Model Name: T500HVN02.0

Issue Date: 2012/03/02

( )Preliminary Specifications
(*)Final Specifications

Customer Signature	Date	AUO	Date
Approved By		Approval By PM Director CP Wang	
Note		Reviewed By RD Director Eugene CC Chen Reviewed By Project Leader Jason Hsiao	
		Prepared By PM ChihYang Wang	

Contents

Record of Revision

Version	Date	Page	Description
0.0	2012/03/02		First release
0.1	2012/03/26		Update 5. drawing
			Update 3-2 LVDS pin assignment
0.2	2012/04/10		Update 3.7.3 Protection Circuit specification
0.3	2012/04/27		Update 3.7.3 Protection Circuit specification
0.4	2012/05/10		Update 3.1.1: DC Characteristics
			Update 3.7.1 Electrical specification
0.5	2012/05/28		Update 3.2 Interface Connections
			Update 3.5 Color Input Data Reference
			Update 3.7.1 Input Pin Assignment
			Update 3.7.2 Input Pin Assignment
			Update 3.7.4: Lamp specification
			Update 5. drawing
			Final

1. General Description

This specification applies to the 50.0 inch Color TFT-LCD Module T500HVN02.0. This LCD module has a TFT active matrix type liquid crystal panel 1,920 x 1,080 pixels, and diagonal size of 50.0 inch. This module supports 1,920 x 1,080 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 T500HVN02.0 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.

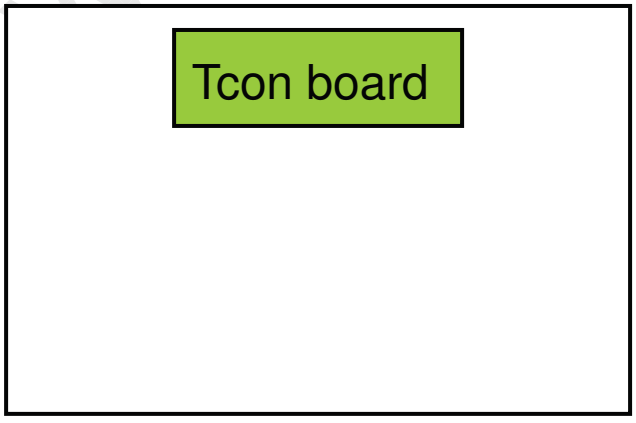
*** General Information**

Items	Specification	Unit	Note
Active Screen Size	50	inch	
Display Area	1095.84 (H) x 616.41(V)	mm	
Outline Dimension	1131.8(H) x 657.2 (V) x 62(D)	mm	D: front bezel to T-con cover
Driver Element	a-Si TFT active matrix		
Bezel Opening	1101.8 (H) x 622.4 (V)	mm	
Display Colors	10bits (8 bit + FRC), 1.07b	Colors	
Number of Pixels	1,920x1,080	Pixel	
Pixel Pitch	0.19025 (H) x 0.57075(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

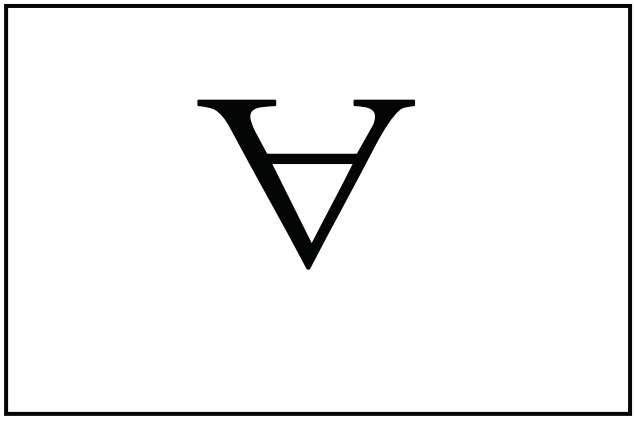
Note 1: Rotate Function refers to LCD display could NOT be able to rotate.

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

Rear side



Front side



2. Absolute Maximum Ratings

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

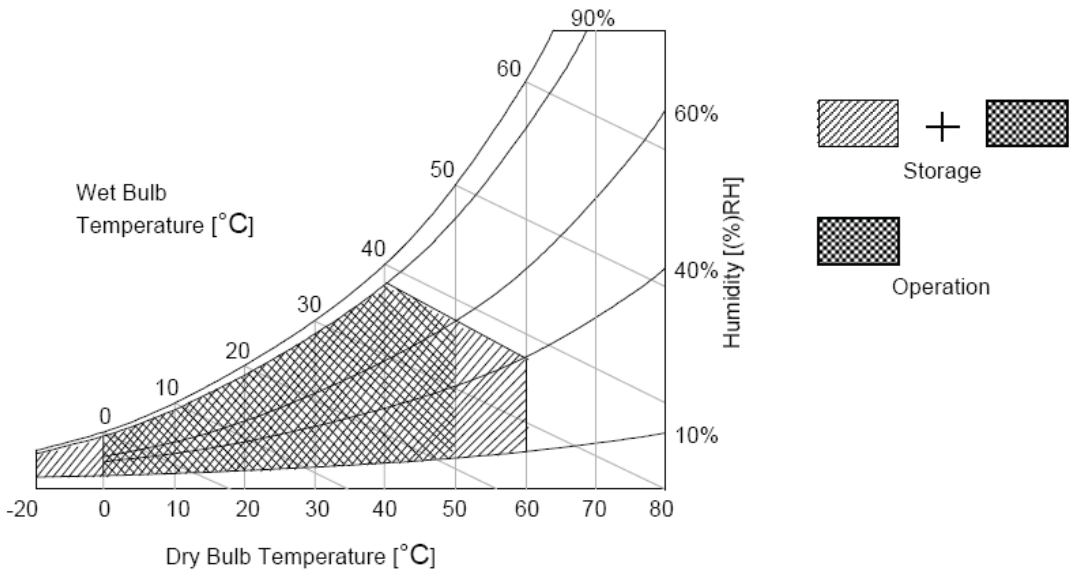
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note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

Note 1: Duration: 50 msec.

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

The relative humidity must not exceed 90% non-condensing at temperatures of 40℃ or less. At temperatures greater than 40℃, the wet bulb temperature must not exceed 39℃.

Note 3: Surface temperature is measured at 50℃ Dry condition



3. Electrical Specification

The T500HVN02.0 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The other is to power Back Light Unit.

3.1 Electrical Characteristics

3.1.1: DC Characteristics

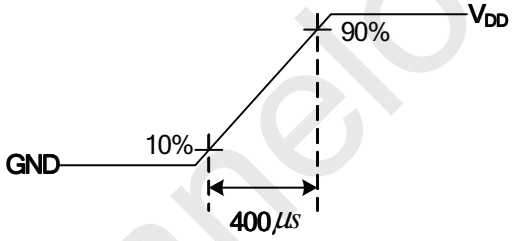
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LCD							
Power Supply Input Voltage		V_{DD}	10.8	12	13.2	V_{DC}	
Power Supply Input Current		I_{DD}	--	1.1	2.292	A	1
Power Consumption		P_C	--	13.2	27.504	Watt	1
Inrush Current		I_{RUSH}	--	2.9	5	A	2
Permissible Ripple of Power Supply Input Voltage		V_{RP}	--	--	V_{DD} * 5%	mV_{pk-pk}	3
LVDS Interface	Input Differential Voltage	$\lvert V_{ID} \rvert$	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}	--	158.4	176	Watt	
Life time			5000			Hour	9,10, 11

3.1.2: AC Characteristics

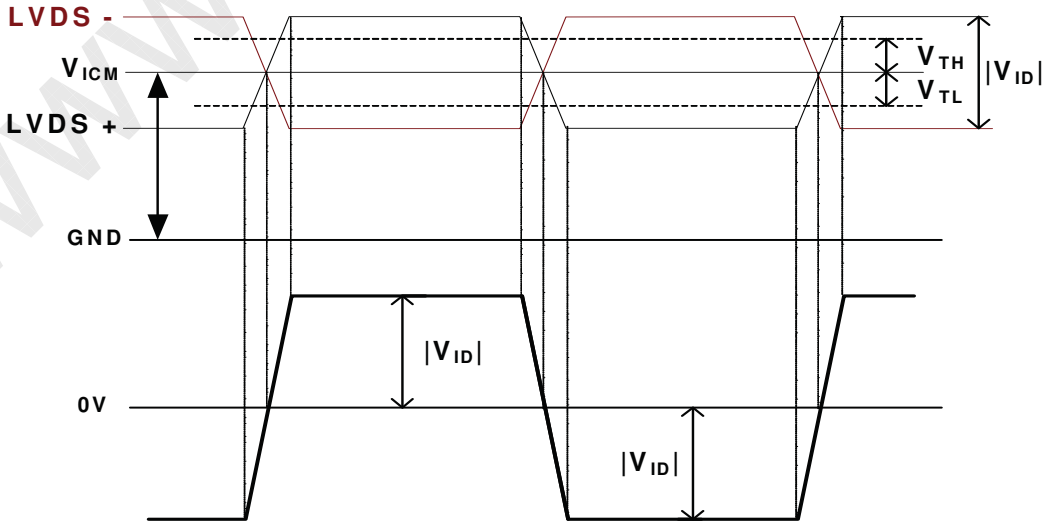
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LVDS Interface	Input Channel Pair Skew Margin	$t_{SKEW\ (CP)}$	-500	--	+500	ps	6
	Receiver Clock : Spread Spectrum Modulation range	Fclk_ss	Fclk -3%	--	Fclk +3%	MHz	7
	Receiver Clock : Spread Spectrum Modulation frequency	Fss	30	--	200	KHz	7
	Receiver Data Input Margin Fclk = 85 MHz Fclk = 65 MHz	tRMG	-0.4 -0.5	-- --	0.4 0.5	ns	8

Note :

1. V_{DD} = 12.0V, Fv = 120Hz, Fclk= Max freq. , 25 ℃, Test Pattern : White Pattern
2. Measurement condition : Rising time = 400us

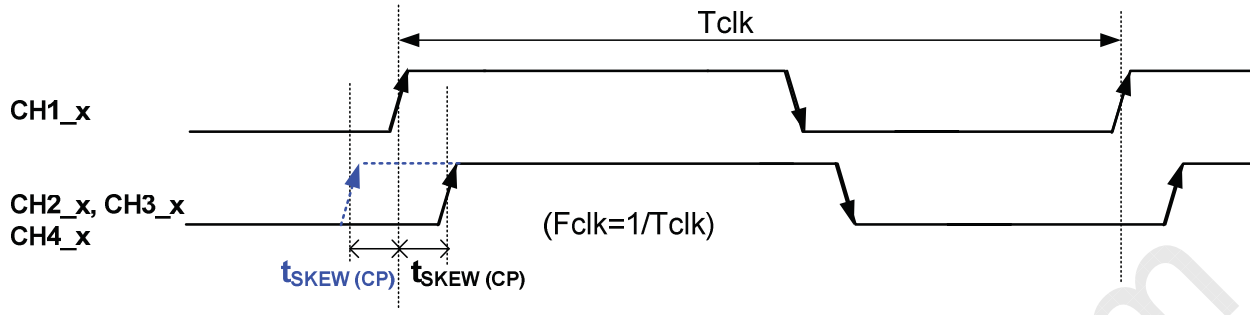


3. Test Condition:
   (1) The measure point of V_{RP} is in LCM side after connecting the System Board and LCM.
   (2) Under Max. Input current spec. condition.
4. V_{ICM} = 1.25V



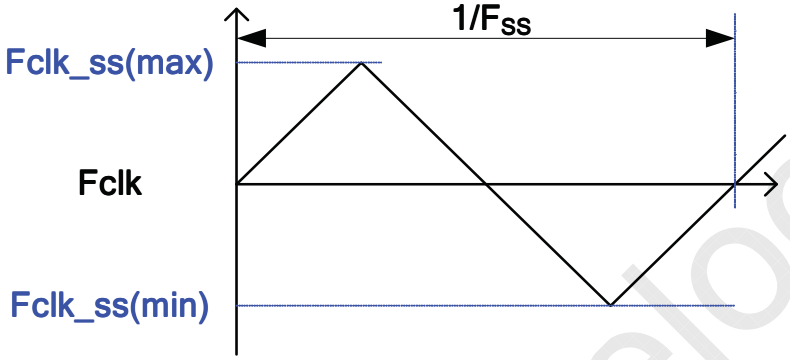
5. The measure points of V_{IH} and V_{IL} are in LCM side after connecting the System Board and LCM.

6. Input Channel Pair Skew Margin



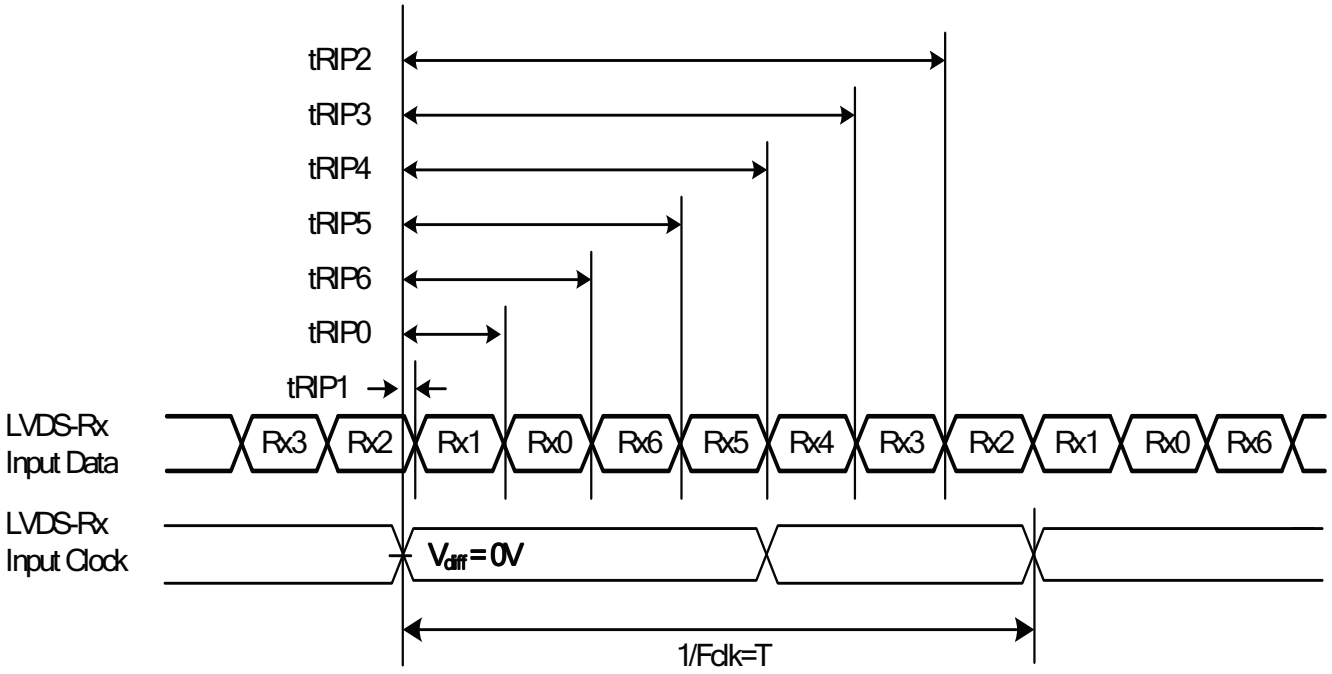
Note: x = 0, 1, 2, 3, 4

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



8. 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	



9. 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.

10. The relative humidity must not exceed 80% non-condensing at temperatures of 40℃ or less. At temperatures greater than 40℃, the wet bulb temperature must not exceed 39℃. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.

11. Specified values are for a single lamp only which is aligned horizontally. The lifetime is defined as the time which luminance of the lamp is 50% compared to its original value.
[Operating condition: Continuous operating at Ta = 25±2℃]

3.2 Interface Connections

- LCD connector: FI-RE51S-HF (JAE, LVDS connector)
- Mating connector:

PIN	Symbol	Description	PIN	Symbol	Description
1	Open	No connection (Internal Open)	26	GND	Ground
2	N.C.	AUO Internal Use Only	27	GND	Ground
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	BITSEL	LVDS 8/10bit Input Selection Open/Low(GND) : 8bits High(3.3V) : 10bits	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	Open	No connection (Internal Open)	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- (for 10-bit input)
16	CH1_2-	LVDS Channel 1, Signal 2-	41	CH2_4+	LVDS Channel 2, Signal 4+ (for 10-bit input)
17	CH1_2+	LVDS Channel 1, Signal 2+	42	GND	Ground
18	GND	Ground	43	GND	Ground
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	VDD	Power Supply, +12V DC Regulated
24	CH1_4-	LVDS Channel 1, Signal 4- (for 10-bit input)	49	VDD	Power Supply, +12V DC Regulated
25	CH1_4+	LVDS Channel 1, Signal 4+ (for 10-bit input)	50	VDD	Power Supply, +12V DC Regulated
			51	VDD	Power Supply, +12V DC Regulated

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

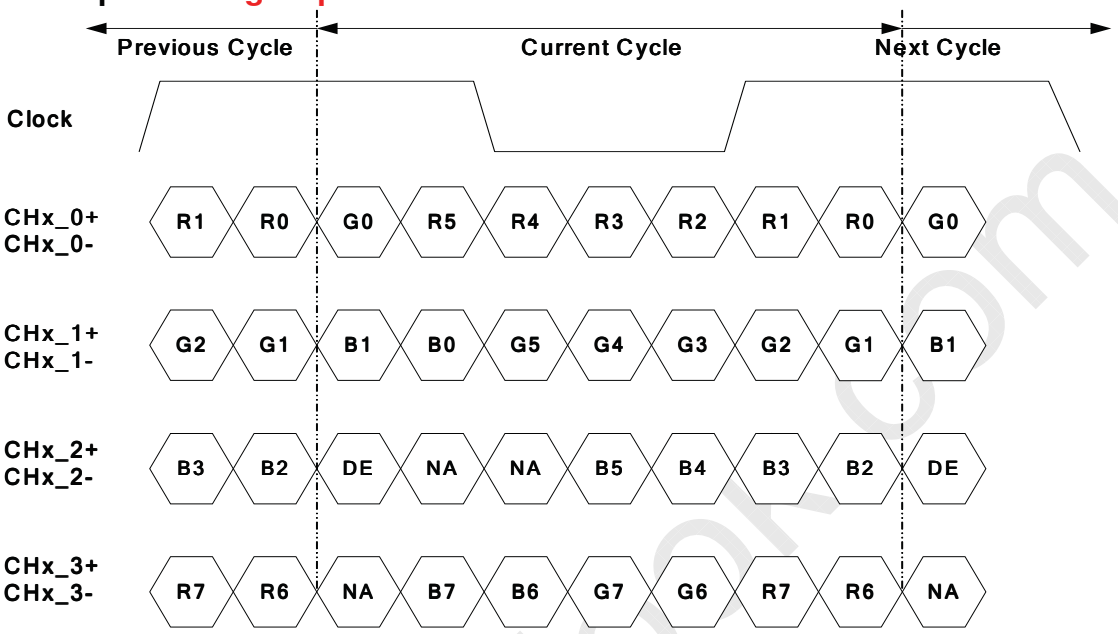
- LCD connector: FI-RE41S-HF (JAE, LVDS connector)
- Mating connector:

PIN	Symbol	Description	PIN	Symbol	Description
1	N.C.	No connection	21	CH3_3+	LVDS Channel 3, Signal 3+
2	N.C.	No connection	22	CH3_4-	LVDS Channel 3, Signal 4- (for 10-bit input)
3	N.C.	No connection	23	CH3_4+	LVDS Channel 3, Signal 4+ (for 10-bit input)
4	N.C.	No connection	24	GND	Ground
5	N.C.	No connection	25	GND	Ground
6	N.C.	No connection	26	CH4_0-	LVDS Channel 4, Signal 0-
7	N.C.	AUO Internal Use Only	27	CH4_0+	LVDS Channel 4, Signal 0+
8	N.C.	No connection	28	CH4_1-	LVDS Channel 4, Signal 1-
9	GND	Ground	29	CH4_1+	LVDS Channel 4, Signal 1+
10	CH3_0-	LVDS Channel 3, Signal 0-	30	CH4_2-	LVDS Channel 4, Signal 2-
11	CH3_0+	LVDS Channel 3, Signal 0+	31	CH4_2+	LVDS Channel 4, Signal 2+
12	CH3_1-	LVDS Channel 3, Signal 1-	32	GND	Ground
13	CH3_1+	LVDS Channel 3, Signal 1+	33	CH4_CLK-	LVDS Channel 4, Clock -
14	CH3_2-	LVDS Channel 3, Signal 2-	34	CH4_CLK+	LVDS Channel 4, Clock +
15	CH3_2+	LVDS Channel 3, Signal 2+	35	GND	Ground
16	GND	Ground	36	CH4_3-	LVDS Channel 4, Signal 3-
17	CH3_CLK-	LVDS Channel 3, Clock -	37	CH4_3+	LVDS Channel 4, Signal 3+
18	CH3_CLK+	LVDS Channel 3, Clock +	38	CH4_4-	LVDS Channel 4, Signal 4- (for 10-bit input)
19	GND	Ground	39	CH4_4+	LVDS Channel 4, Signal 4+ (for 10-bit input)
20	CH3_3-	LVDS Channel 3, Signal 3-	40	GND	Ground
			41	GND	Ground

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

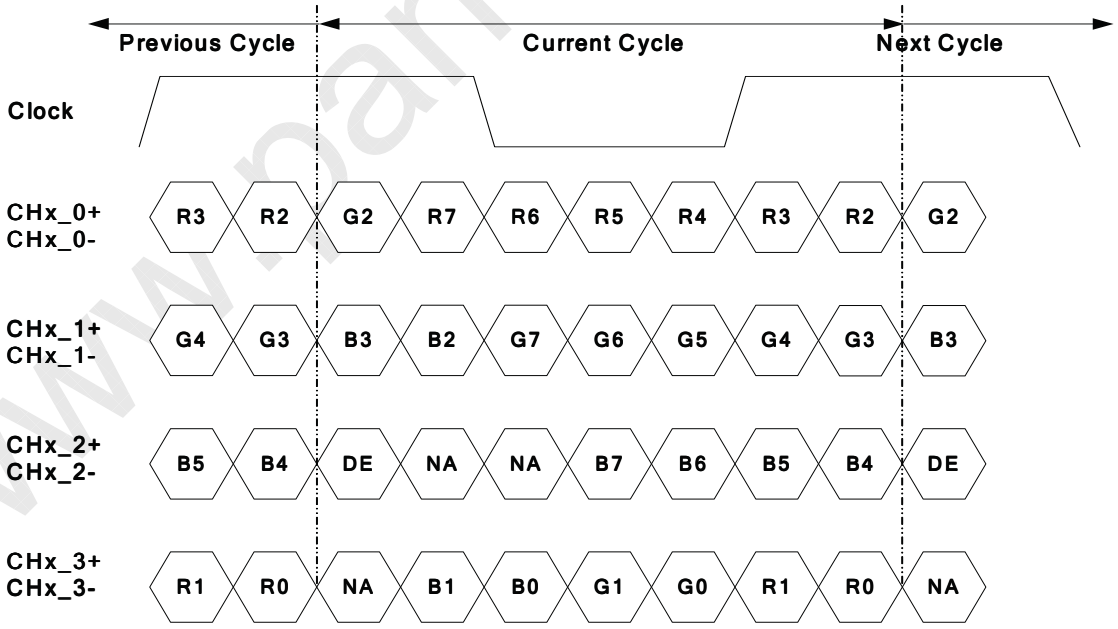
LVDS Option for 8bit

■ LVDS Option = High/Open➔NS



Note: x = 1, 2, 3, 4…

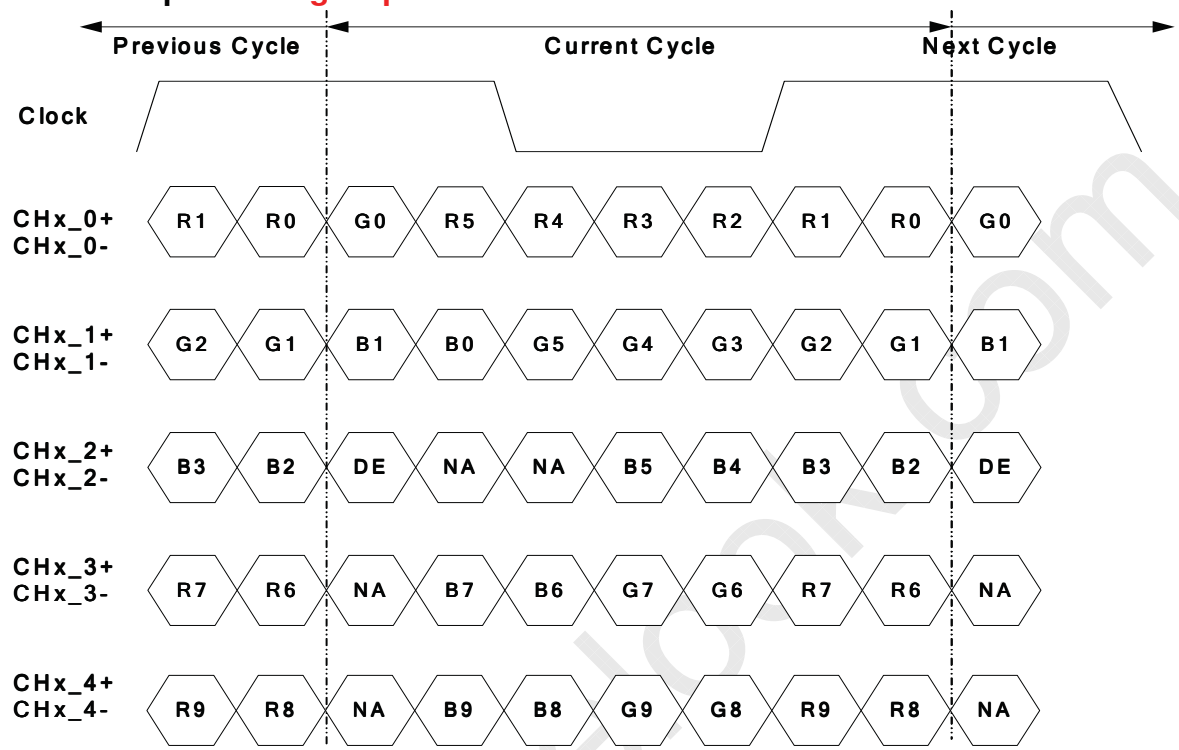
■ LVDS Option = Low➔JEIDA



Note: x = 1, 2, 3, 4…

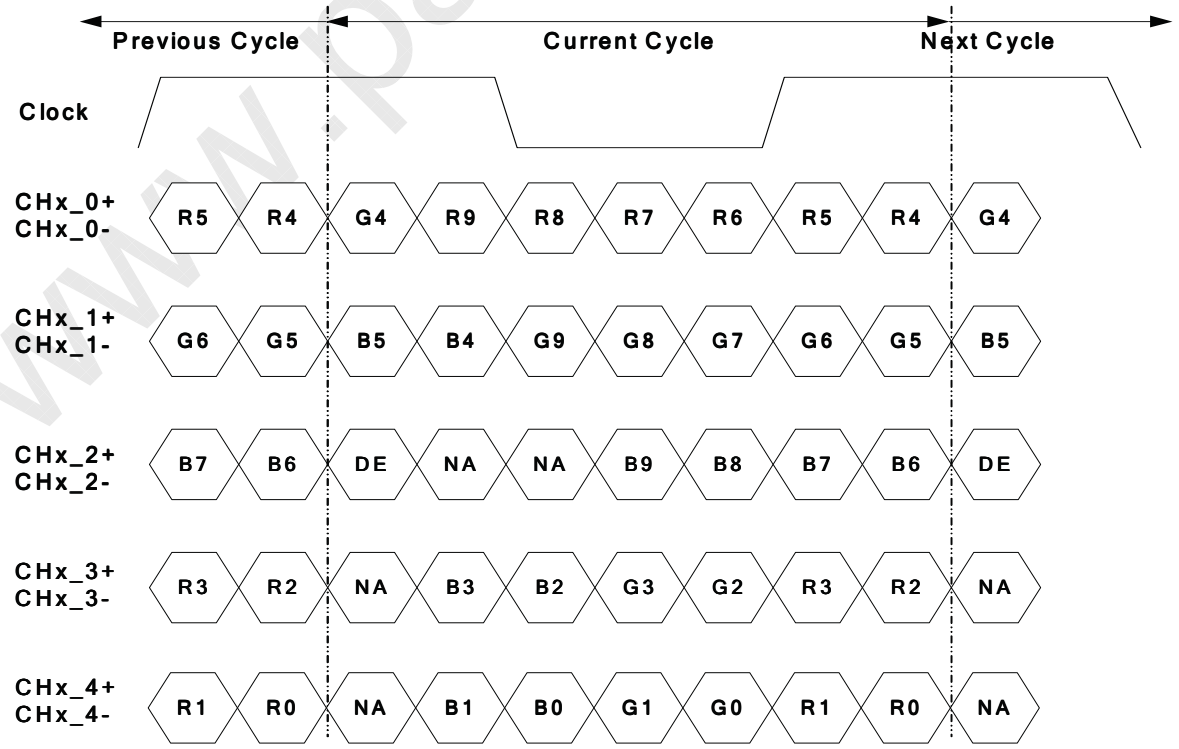
LVDS Option for 10bit

■ 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	1130	1392	Th
	Active	Tdisp (v)		1080		
	Blanking	Tblk (v)	16	50	312	Th
Horizontal Section	Period	Th	520	570	580	Tclk
	Active	Tdisp (h)		480		
	Blanking	Tblk (h)	40	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:

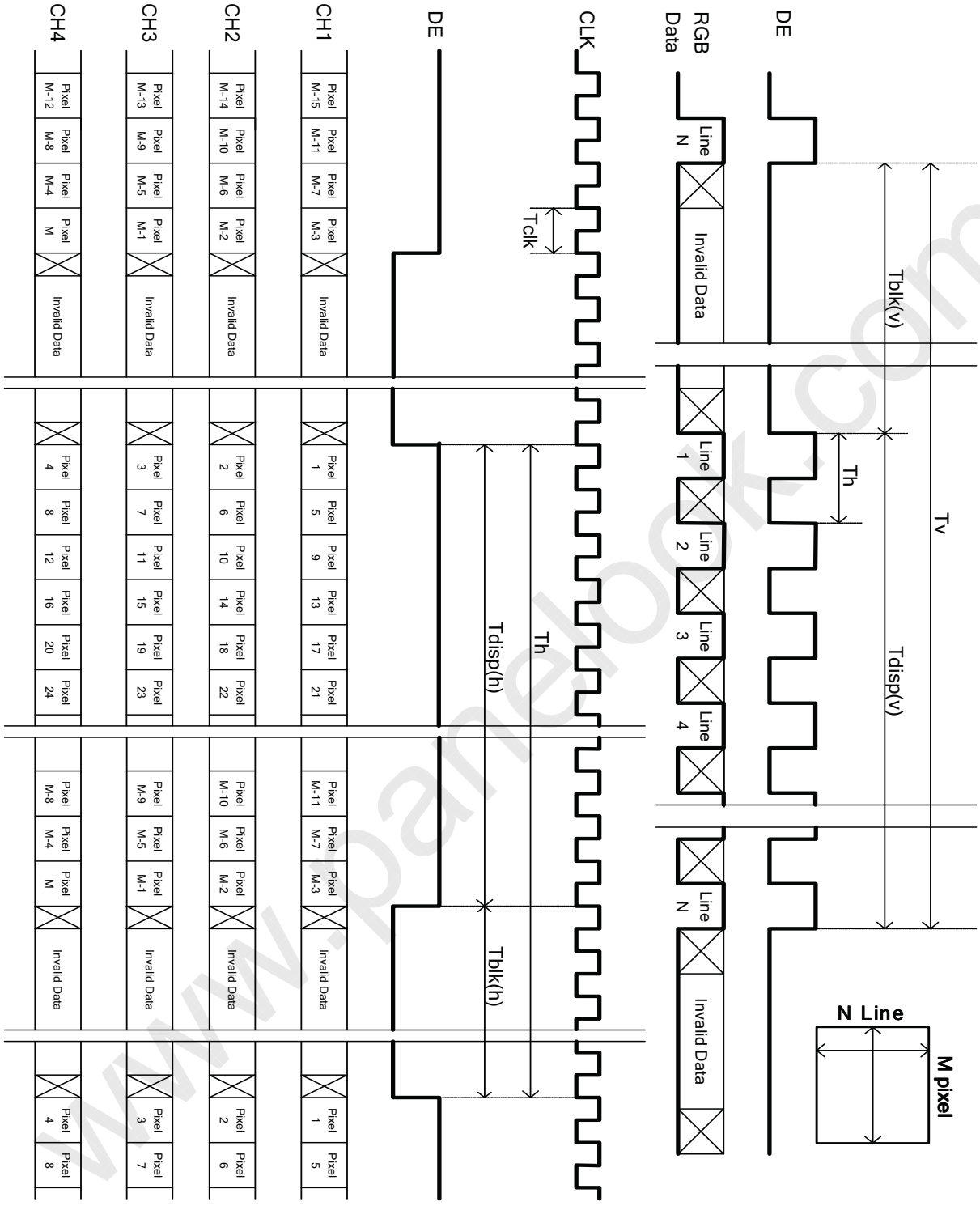
(1) Display position is specific by the rise of DE signal only.
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(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 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
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
	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
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
	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
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
	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

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

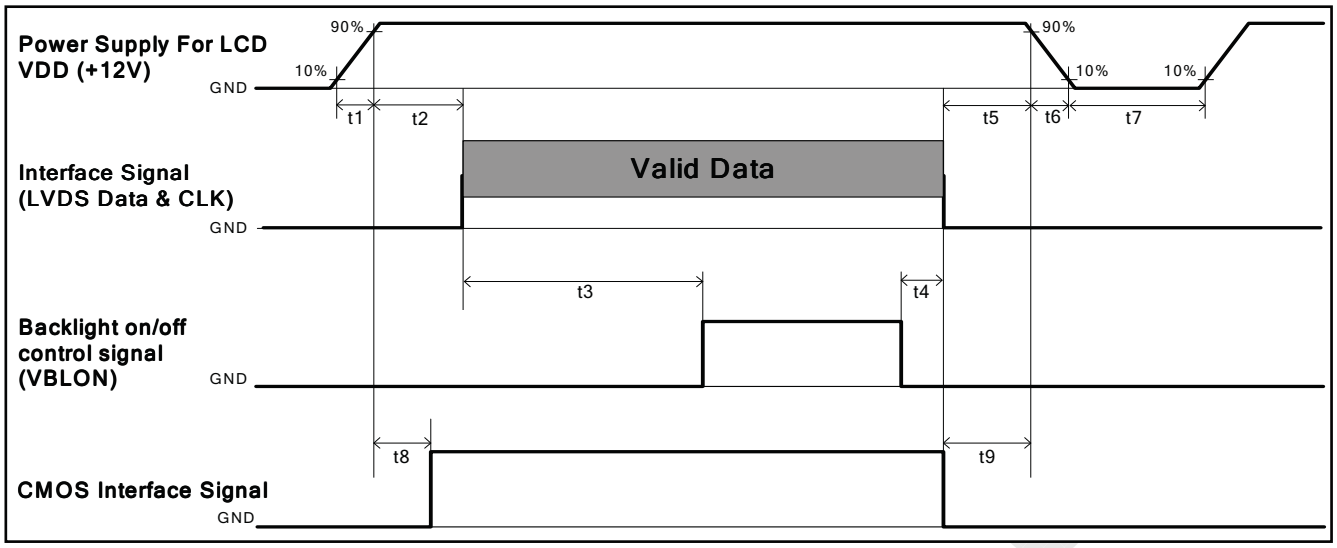
Color		Input Color Data																													
		RED										GREEN										BLUE									
		MSB									LSB	MSB									LSB	MSB									LSB
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0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

	BLUE(1022)	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	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

3.6 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 *3	---	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 signal is N.C. (no connection), opened in Transmitted end, t8 & t9 timing spec can be negligible.

3.7 Backlight Specification (T balance board Type)

The backlight unit contains 12-I type CCFLs (Cold Cathode Fluorescent Lamp)

3.7.1 Electrical specification

Item	Symbol	Condition	Spec			Unit	Note
			Min	Typ	Max		
Operating Voltage	+VBL	-		95		Vrms	
	-VBL	-		-95		Vrms	
Operating Current	Io	-	10.5	11	11.5	mArms	
BL Total Power Dissipation	PBL	-	-	158.4	176	Watt	
Striking Voltage	Vstk	At 0℃	-	-	1930	Vrms	
		At 25℃	-	-	1680		
Striking Time	Ts	-	1000	1500	2000	msec	
Operating Frequency	fo	-		55		kHz	
PWM Operating Frequency	F_PWM	-	140		240	Hz	
PWM Dimming Duty Ratio	D_PWM	-	5	-	100	%	Note 1&2
Lamp Type			Straight				
Number of Lamps			12			pcs	
Type of current balance			T-balance				

（Ta=25±5℃, 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)_Normal or equivalent

Pin	Symbol	Description
1	+VBL	AC ±95V
2	+VBL	
3	NC	
4	-VBL	
5	-VBL	
6	NC	
7	S_GND	Signal Ground
8	VCC	Power Supply for Protection Circuit
9	CNT_PRT	Open Connector Protection
10	VLD	Protection Signal (Lamp Detection)
11	FB1	Lamp Current Feedback Signal 1
12	FB2	Lamp Current Feedback Signal 2

3.7.3 Protection Circuit specification

Item	Symbol	Spec			Unit	Note
		Min	Typ	Max		
Supply control voltage	Vcc	4.5	5	5.5	VDC	
Input Current of VCC	Icc	--	-	100	mADC	
Current feedback signal	IFB	2.05	2.20	2.35	Vrms	
Open Connector Detection	CNT_PRT(H)	4.5	-	5.5	VDC	Lamp normal status
	CNT_PRT(L)	0	-	0.8	VDC	Lamp abnormal status
Lamp Detection	LD(H)	2	-	-	VDC	Lamp abnormal status
	LD(L)	-	-	1.4	VDC	Lamp normal status

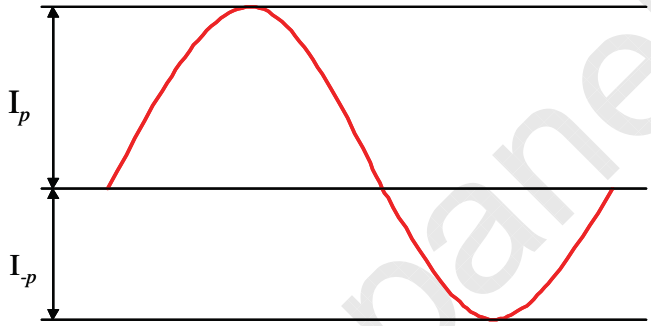
3.7.4: Lamp specification

Item	Symbol	Condition	Spec			Unit	Note
			Min	Typ	Max		
Lamp voltage	VL		1071	1190	1309	Vrms	
Lamp current	IL		-	11.0	-	mArms	
Lamp frequency	fL		40	-	80	kHz	
Starting voltage	Vs	At 0℃	-	-	1930	Vrms	
		At 25℃	-	-	1680	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℃, 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 $\sqrt{2}\pm10\%$).



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

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

I_p : High side peak value

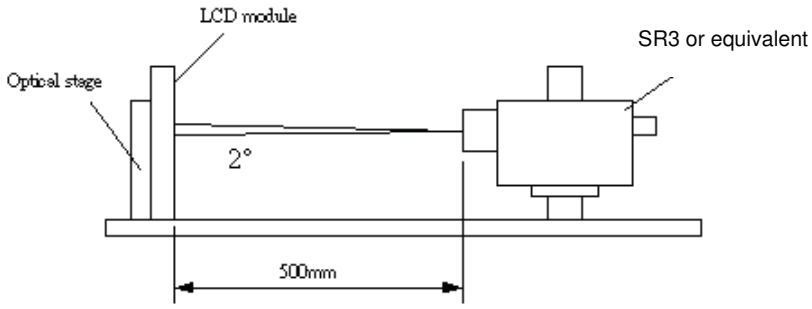
I_{-p} : Low side peak value

I_{rms} : Root mean square value

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25℃. 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	2400	3000	--		1
Surface Luminance (White)		L_{WH}	280	350	--	cd/m^2	2
Luminance Variation		$\delta_{WHITE(9P)}$	--	--	1.33		3
Response Time (G to G)		Tγ	--	5.5	--	ms	4
Color Gamut		NTSC		72		%	
Color Coordinates							
	Red	R_X	Typ.-0.03	0.630	Typ.+0.03		
		R_Y		0.330			
	Green	G_X		0.32			
		G_Y		0.620			
	Blue	B_X		0.150			
		B_Y		0.040			
	White	W_X		0.280			
		W_Y		0.290			
Viewing Angle							5
	x axis, right(φ=0°)	θ_r	--	89	--	degree	
	x axis, left(φ=180°)	θ_l	--	89	--	degree	
	y axis, up(φ=90°)	θ_u	--	89	--	degree	
	y axis, down (φ=270°)	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 = 11mA. $L_{WH}=L_{on}5$ where $L_{on}5$ is the luminance with all pixels displaying white at center 5 location.
3. The variation in surface luminance, δWHITE is defined (center of Screen) as:

   $\delta_{WHITE(9P)}$= Maximum(L_{on1}, L_{on2},…,L_{on9})/ Minimum(L_{on1}, L_{on2},…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=120Hz 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%	

T_γ is determined by 10% to 90% brightness difference of rising or falling period. (As illustrated)

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 gray(dark)".

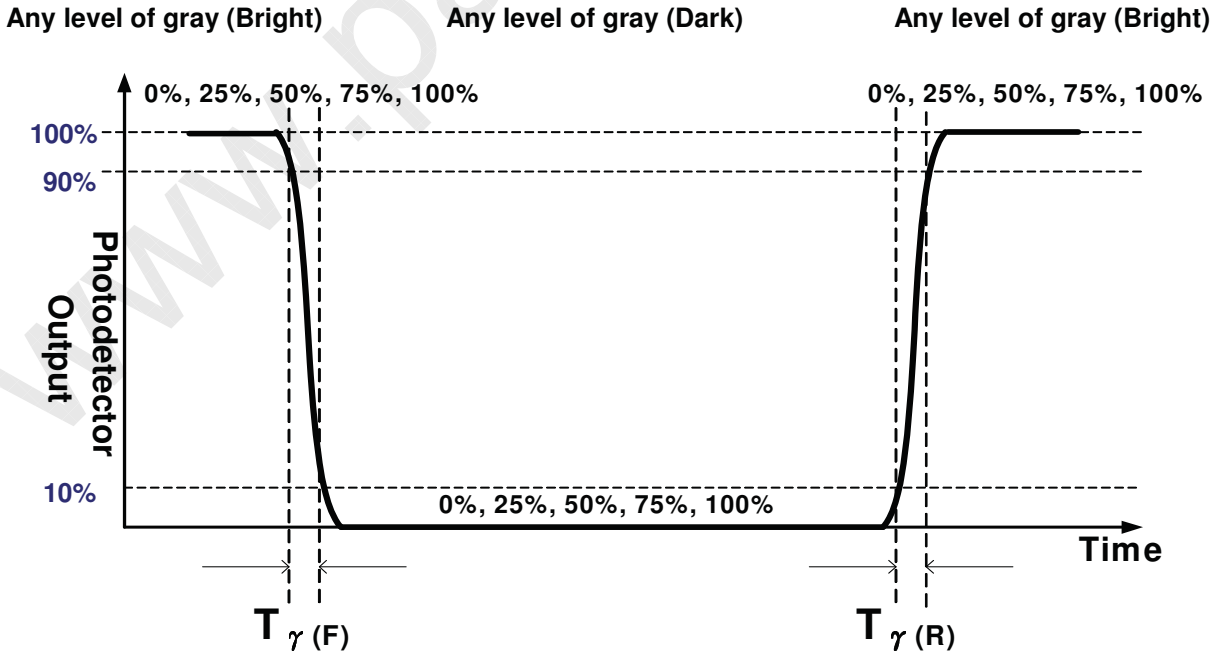
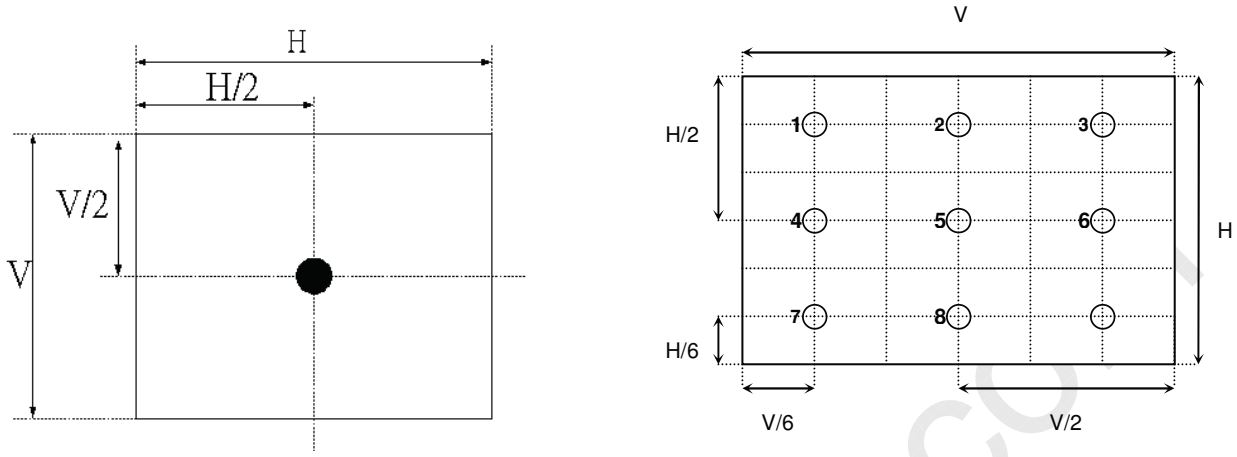
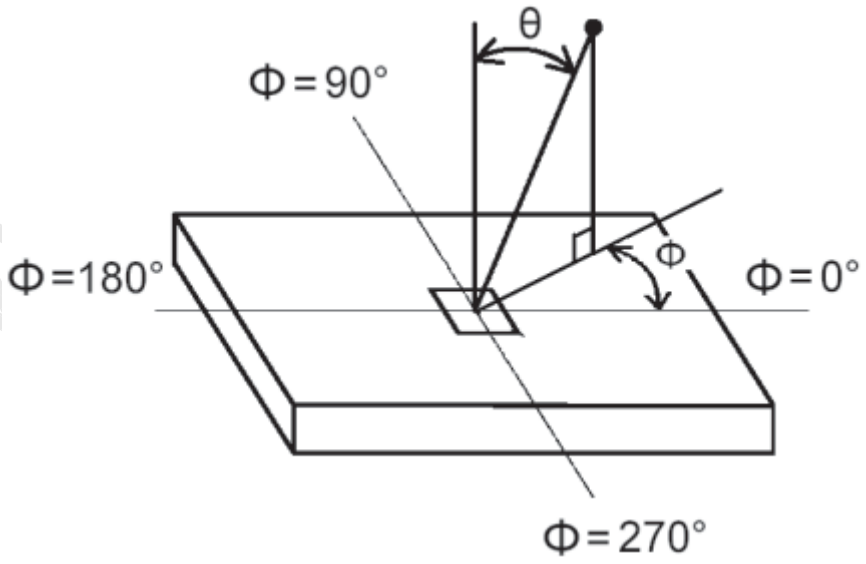


FIG. 2 Luminance



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 FIG3.

FIG.3 Viewing Angle

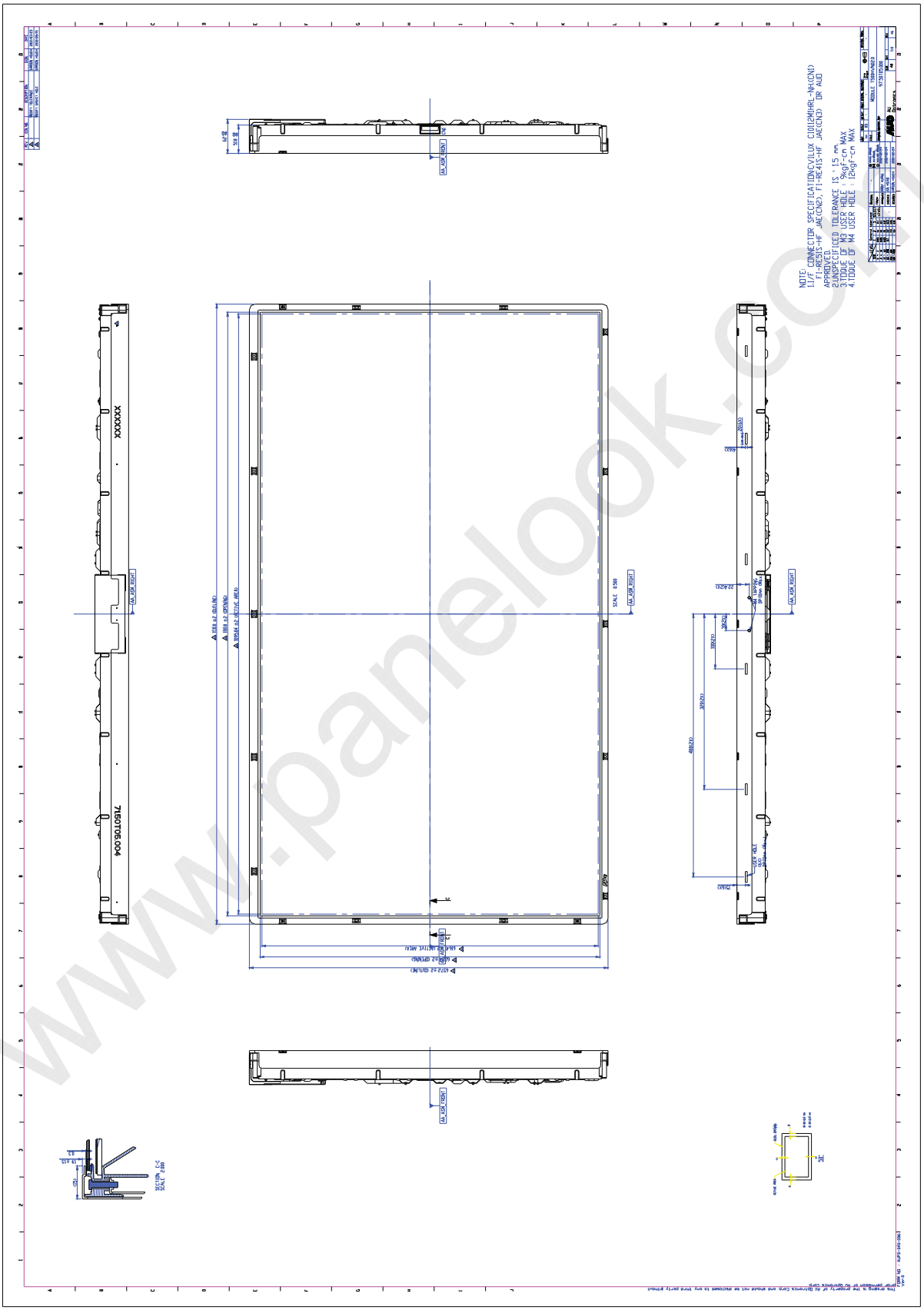


5. Mechanical Characteristics

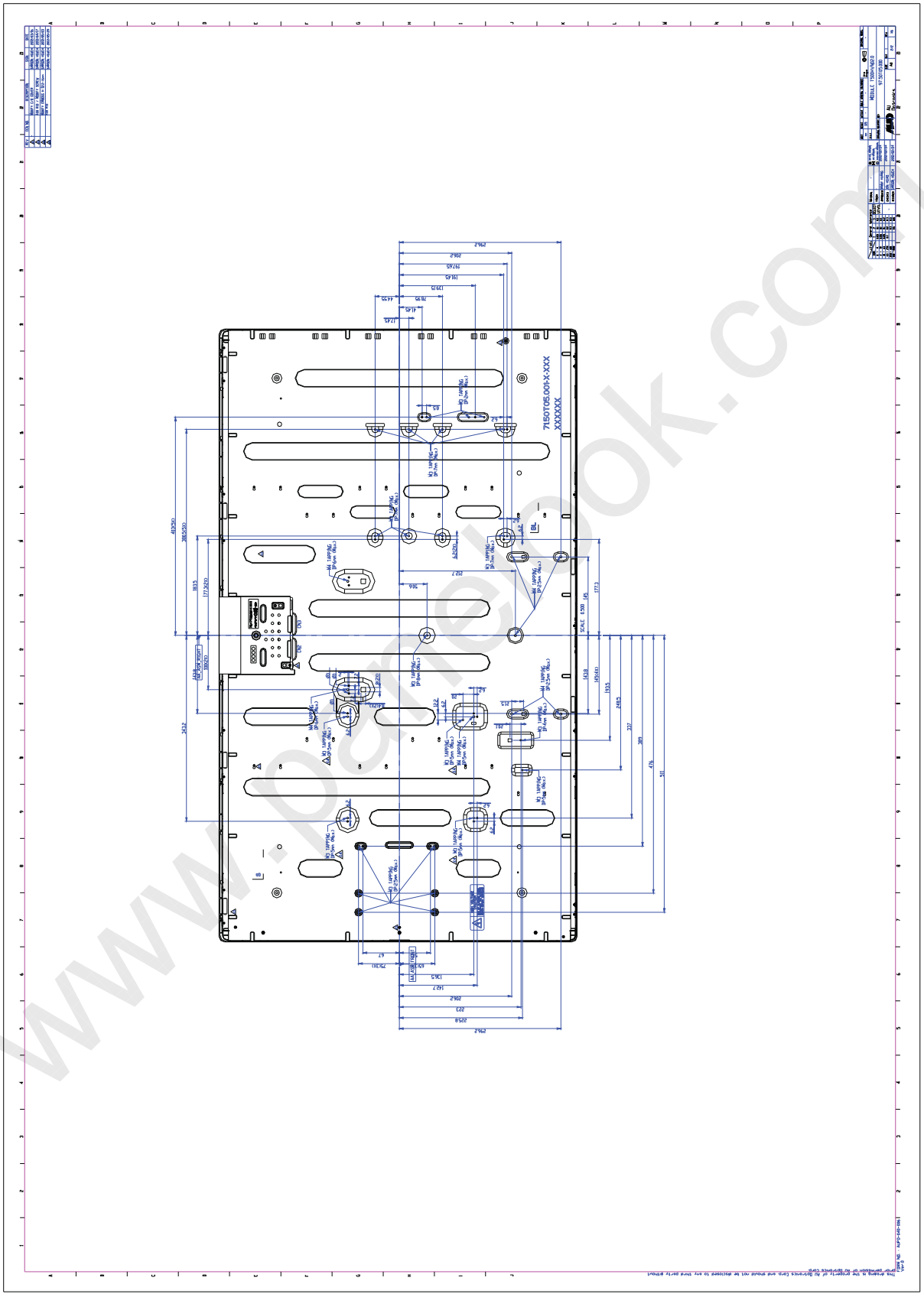
The contents provide general mechanical characteristics for the model T500HVN02.0. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	1131.8	mm	
	Vertical	657.2	mm	
	Depth (Dmin)	51.8	mm	to rear
	Depth (Dmax)	62	mm	to T-con cover
Weight	11600		g	

Front View



Back View



6. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60℃, 300hrs
2	Low temperature storage test	3	-20℃, 300hrs
3	High temperature operation test	3	50℃, 300hrs
4	Low temperature operation test	3	-5℃, 300hrs
5	Vibration test (non-operation)	3	Wave form: random Vibration level: 1.5G RMS Bandwidth: 10-300Hz, Duration: X, Y, Z 30min One time each direction
6	Shock test (non-operation)	3	Shock level: 50G Waveform: half since wave, 11ms Direction: ±X, ±Y, ±Z, One time each direction
7	Vibration test (With carton)	6	Random wave (1.5 GRMS, 10-200Hz) 30mins/ Per each X,Y,Z axes
8	Drop test (With carton)	6	Height: 25.4cm (ASTMD4169) Surround four flats (Front, Rear, Left, Right flat) one time, Bottom flat two times.

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

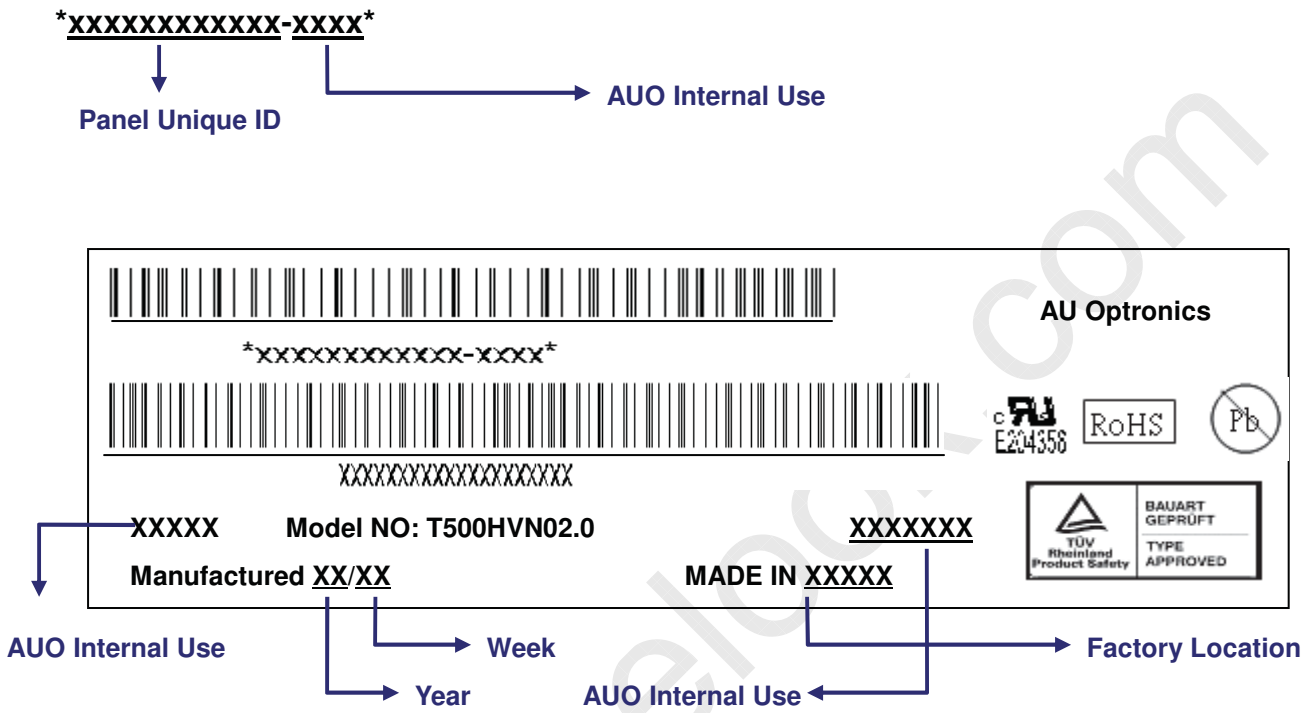
(2) C.I.S.P.R “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.” International Special committee on Radio Interference.

(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:



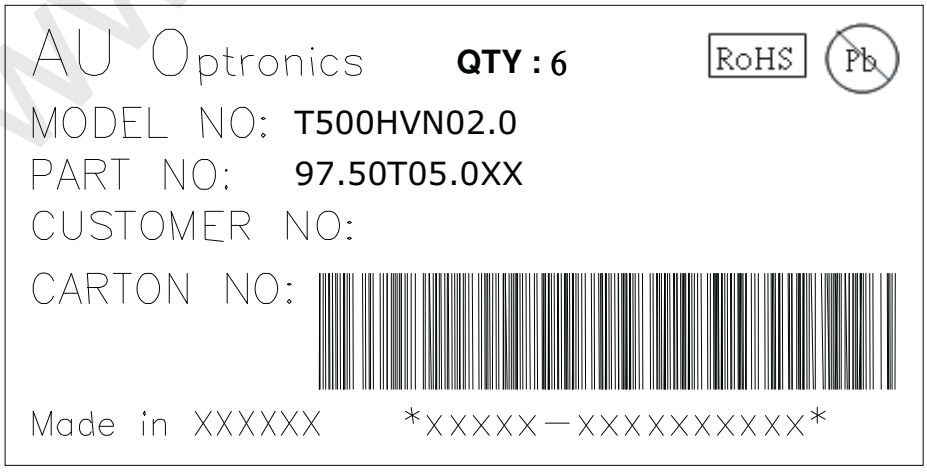
Green mark description

(1) For Pb Free Product, AUO will add Pb for identification.

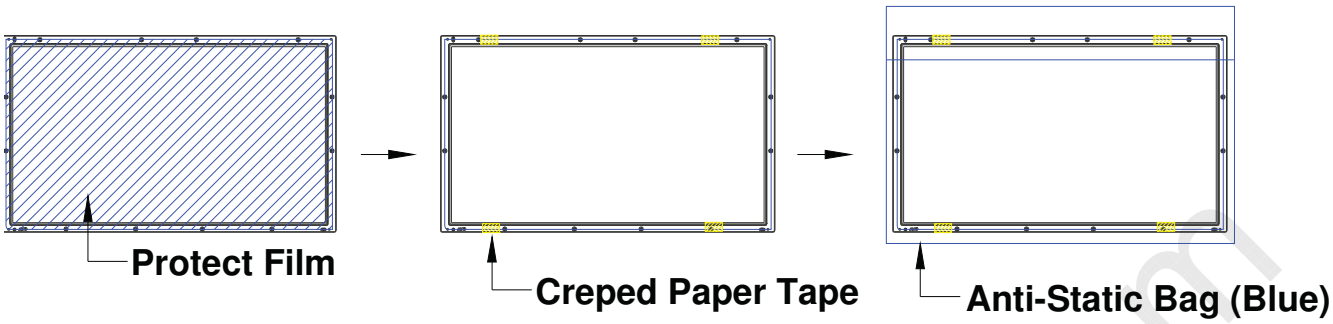
(2) For RoHs compatible products, AUO will add RoHS for identification.

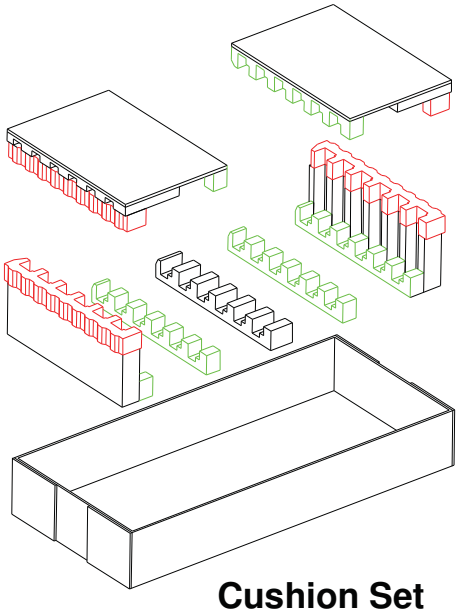
Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

B. Carton Label:

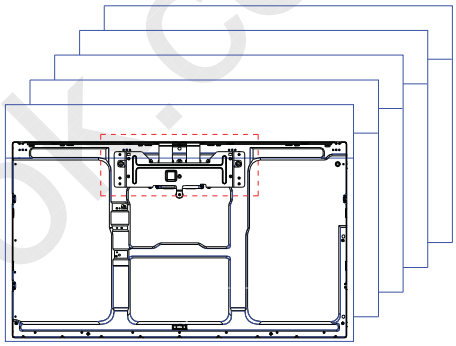


8-2 PACKING METHODS:



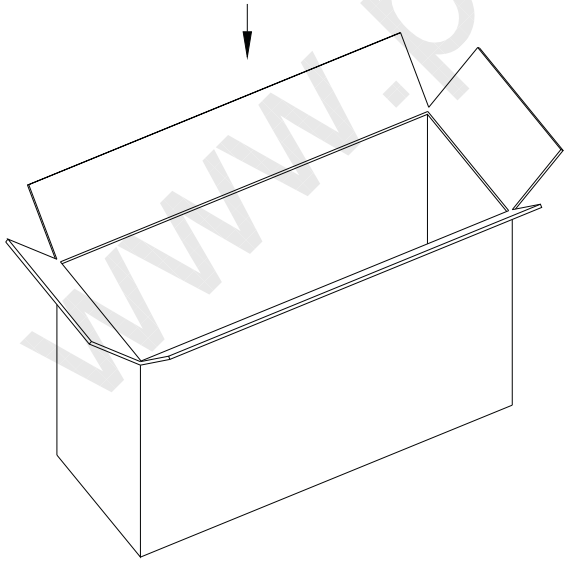


Cushion Set

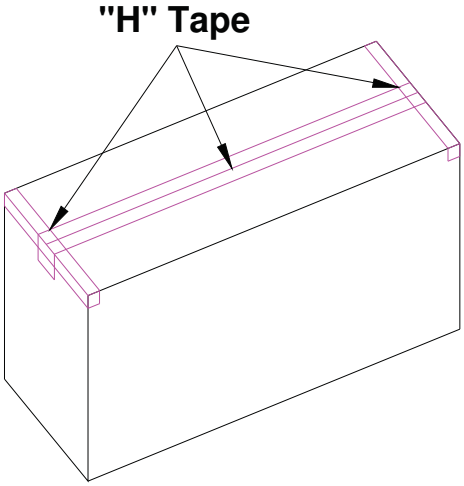


Packing Way : Panel Top Side Up

(6) Pcs Modules

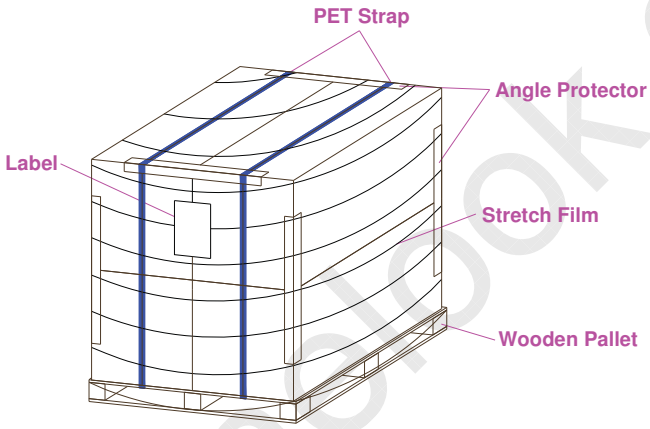


(6) Pcs / 1 Carton



8-3 Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing BOX	6pcs/box	1230(L)*570(W)*730(H)	76	Box = 3.4 kg Cushion = 3 kg
2	Pallet	1	1260(L)*1150(W)*138(H)	17.3	
3	Boxes per Pallet	2 boxes/pallet			
4	Panels per Pallet	12 pcs/pallet			
	Pallet after packing	12	1260(L)*1150(W)*868(H)	169.3	



Single pallet packaging illustration

12. 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 cause circuit broken 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=±200mV(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℃ 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 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.

