



Document Version: 0.0

Date:2008/09/30

Product Specifications

40" Full HD Color TFT-LCD Module
Model Name: T400HW02 V5

(*) Preliminary Specifications

() Final Specifications



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 CONNECTOR PIN CONFIGURATION
4		OPTICAL SPECIFICATION
5		MECHANICAL CHARACTERISTICS
6		RELIABILITY TEST ITEMS
7		INTERNATIONAL STANDARD
	7-1	Safety
	7-2	EMC
8		PACKING
9		PRECAUTION



Record of Revision

Version	Data	No	Old Description	New Description	Remark
0.0	2008/09/30		First release		N/A



1. General Description

This specification applies to the 40.0 inch Color TFT-LCD Module T400HW02 V5. This LCD module has a TFT active matrix type liquid crystal panel 1,920x1,080 pixels, and diagonal size of 40.0 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 T400HW02 V5 has been designed to apply the 10-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	40.00	inch	
Display Area	885.6(H) x 498.15(V)	mm	
Outline Dimension	952.0(H) x 551.0 (V) x 49.6(D)	mm	With T-con cover
Driver Element	a-Si TFT active matrix		
Display Colors	10 bit, 1073.7M	Colors	
Number of Pixels	1,920x1,080	Pixel	
Pixel Pitch	0.46125 (H) x 0.46125(W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Super Clear (Anti-reflection coating)		



2. Absolute Maximum Ratings

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

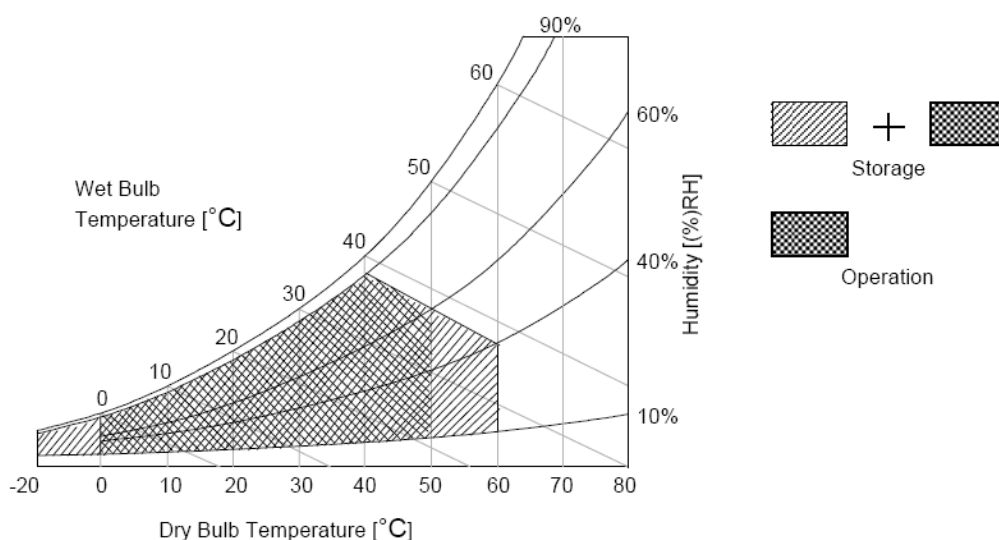
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	3.6	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 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 T400HW02 V5 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input, which powers the CCFL, is typically generated by an integrate power (I/P) system.

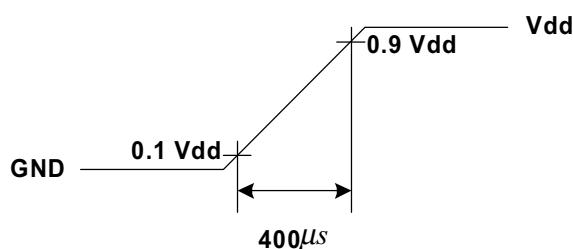
3.1 Electrical Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LCD							
Power Supply Input Voltage		V_{DD}	10.8	12	13.2	V_{DC}	1
Power Supply Input Current		I_{DD}	--	1.14	1.25	A	2
Power Consumption		P_C	--	13.68	15.0	Watt	2
Inrush Current		I_{RUSH}	--	--	4.5	A	3
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}	--	--	+100	mV_{DC}	4
	Differential Input Low Threshold Voltage	V_{TL}	-100	--	--	mV_{DC}	4
	Input Common Mode Voltage	V_{ICM}	0.6	1.2	1.8	V_{DC}	4
CMOS Interface	Input High Threshold Voltage	V_{IH} (High)	2.4	--	3.3	V_{DC}	
	Input Low Threshold Voltage	V_{IL} (Low)	0	--	0.7	V_{DC}	
Life Time			50000		--	Hours	

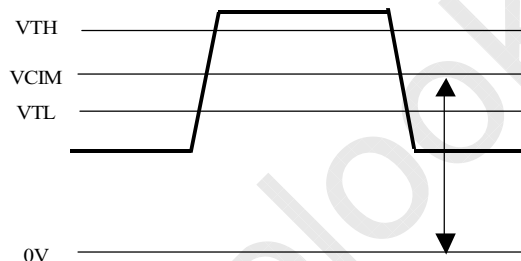


Note :

1. The ripple voltage should be controlled under 10% of V_{CC}
2. $V_{CC}=12.0V$, $f_v = 60Hz$, $f_{CLK}=81.5Mhz$, $25^{\circ}C$, Test Pattern : White Pattern
3. Measurement condition :



4. $V_{CIM} = 1.2V$



5. The performance of the Lamp in LCD panel, for example life time or brightness, is extremely influenced by the characteristics of balanced board and I/P board. All the parameters should be carefully designed as not to produce too much leakage current from high-voltage output. While you design or order the balance board, please make sure unwanted lighting caused by the mismatch of the lamp and the balanced board (no lighting, flicker, etc) never occurs. After confirmation, the LCD panel should be operated in the same condition as installed in your instrument
6. Do not attach a conducting tape to lamp connecting wire. If the lamp wire attach to conducting tape, TFT-LCD Module have a low luminance and the inverter has abnormal action because leakage current occurs between lamp wire and conducting tape.
7. The relative humidity must not exceed 80% non-condensing at temperatures of $40^{\circ}C$ or less. At temperatures greater than $40^{\circ}C$, the wet bulb temperature must not exceed $39^{\circ}C$. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.



3.2 Interface Connections

- LCD connector: FI-RE51S-HF (JAE)
- Mating connector: FI-RE51S-HL (JAE)

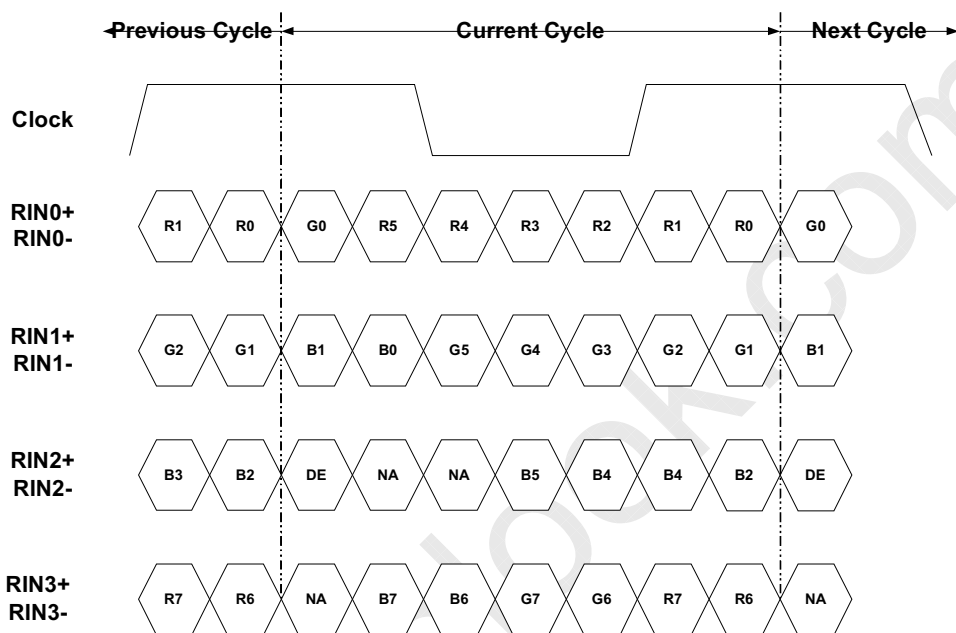
PIN #	Signal Name	Description
1	V _{DD}	Operating Voltage Supply, +12V DC Regulated
2	V _{DD}	Operating Voltage Supply, +12V DC Regulated
3	V _{DD}	Operating Voltage Supply, +12V DC Regulated
4	V _{DD}	Operating Voltage Supply, +12V DC Regulated
5	V _{DD}	Operating Voltage Supply, +12V DC Regulated
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	RO_0-	LVDS Channel Odd, Signal 0-
11	RO_0+	LVDS Channel Odd, Signal 0+
12	RO_1-	LVDS Channel Odd, Signal 1-
13	RO_1+	LVDS Channel Odd, Signal 1+
14	RO_2-	LVDS Channel Odd, Signal 2-
15	RO_2+	LVDS Channel Odd, Signal 2+
16	GND	Ground
17	RO_CLK-	LVDS Channel Odd, Clock -
18	RO_CLK+	LVDS Channel Odd, Clock +
19	GND	Ground
20	RO_3-	LVDS Channel Odd, Signal 3-
21	RO_3+	LVDS Channel Odd, Signal 3+
22	NC	No Connect (Reserved for 10-bit)
23	NC	No Connect (Reserved for 10-bit)
24	GND	Ground
25	RE_0-	LVDS Channel Even, Signal 0-
26	RE_0+	LVDS Channel Even, Signal 0+
27	RE_1-	LVDS Channel Even, Signal 1-
28	RE_1+	LVDS Channel Even, Signal 1+
29	RE_2-	LVDS Channel Even, Signal 2-
30	RE_2+	LVDS Channel Even, Signal 2+



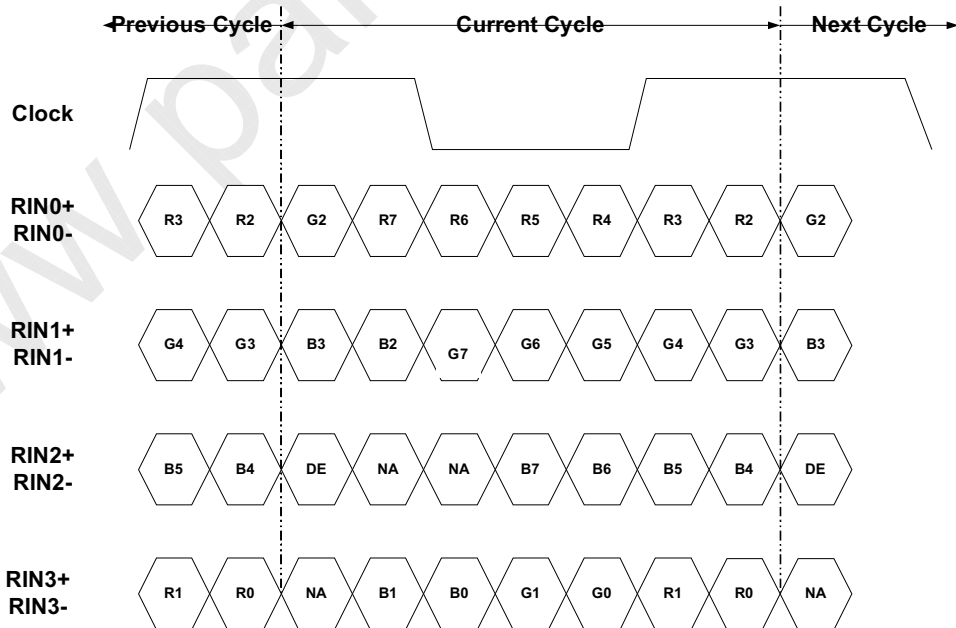
31	GND	Ground
32	RE_CLK-	LVDS Channel Even, Clock -
33	RE_CLK+	LVDS Channel Even, Clock +
34	GND	Ground
35	RE_3-	LVDS Channel Even, Signal 3-
36	RE_3+	LVDS Channel Even, Signal 3+
37	NC	No Connect (Reserved for 10-bit)
38	NC	No Connect (Reserved for 10-bit)
39	GND	Ground
40	SCL_TCON	Please leave it open
41	SDA_TCON	Please leave it open
42	NC	Please leave it open
43	B_INT	B_INT(same as WP);EEPROM Write Protection High(3.3V) for Writable, Low(GND) for Protection
44	Hsync_OUT	H-Sync Output for Inverter/IPB
45	LVDS_SEL	Open/High(3.3V) for NS, Low(GND) for JEIDA
46	SCL_FRC	EEPROM Serial Clock for FRC
47	Reset_FRC	Reset for FRC Chip
48	SDA_FRC	EEPROM Serial Data for FRC
49	PVCC_SW	Panel VCC Sequence Control
50	SYS_DET	Detection Pin to Check if System Board Connected (GND if connected)
51	NC	Please leave it open



LVDS Option = High/Open → NS



LVDS Option = Low → JEIDA





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)

For 60Hz

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	T_V		1125		T_H
	Active	$T_{DISP} (V)$		1080		T_H
	Blanking	$T_{BLK} (V)$		45		T_H
Horizontal Section	Period	T_H		1100		T_{CLK}
	Active	$T_{DISP} (H)$		960		T_{CLK}
	Blanking	$T_{BLK} (H)$		140		T_{CLK}
Clock	Frequency	$1/T_{CLK}$		74.25		MHz
Vertical Frequency	Frequency	F_V		60		Hz
Horizontal Frequency	Frequency	F_H		67.5		KHz

Notes:

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

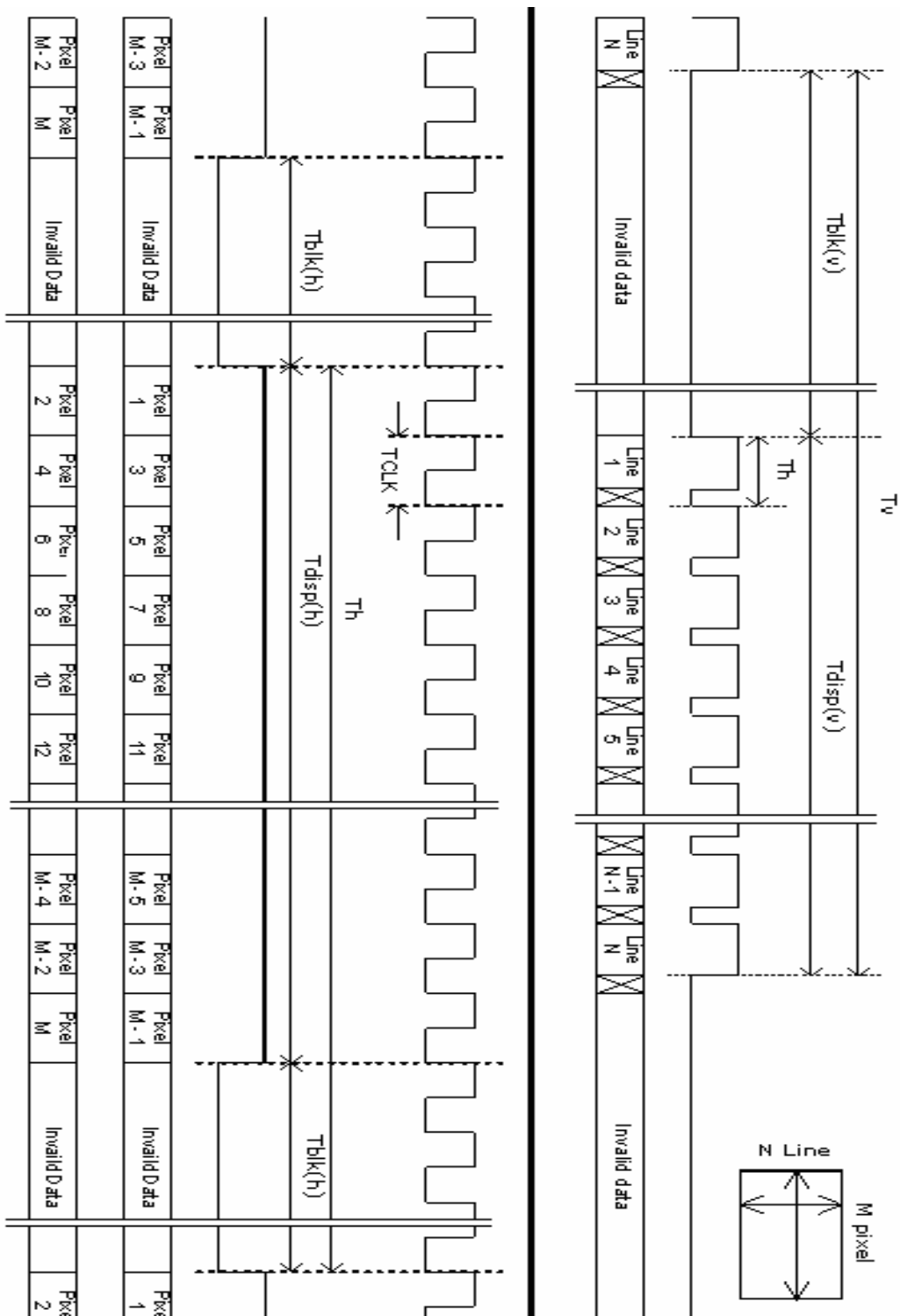
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

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 1st DE is displayed at the top line of screen.

3.) If a period of DE "High" is less than 1366 DCLK or less than 768 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 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

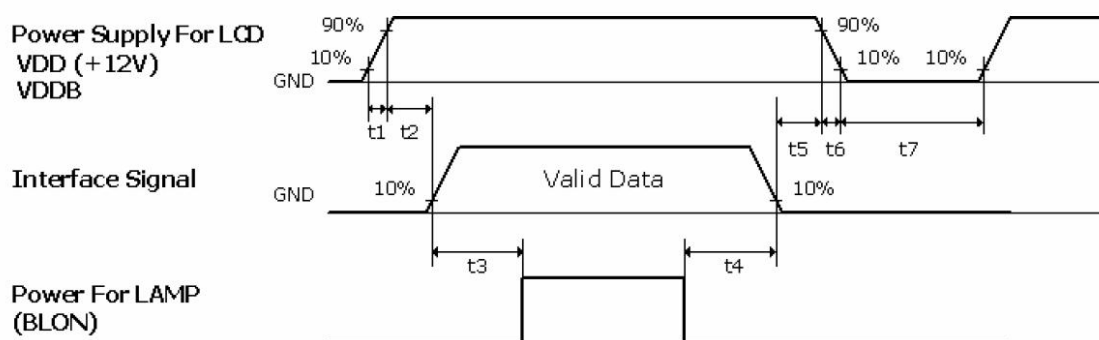
Color		Input Color Data																													
		RED										GREEN										BLUE									
		MSB					LSB					MSB					LSB					MSB					LSB				
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
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	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	
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	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	1	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	
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	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	

3.6 Power Sequence



Parameter	Values			Unit
	Min.	Typ.	Max.	
t1	0.4	--	30	ms
t2	0.1	--	50	ms
t3	2300	--	--	ms
t4	10	--	--	ms
t5	0.1	--	50	ms
t6	--	--	300	ms
t7	500	--	--	ms

Note:

The timing controller will not be damaged in case of TV set AC input power suddenly shut down.

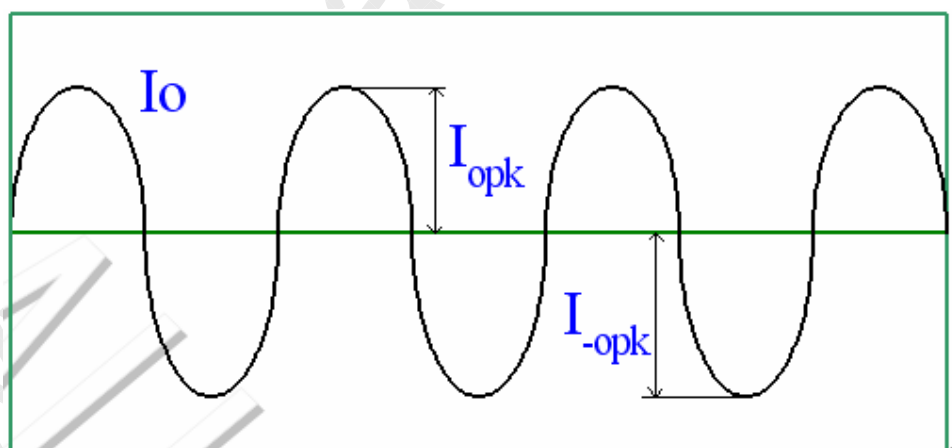
Once power reset, it should follow power sequence as spec. definition.

- (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.

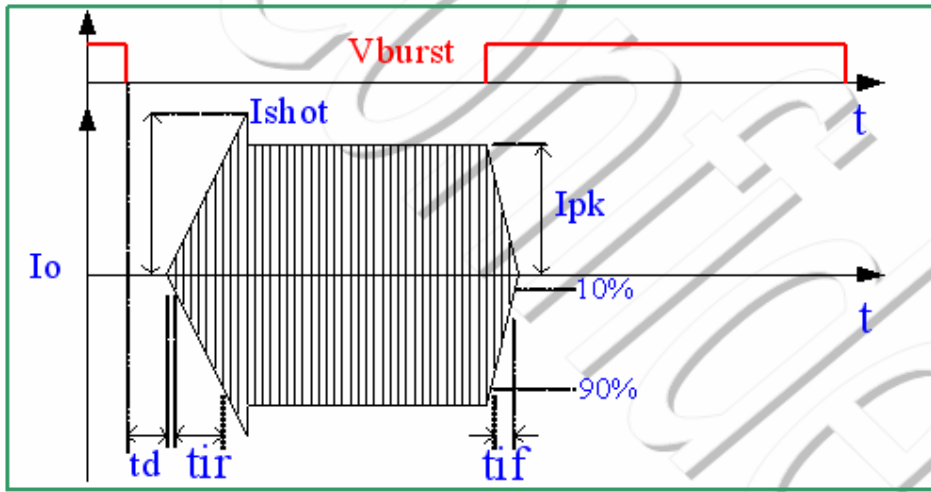
3.7 Backlight Connector Pin Configuration

No	Item	Symbol	Condition		Description	Specification				Note
			Dimming	Temp. (°C)		Min	Typ	Max	unit	
1	Output current	Io	Max	25	Output current of each lamp (HV terminal)	10.0	TBD	11.0	mA	
2	Output current variation	IVAR	Max	25	IVAR=Imax-Imin, Imax and Imin are max and min lamp current within whole backlight	-	-	1	mA	
3	Output working voltage	VL	Max	25	Lamp voltage of one lamp	950	TBD	1000	Volt (rms)	
4	Power consumption	Pin	Max	25	Pin spec on max brightness	135	150	165	W	
5	Lamp current DC bias	Idc	Max	25	$I_{dc} = \frac{I_{opk} - I_{-opk} }{(I_{opk} + I_{-opk})/2}$	-5	-	5	%	(1)
6	Lamp current harmonic	HR	Max	25	$HR = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2}}{I_1}$	-	-	20	%	
7	Burst mode dimming waveform of lamp current	Over ratio	Max	25	Over Ratio=(Ishot-Ipk)/Ipk	-	-	10	%	(2)
		tir			tir: Lamp current rising time	-	450	500	us	
		tif			tif: Lamp current falling time	-	-	100	us	
8	Lamp current vibration and brightness flicker	VBR	Max	25	VBR=(Iomax-Iomin)/(Iomax+Iomin)/2	-20	-	20	%	(3)
		flicker			Brightness flicker	No flicker				
9	Lamp striking voltage	Vstrike	Max	0	Vstrike: trigger voltage of one lamp	1.44	1.64	1.835	kVolt (rms)	
		tstrike			tstrike: trigger time of one lamp	1	1.5	-	ms	
11	LTS		20%	-20	Turn on inverter at -20°C temperature (5hrs at least)	No Flicker phenomenon				

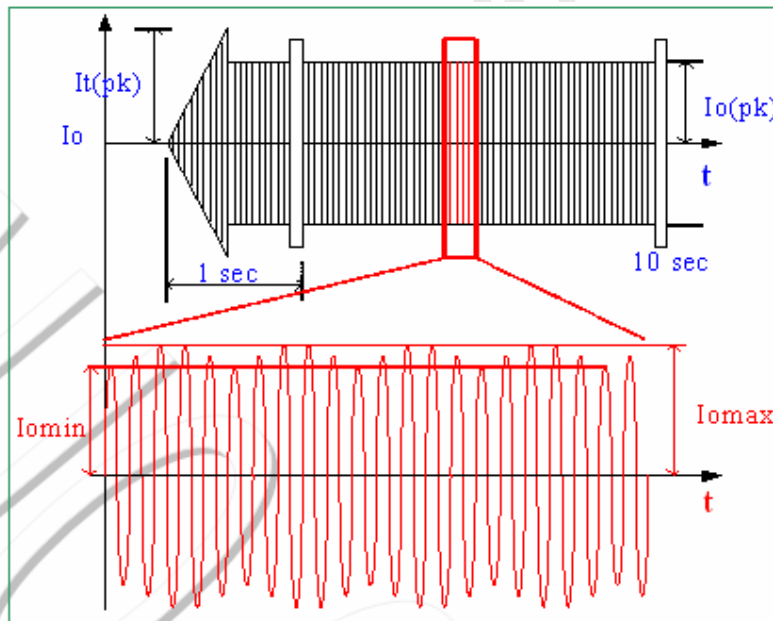
Note 1



Note 2

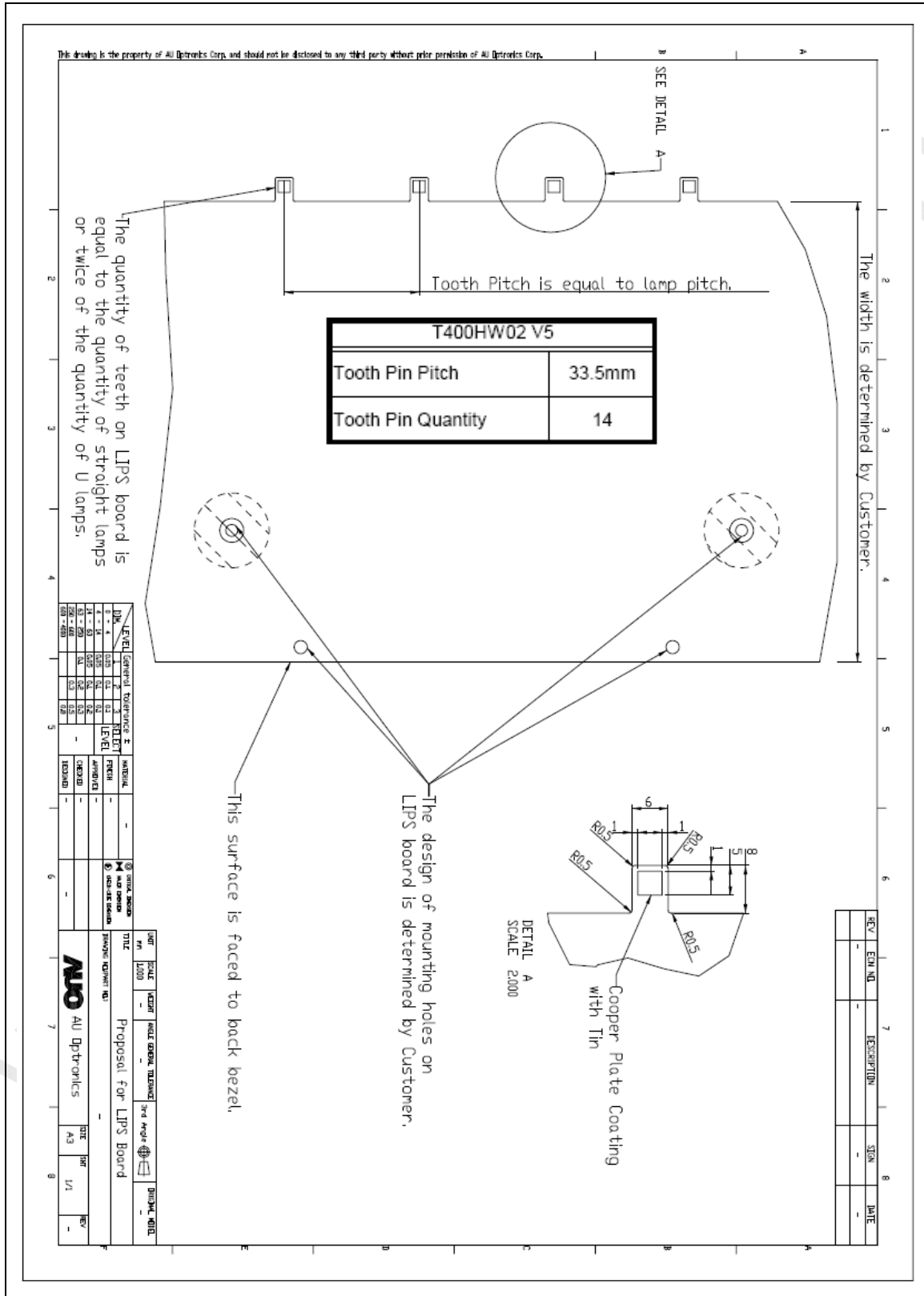


Note 3



Input Interface for LIPS board

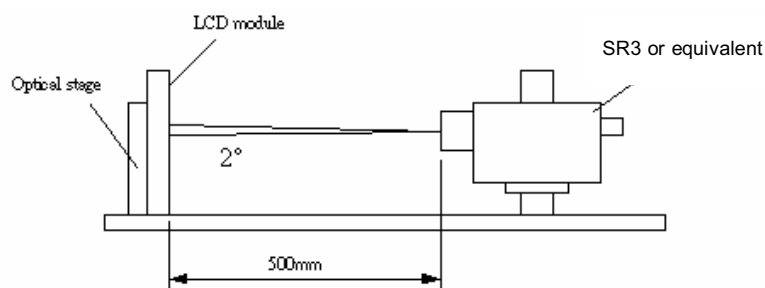
CN1 :EL7H001ZZ2 (JAE)



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.



Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max		
Contrast Ratio	CR	4000	5000	--		1
Surface Luminance (White)	L_{WH}	400	500	--	cd/m ²	2
Luminance Variation	$\delta_{WHITE(9P)}$	--	--	1.3		3
Response Time (G to G)	T_y	--	8	--	Ms	4
Color Gamut	NTSC		72		%	
Color Coordinates						
Red	R_x	Typ.-0.03	0.637	Typ.+0.03		
	R_y		0.336			
Green	G_x		0.277			
	G_y		0.590			
Blue	B_x		0.145			
	B_y		0.057			
White	W_x		0.280			
	W_y		0.290			
Viewing Angle						5
x axis, right($\varphi=0^\circ$)	θ_r	--	89	--	degree	
x axis, left($\varphi=180^\circ$)	θ_l	--	89	--	degree	
y axis, up($\varphi=90^\circ$)	θ_u	--	89	--	degree	
y axis, down ($\varphi=270^\circ$)	θ_d	--	89	--	degree	

Note:

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

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

2. 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 lamp current $I_H = 11\text{mA}$. $L_{WH} = L_{on5}$ where L_{on5} is the luminance with all pixels displaying white at center 5 location.

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

$$\delta_{WHITE(9P)} = \text{Maximum}(L_{on1}, L_{on2}, \dots, L_{on9}) / \text{Minimum}(L_{on1}, L_{on2}, \dots, L_{on9})$$

4. 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.

	0%	25%	50%	75%	100%
0%		t0%-25%	t0%-50%	t0%-75%	t0%-100%
25%	t25%-0%		t25%-50%	t25%-75%	t25%-100%
50%	t50%-0%	t50%-25%		t50%-75%	t50%-100%
75%	t75%-0%	t75%-25%	t75%-50%		t75%-100%
100%	t100%-0%	t100%-25%	t100%-50%	t100%-75%	

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 FIG4.

FIG. 2 Luminance

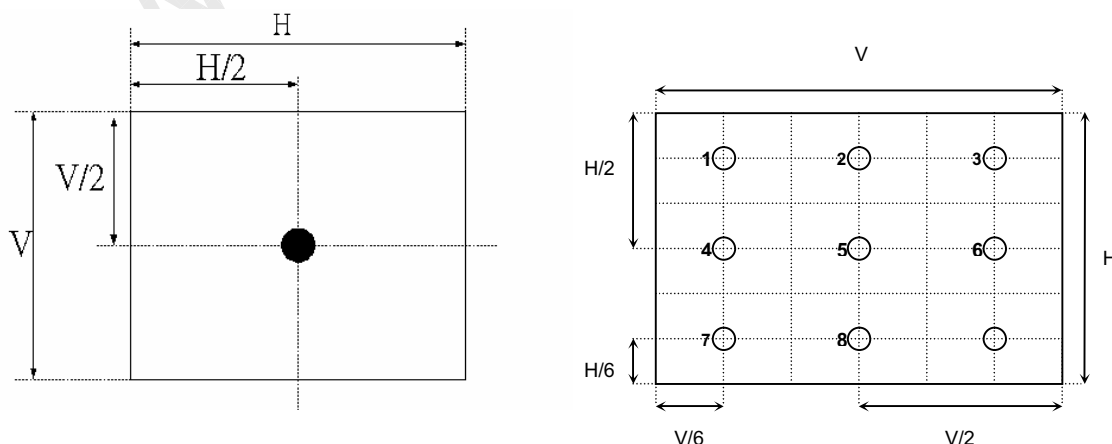
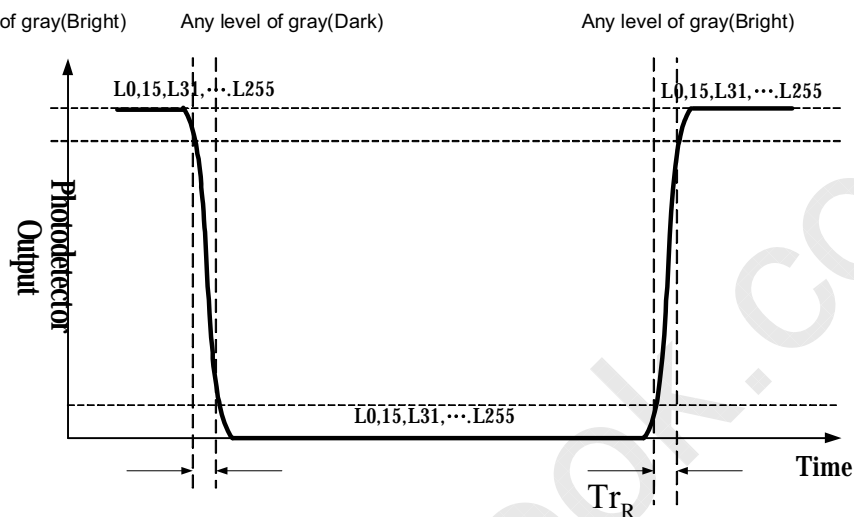
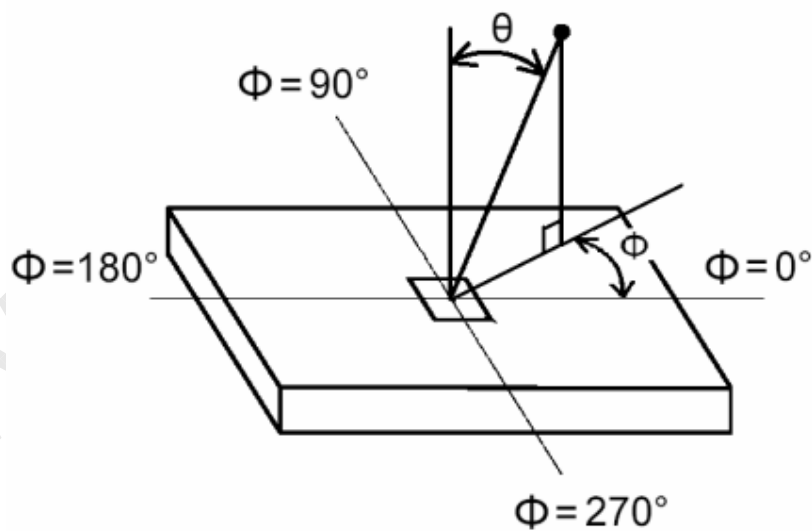


FIG.3 Response Time

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)".

**FIG.4 Viewing angle**

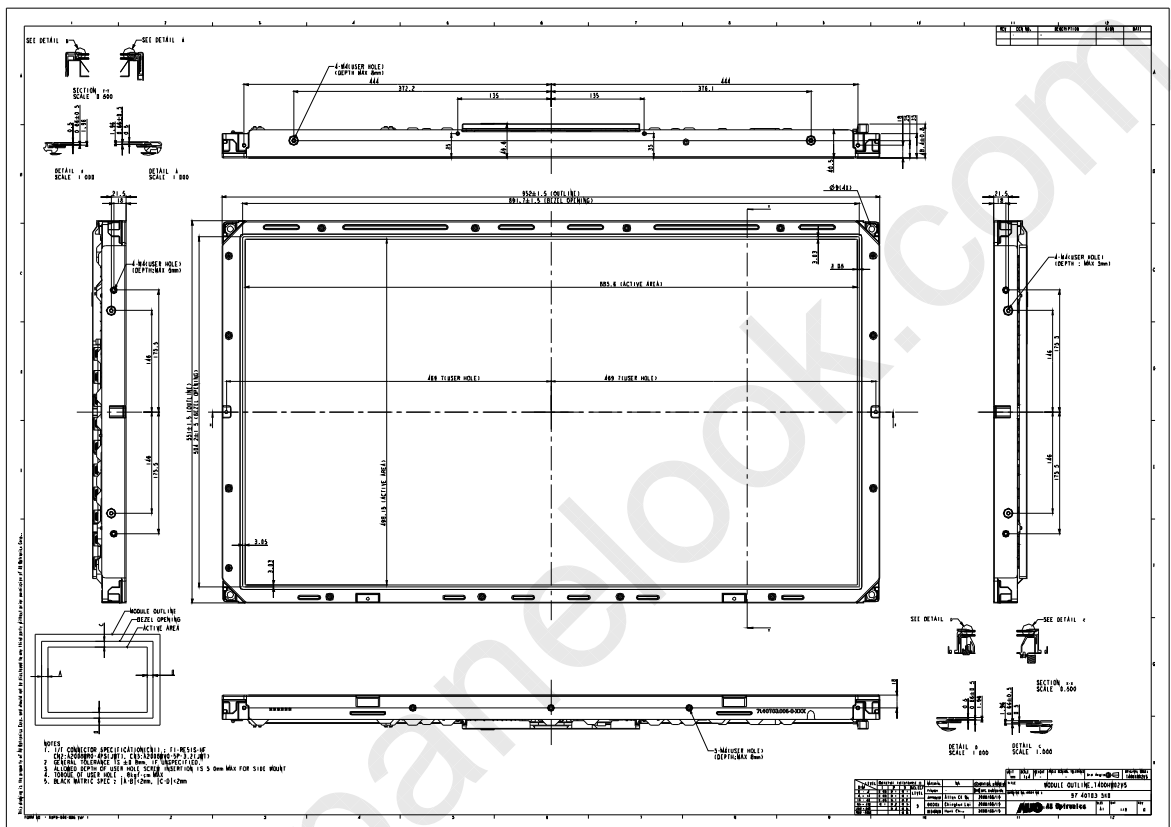
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model T400HW02 V5. In addition the figures in the next page are detailed mechanical drawing of the LCD.

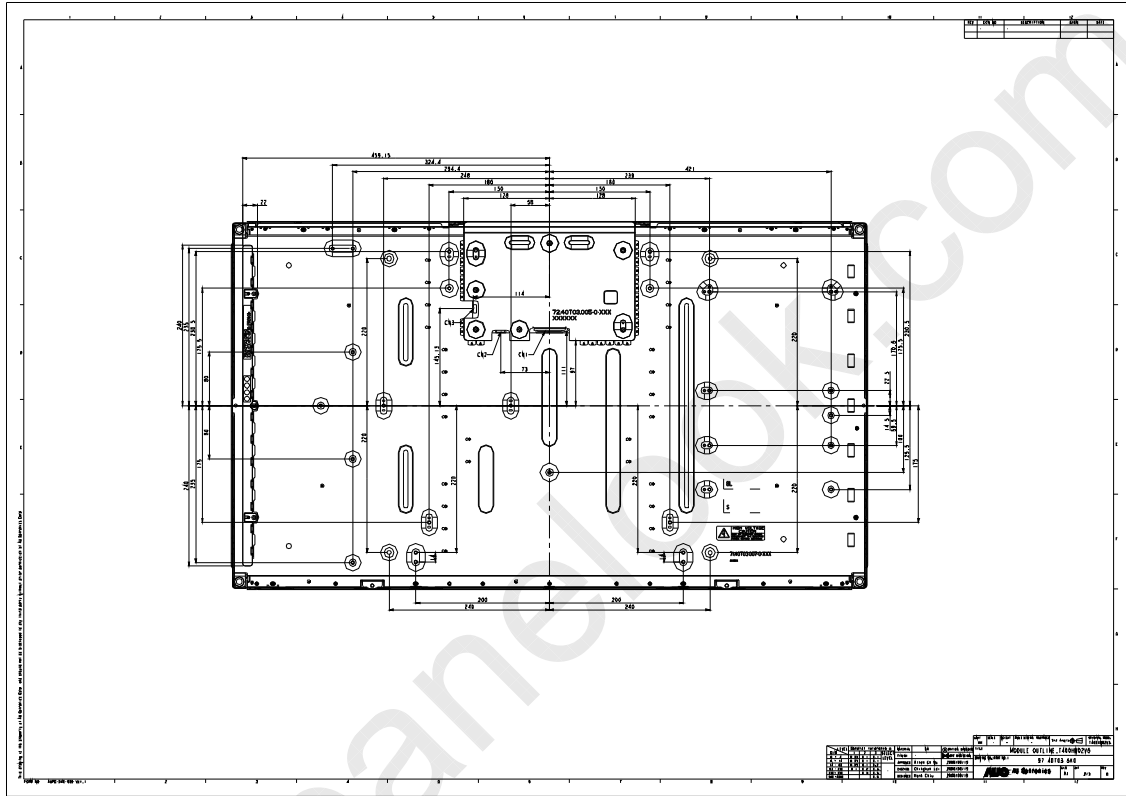
Outline Dimension	Horizontal	952.0 mm
	Vertical	551.0 mm
	Depth	49.6mm (to T-con cover)
Bezel Opening	Horizontal	891.7 mm
	Vertical	504.2 mm
Active Display Area	Horizontal	885.6mm
	Vertical	498.15 mm
Weight	10500g (Typ.)	
Surface Treatment	Super Clear (Anti-reflection coating)	



Front view



Rear view



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	(10~300Hz/1.5G/11min SR, XYZ 30,im/axis) Vibration level : 1.5G RMS, Bandwidth: 10-300Hz, Duration: X, Y, Z 30min
6	Shock test (non-operation)	3	Shock level: 50G Waveform: half sine wave, 11ms Direction: ±X, ±Y, ±Z, One time each direction
7	Vibration test (With carton)	3	Random wave (1.5G RMS, 10-200Hz) 30mins/ Per each X,Y,Z axes
8	Drop test (With carton)	3	Height: 38.1cm 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)

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.

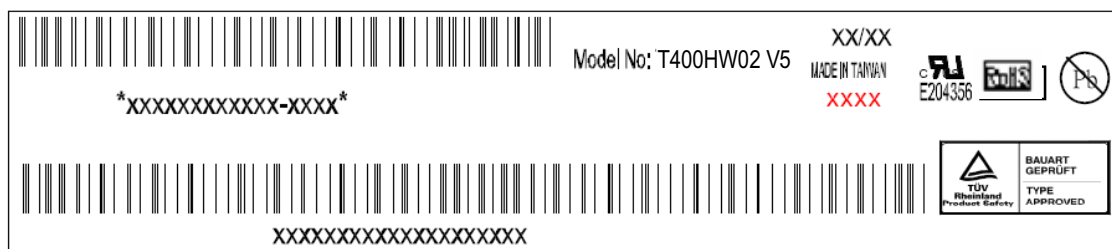
7.2 EMC

- 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


8. Packing

8-1 DEFINITION OF LABEL:

A. Panel Label:



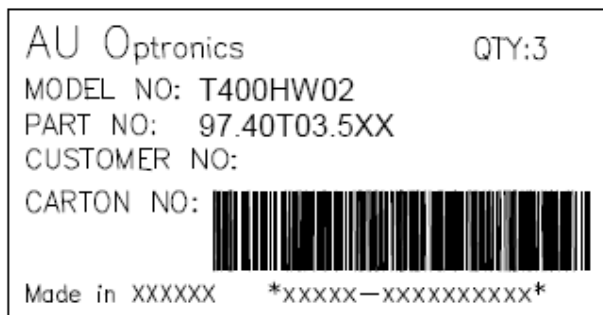
Green mark description

For Pb Free Product, AUO wil add  for identification.

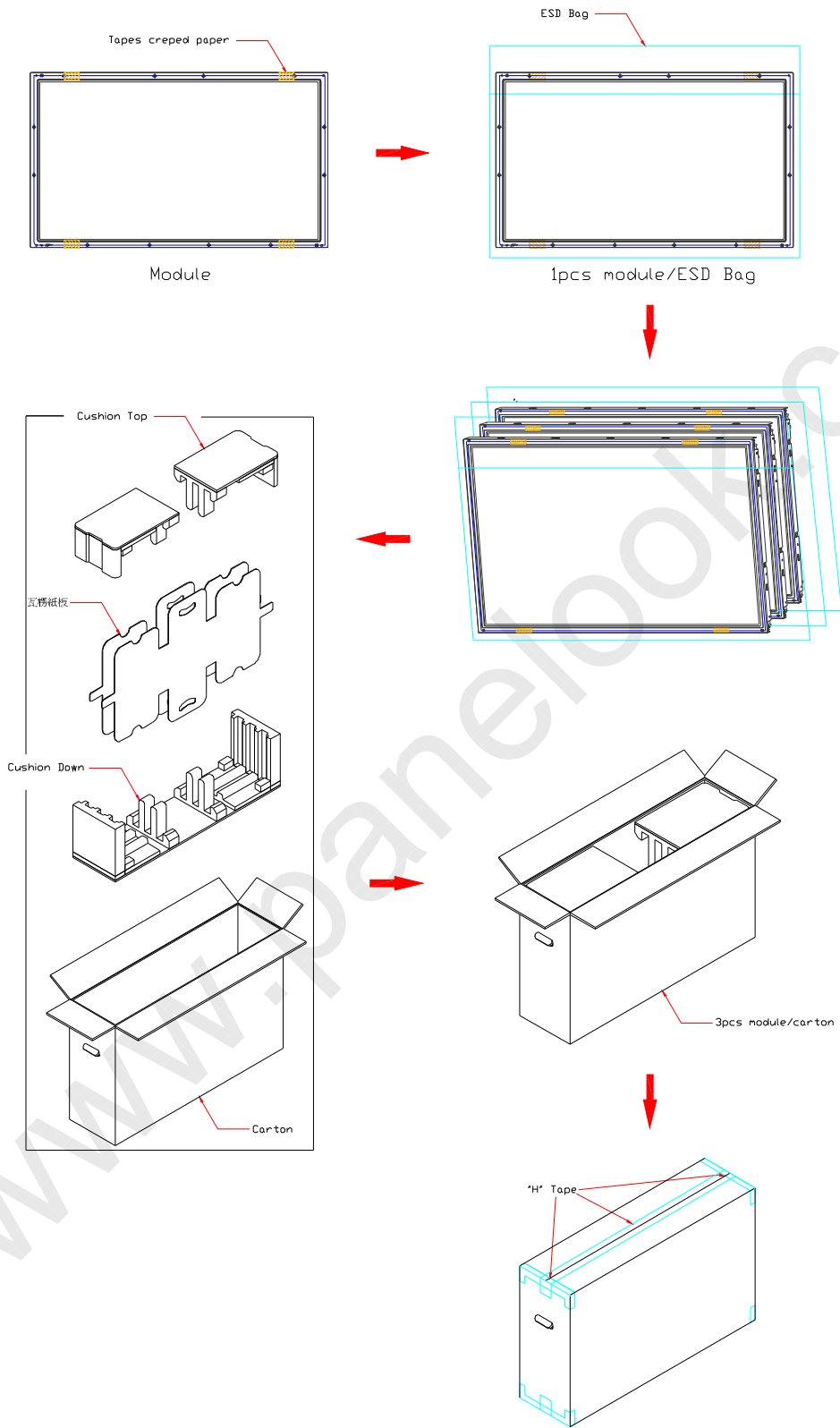
For RoHs compatible products, AUO will add  for identification.

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:

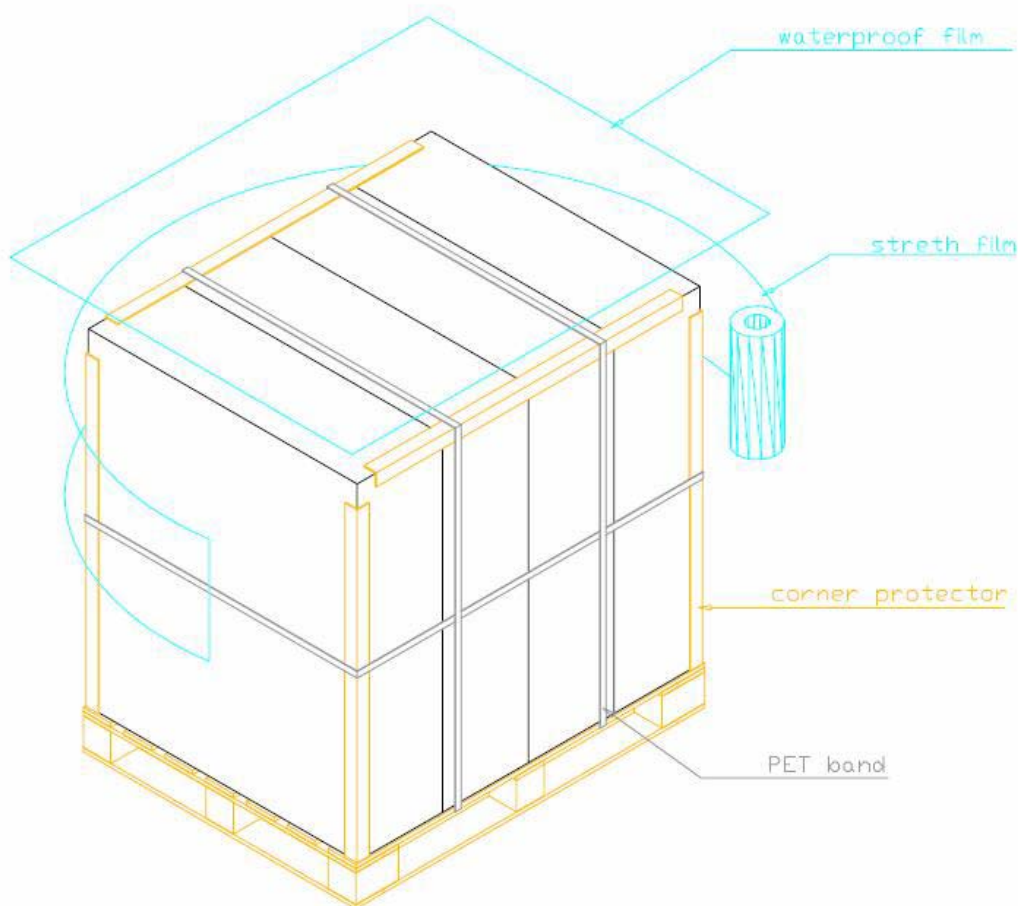


8-2 PACKING METHODS:



8-3 Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing BOX	3pcs/box	1050(L)*280(W)*650(H)	38	
2	Pallet	1	1140(L)*1060(W)*138(H)	16	
3	Boxes per Pallet	8 boxes/pallet			
4	Panels per Pallet	24pcs/pallet			
	Pallet after packing	24	1140(L)*1060(W)*1438(H)	320	



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 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 device 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 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.
- (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 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°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

- (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.