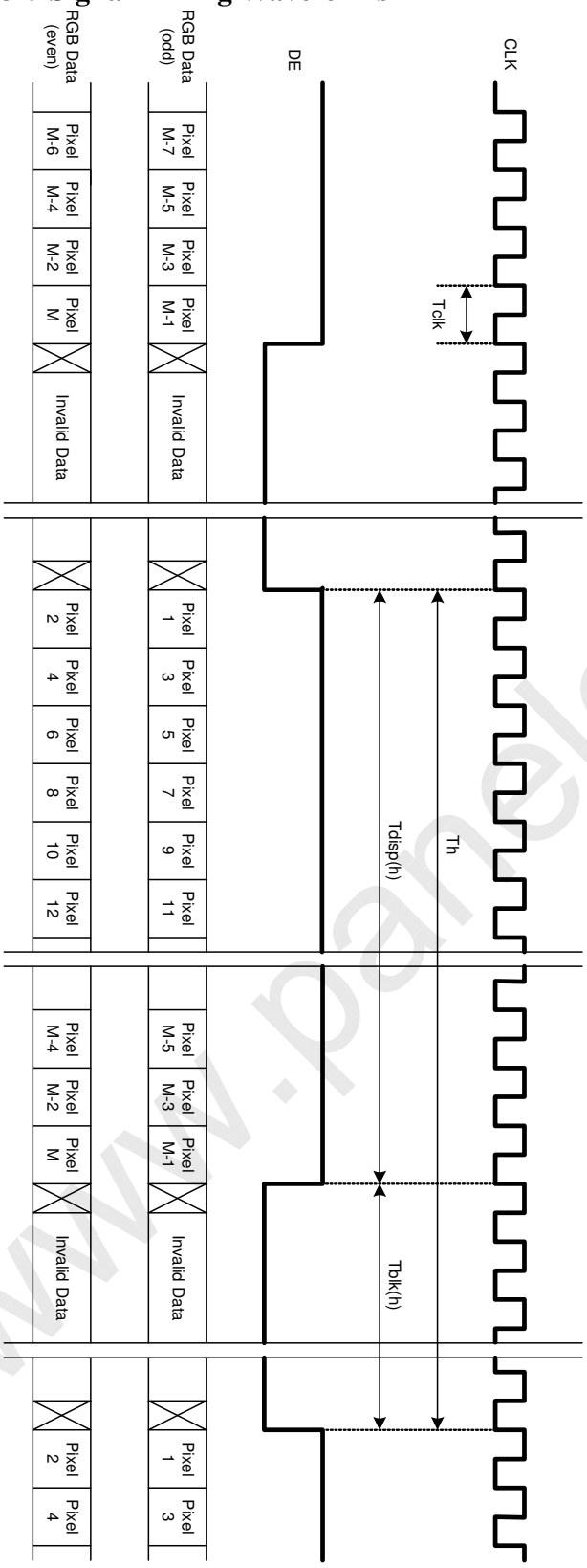
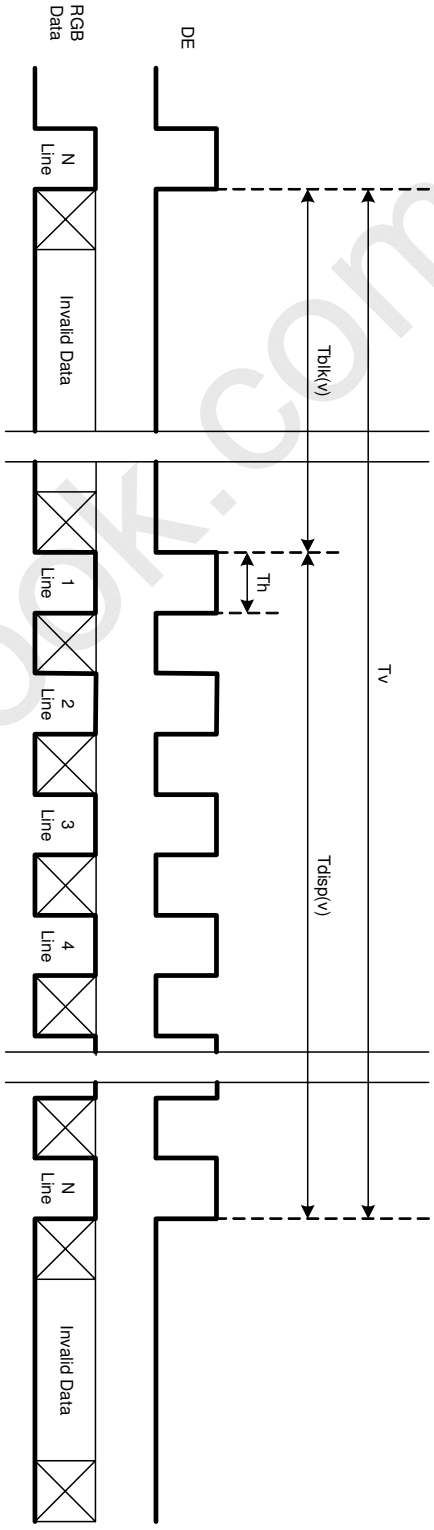
3-5 Signal Timing Waveforms





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3-6 COLOR INPUT DATA ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8 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
		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 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
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	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(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
	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
	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	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
	RED(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	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
	GREEN(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	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	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
	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	1

	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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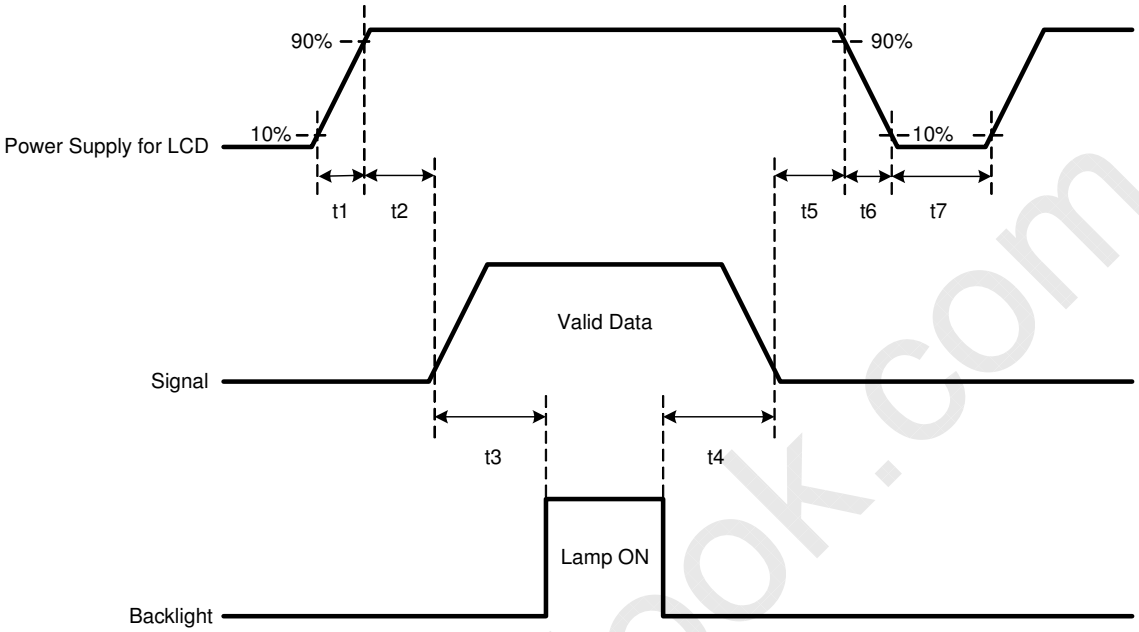
3-7 Power Sequence of LCD Module

3-7-1 Power sequence for LCD



Parameter	Values			Units
	Min.	Typ.	Max.	
t1	0.4		30	**ms**
t2	0.1		50	**ms**
t3*	200			**ms**
t4	10			**ms**
t5	0.1		50	**ms**
t6			300	**ms**
t7	300			**ms**

Note:

The timing controller will not be damaged in case of TV set AC input power suddenly shut down. Once power reset, it should follow power sequence as spec. definition.

(1) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become abnormal screen.

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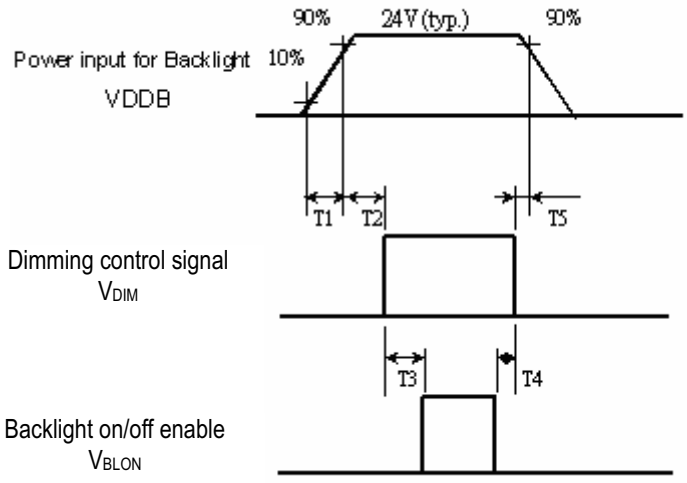
3-7-2 Power Sequence for Inverter



Parameter	Values			Units
	Min.	Typ.	Max.	
T1	20	-	-	ms
T2	50	-	-	ms
T3	0	-	-	ms
T4	0	-	-	ms
T5	0	-	-	ms
T6	-	-	10	ms

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4. Optical Specification

Optical characteristics are determined after the unit has been "ON" 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.

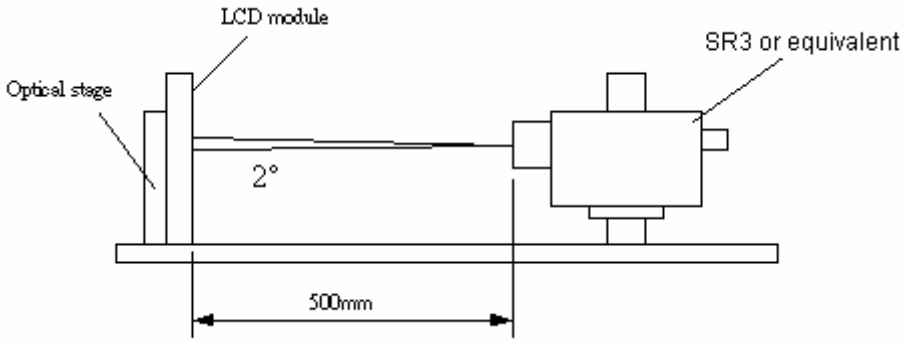

FIG.1 Measurement equipment

Parameter		Symbol		Condition	Value			Units	Notes
					Min.	Typ.	Max.		
Contrast Ratio		CR		φ =0°, θ=0° Viewing Normal angle	1800	2000			1
Surface Luminance, white		LWH			360	450		cd/㎡	2
Luminance Variation		δ_{WHITE}	9 pts				1.3	cd/㎡	3
Response Time	Gray to Gray	T_γ				8		ms	4
Color Coordinates (CIE 1931)	RED	R_X			Typ -0.03	0.645	Typ +0.03		
		R_Y				0.335			
	GREEN	G_X				0.280			
		G_Y				0.610			
	BLUE	B_X				0.145			
		B_Y				0.055			
	WHITE	W_X				0.275			
		W_Y				0.293			
Viewing Angle	x axis, right	θ_r	(φ=0°)	CR≥20	89			Degree	5
	x axis, left	θ_l	(φ=180°)		89				
	y axis, up	θ_u	(φ=90°)		89				
	y axis, down	θ_d	(φ=0°)		89				

Note:

1. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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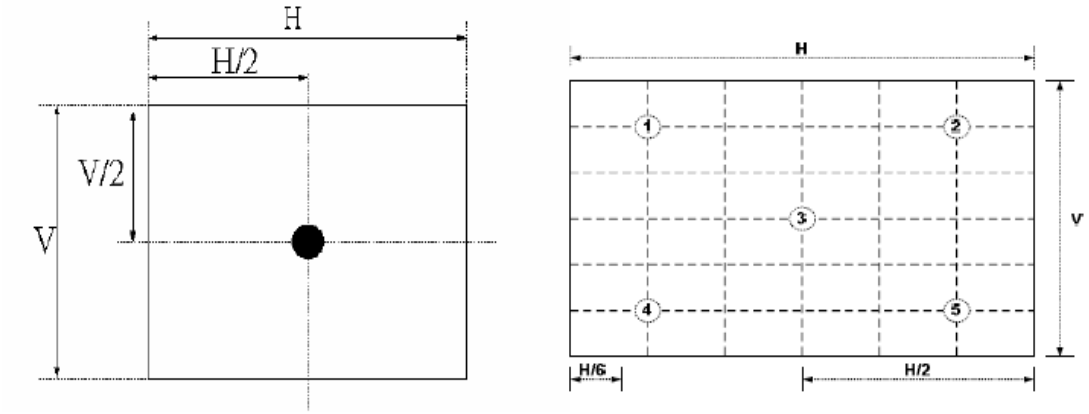
2. Surface luminance is luminance value at point 1 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2.

FIG. 2 Luminance



3. The variation in surface luminance, δWHITE is defined (center of Screen) as:

$$\delta_{WHITE(5P)}=\text{Maximum}(L_{on1}, L_{on2},\ldots,L_{on5})/\text{Minimum}(L_{on1}, L_{on2},\ldots L_{on5})$$

4. Response time Tγ 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=60Hz to optimize.

	0%	25%	50%	75%	100%
0%		t:0%-25%	t:0%-50%	t:0%-75%	t:0%-100%
25%	t:25%-0%		t:25%-50%	t:25%-75%	t:25%-100%
50%	t:50%-0%	t:50%-25%		t:50%-75%	t:50%-100%
75%	t:75%-0%	t:75%-25%	t:75%-50%		t:50%-100%
100%	t:100%-0%	t:100%-25%	t:100%-50%	t:100%-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)

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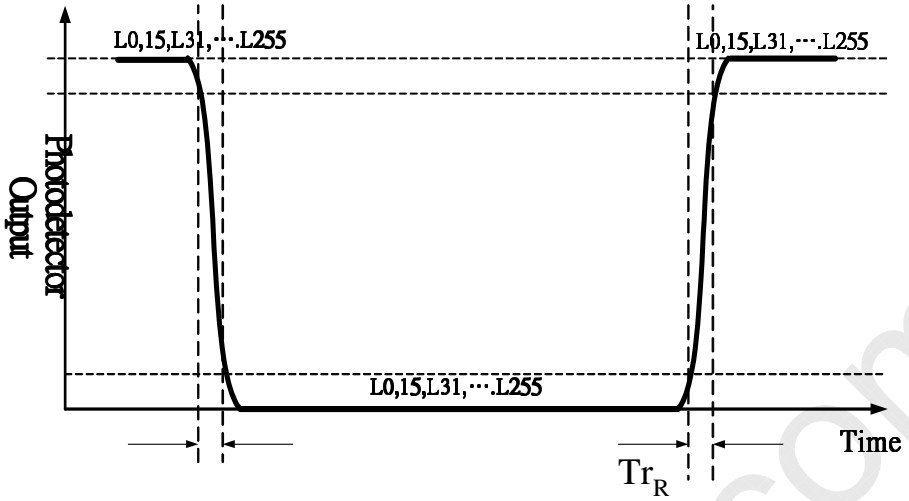
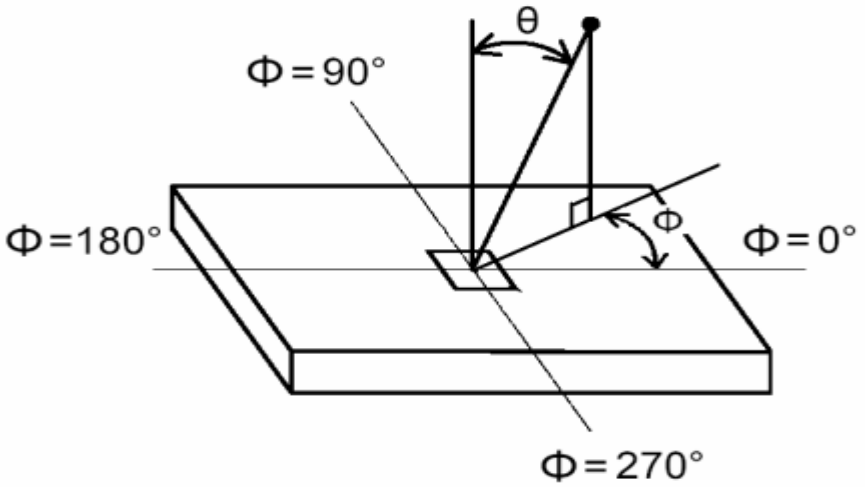


5 . Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal (or x-axis) and the vertical (or y-axis) with respect to the z-axis which is normal to the LCD surface. For more information see Fig. 4-3.

FIG. 3 Viewing angle



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5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model T400XW01 V5. Detailed mechanical drawings are shown in the following pages.

Outline Dimension	Horizontal	952.0 mm
	Vertical	551.0 mm
	Depth	53.2 mm(with balance board cover)
Bezel Opening	Horizontal	891.7 mm
	Vertical	504.2 mm
Active Display Area	Horizontal	885.168mm
	Vertical	497.664 mm
Weight	11500g (Typ.)	

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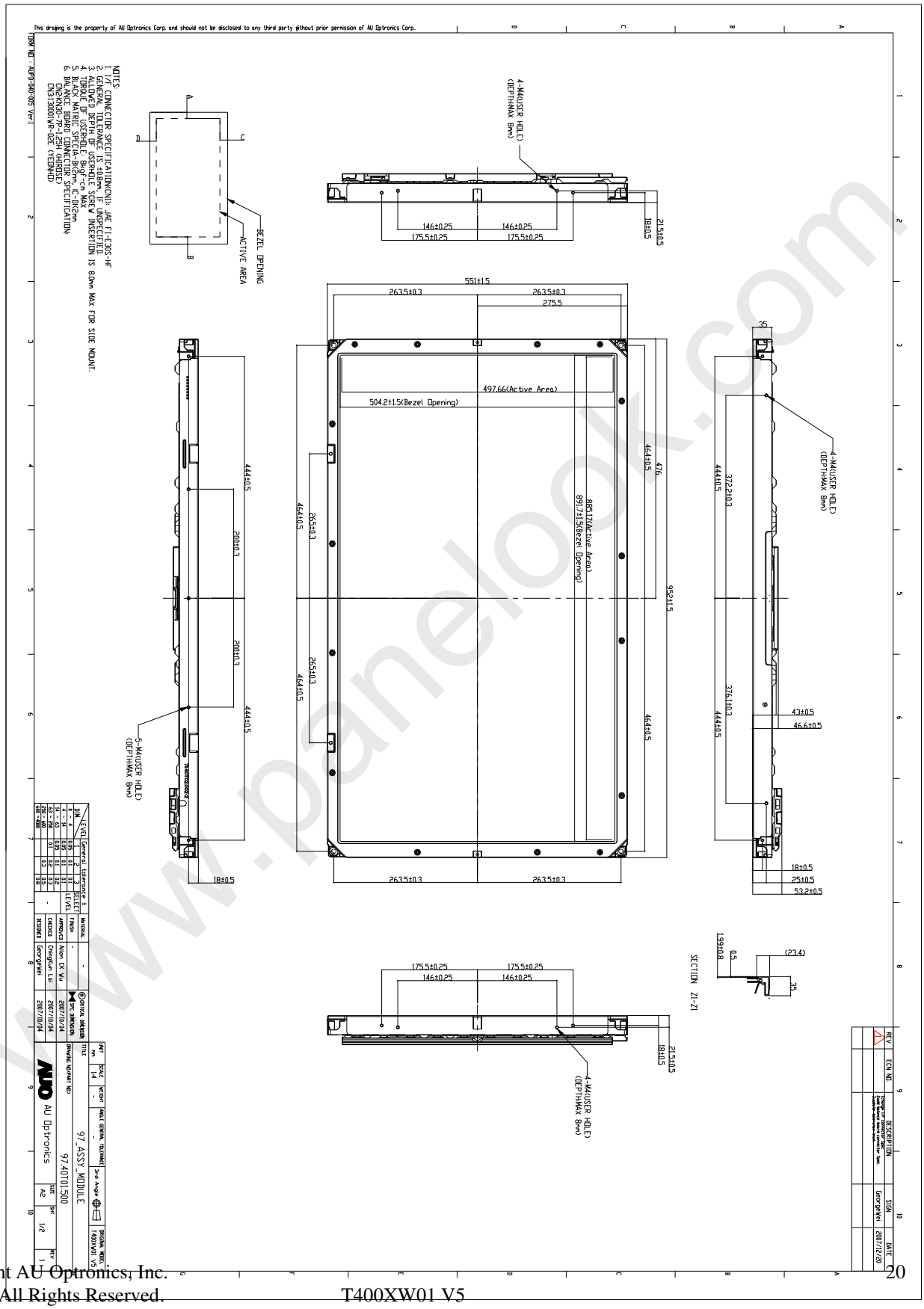
Mechanical Figure:



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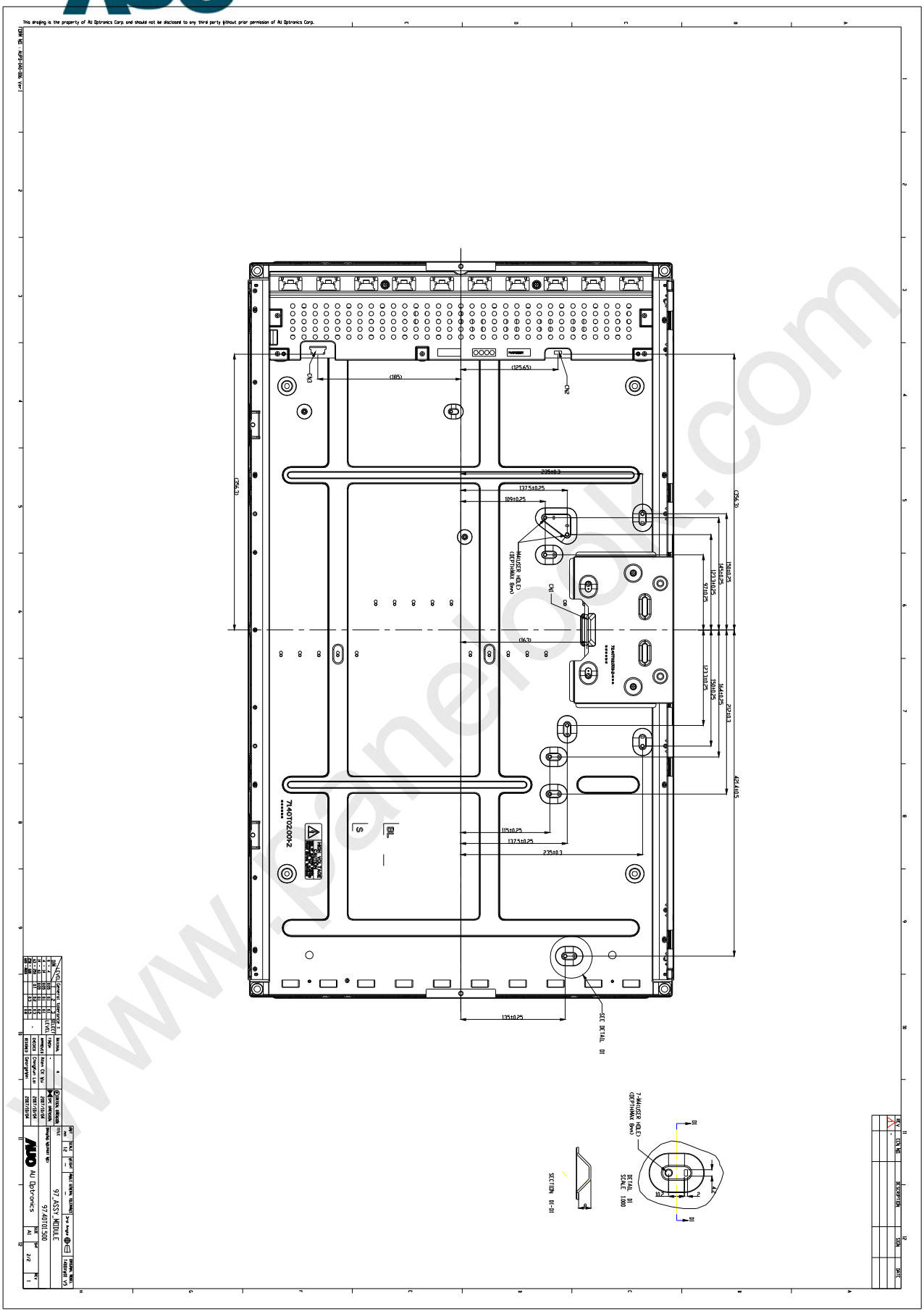

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6. Reliability

Environment test condition:

	Test Items	Q'ty	Conditions
1	High Temperature Stroage	3	60℃ 300 hrs
2	Low Temperature Stroage	3	-20℃, 300 hrs
3	High Temperature Operation	3	50℃, 300 hrs
4	Low Temperature Operation	3	-5℃, 300 hrs
5	Vibration (non-operation)	3	(10 ~ 300Hz/1.5G/11min SR, XYZ 30min/axis) Vibration level : 1.5G RMS, Bandwidth : 10-300Hz Duration: X, Y, Z 30min,
6	Shock (non-operation)	3	Shock level: 50G Waveform: have sine wave, 11ms Direction: ±X,±Y, ±Z One time each direction
7	Vibration (With carton)	3	Random wave (1.5 Grms 5~500Hz) 30mins / Per each X.Y.Z axes
8	Drop (With carton)	3	Height: 46cm 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)

Result Evaluation Criteria:
There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

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7. International Standard

7-1 Safety

(1) UL1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995
Standard for Safety of Information Technology Equipment Including electrical Business Equipment.

(2) CAN/CSA C22.2 No. 950-95/60950 Third Edition, Canadian Standards Association,
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.

(3) EN60950: 1992+A2: 1993+A2: 1993+C3: 1995+A4: 1997+A11: 1997
IEC 950: 1991+A1: 1992+A2: 1993+C3: 1995+A4:1996
European Committee for Electrotechnical Standardization (CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2 EMC

a) 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

b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.

c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

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8. Packing

8-1 DEFINITION OF LABEL:

A. Panel Label:

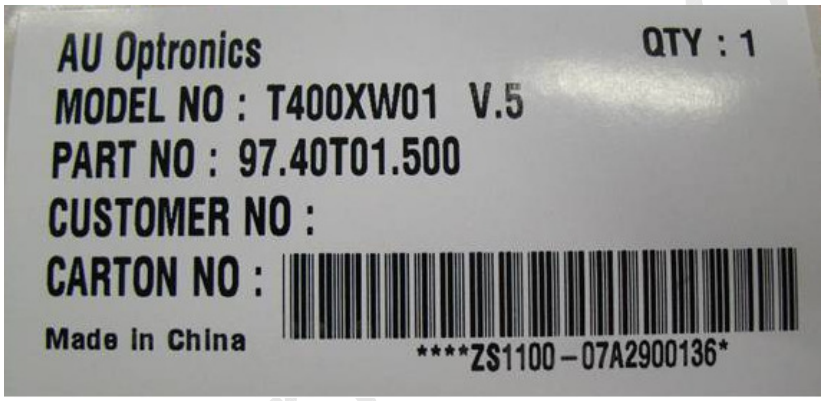
Green mark description

For Pb Free Product, AUO wil add for identification.

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. (The definition of green design follows the AUO green design checklist.)

B. Carton Label:



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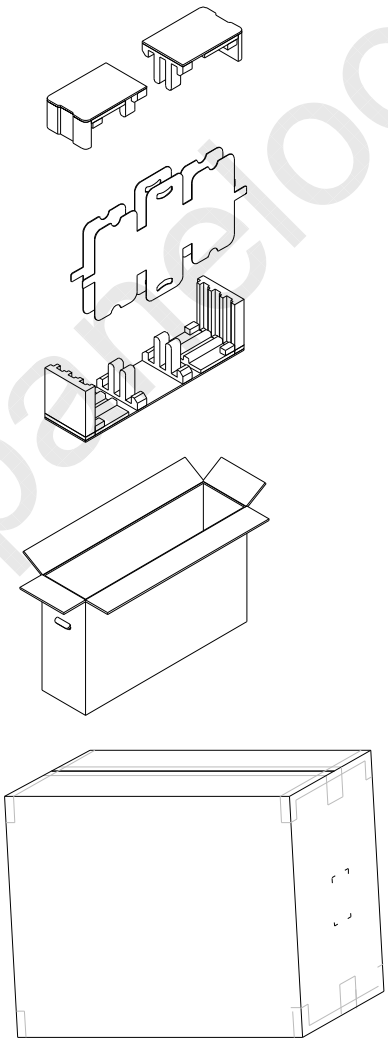
8-2 PACKING METHODS:

3pcs Modules



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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 module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(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 the 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 polarizer 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 polarizer. 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 spike noise causes the mis-operation of circuits. It should be lower than following voltage: V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature. (In lower temperature, it becomes longer..)

(3) Brightness of CCFL 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.

(4) 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.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) 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.

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9-3 ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband 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 modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ 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

(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 flue 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.

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