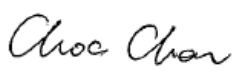


Model Name: P215HVN03.0

Issue Date: 2023/03/28

() Preliminary Specifications
(*) Final Specifications

Customer Signature	Date	AUO	Date
Approved By		Approval By PM Director CT WU 	
Note		Reviewed By RD Director Lamy Chen 	
		Reviewed By Project Leader Choc Chen 	
		Prepared By PM Travis Huang 	

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Record of Revision

[illegible]

1. General Description

This specification applies to the 21.5 inch Color TFT-LCD Module P215HVN03.0. This LCD module has a TFT active matrix type liquid crystal panel 1,920x1,080 pixels, and diagonal size of 21.5 inch. This module supports 1,920x1,080 resolution display. 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 P215HVN03.0 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.

* General Information

Items	Specification	Unit	Note
Active Screen Size	21.45	Inch	
Display Area	478.656 (H) x 260.28 (V)	mm	
Outline Dimension	501.9(H)× 284.8(V)×10.9(D)	mm	(D):front bezel to CB Cover.
Driver Element	a-Si TFT active matrix		
Display Colors	16.7M colors (RGB 6-bits +Hi-FRC)	Colors	
Number of Pixels	1,920x1,080	Pixel	
Pixel Pitch	0.2493×0.241	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	AG, 3H		Haze 25%
Rotate Function	Unachievable		Note 1
Display Orientation	Landscape/Portrait Enable		Note 2
Operating Time	24/7		See Chapter 11.3 for details
Frame Rate	60	Hz	See Chapter 5.1 for details
LED MTTF	30K	hrs	See Chapter 6.1 for details

Note:

Note 1: Rotate Function refers to LCD display could be able to rotate. This function does not work in this model.

Note 2:

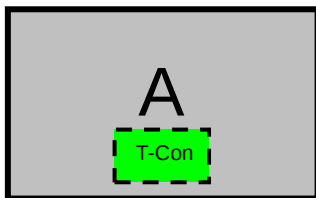
1. Landscape Mode:

The default placement is T-Con Side on the lower side and the image is shown upright via viewing from the front.

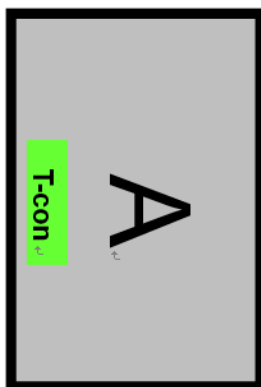
2. Portrait Mode:

The default placement is that T-Con side has to be placed on the left side via viewing from the front.

Landscape (Front view)



Portrait (Front view)



2. Absolute Maximum Ratings

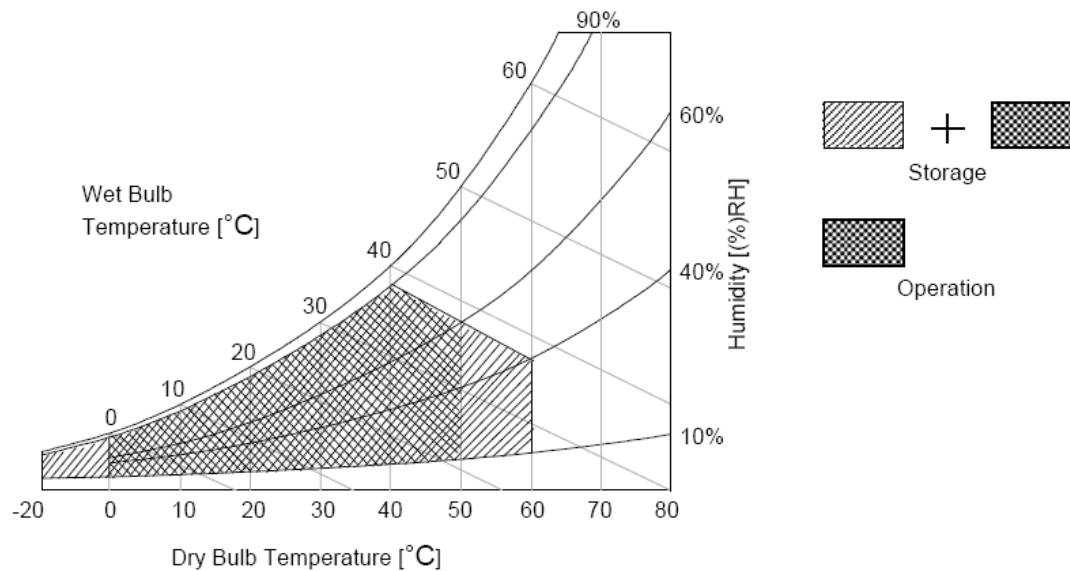
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	6	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	6	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 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.

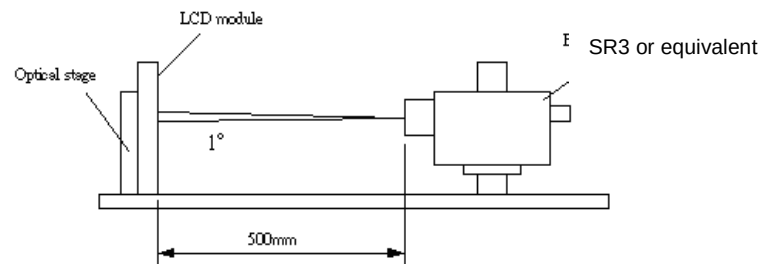
Note 3: Surface temperature is measured at 50°C Dry condition



3. 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 while panel is placed in the default position. The default position is T-con side as the top side of panel. The value specified is 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	2000	3000	--		1
Surface Luminance (White)		L _{WH}	400	500	--	cd/m ²	2
Luminance Variation		$\delta_{\text{WHITE(9P)}}$	--	--	1.33		3
Response Time (G to G)		T _γ	--	20	--	ms	4
Color Gamut		NTSC		72		%	
Color Coordinates							
	Red	R _x	Typ.-0.03	0.655	Typ.+0.03		
		R _y		0.335			
	Green	G _x		0.320			
		G _y		0.618			
	Blue	B _x		0.152			
		B _y		0.077			
	White	W _x		0.313			
		W _y		0.329			
Viewing Angle							5
	x axis, right($\varphi=0^\circ$)	θ_r	85	89	--	degree	
	x axis, left($\varphi=180^\circ$)	θ_l	85	89	--	degree	
	y axis, up($\varphi=90^\circ$)	θ_u	85	89	--	degree	
	y axis, down ($\varphi=270^\circ$)	θ_d	85	89	--	degree	

Note:

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

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

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 $I_H = 11\text{mA}$. $L_{\text{WH}} = L_{\text{on5}}$ where L_{on5} 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:

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

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.

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

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%	

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.

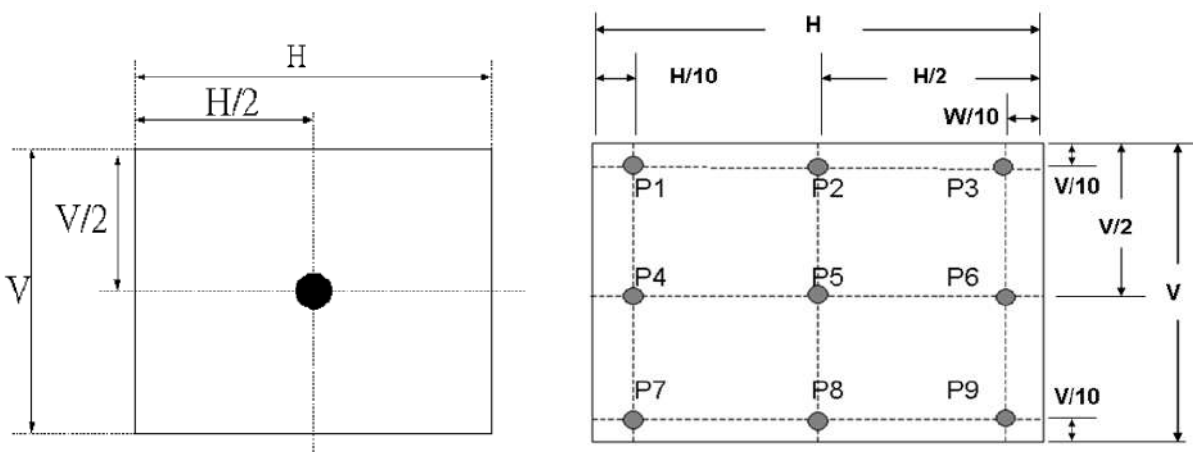


FIG.3 Response Time

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)”.

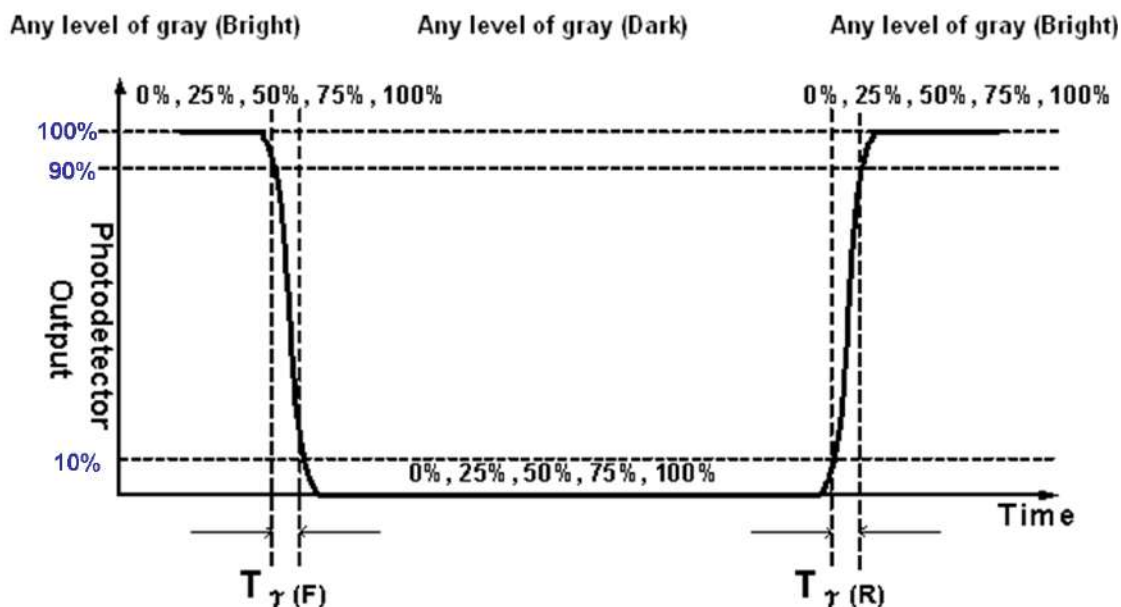
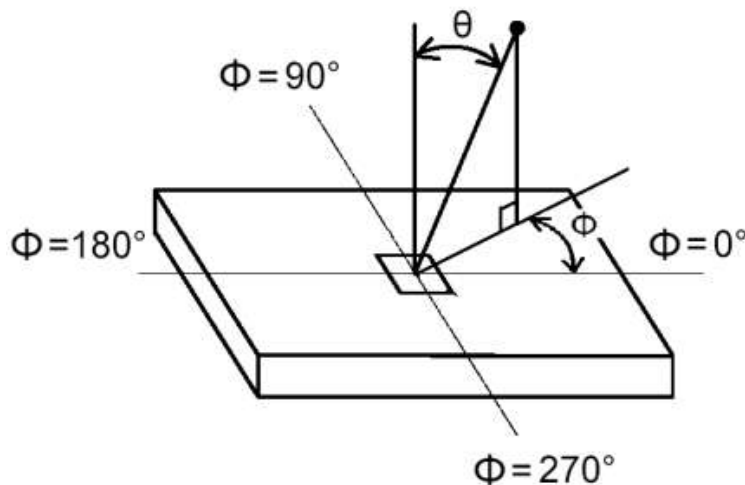


FIG.4 Viewing Angle



4. Interface Specification

4.1. Input power

The P215HVN03.0 module requires power inputs which are employed to power the LCD electronics and to drive the TFT array and liquid crystal.

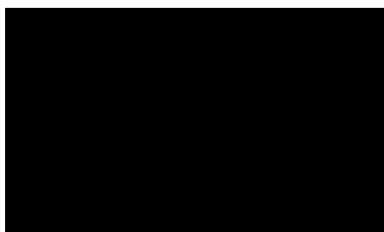
Item	Symbol	Min.	Typ.	Max	Unit	Note
Power Supply Input Voltage	V_{DD}		5.0	5.5	V	1
Power Supply Input Current	Black pattern	-	0.28	0.34	A	2
	White pattern	-	0.28	0.37	A	
	H-strip pattern	-	0.56	0.67	A	
Power Consumption	Black pattern	-	1.4	1.87	Watt	
	White pattern	-	1.4	1.87	Watt	
	H-strip pattern	-	2.8	3.69	Watt	
Inrush Current	I_{RUSH}	--	--	3.0	A	3

The ripple voltage should be fewer than 5% of VDD.

Note1. Test Condition:

- (1) $V_{DD} = 5.0V$, (2) $F_v = 60Hz$, (3) $F_{clk} = 73.1MHz$, (4) Temperature = 25 °C
(5) Power dissipation check pattern. (Only for power design)

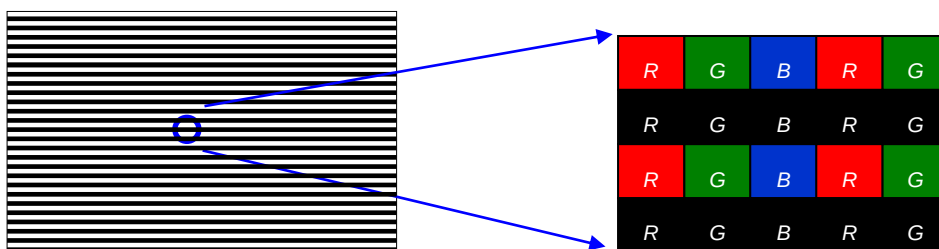
a. Black pattern



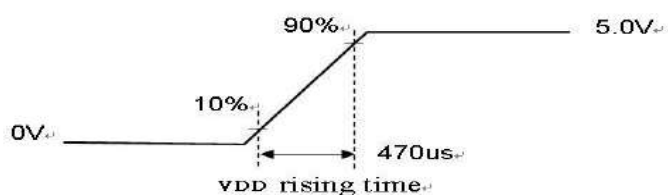
b. White pattern



c. H-Strip pattern



Note2. Measurement condition : Rising time = 470us



4.2. Interface Connections

TFT-LCD Connector	Manufacturer	P-TWO	STM
	Part Number	187034-3009	MSBKT2407P30
Mating Connector	Manufacturer	JAE or Compatible	
	Part Number	FI-X30HL (Locked Type)	

PIN #	Symbol	Description	Remark
1	RxO0-	Negative LVDS differential data input (Odd data)	
2	RxO0+	Positive LVDS differential data input (Odd data)	
3	RxO1-	Negative LVDS differential data input (Odd data)	
4	RxO1+	Positive LVDS differential data input (Odd data)	
5	RxO2-	Negative LVDS differential data input (Odd data)	
6	RxO2+	Positive LVDS differential data input (Odd data)	
7	GND	Ground	
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)	
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)	
10	RxO3-	Negative LVDS differential data input (Odd data)	
11	RxO3+	Positive LVDS differential data input (Odd data)	
12	RxE0-	Negative LVDS differential data input (Even data)	
13	RxE0+	Positive LVDS differential data input (Even data)	
14	GND	Ground	
15	RxE1-	Negative LVDS differential data input (Even data)	
16	RxE1+	Positive LVDS differential data input (Even data)	
17	GND	Ground	
18	RxE2-	Negative LVDS differential data input (Even data)	
19	RxE2+	Positive LVDS differential data input (Even data)	
20	RxECLK-	Negative LVDS differential clock input (Even clock)	
21	RxECLK+	Positive LVDS differential clock input (Even clock)	
22	RxE3-	Negative LVDS differential data input (Even data)	
23	RxE3+	Positive LVDS differential data input (Even data)	
24	GND	Ground	
25	NC	No connection (for AUO test only. Do not connect)	
26	NC	No connection (for AUO test only. Do not connect)	
27	NC	No connection (for AUO test only. Do not connect)	
28	VDD	Power Supply Input Voltage	
29	VDD	Power Supply Input Voltage	
30	VDD	Power Supply Input Voltage	

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

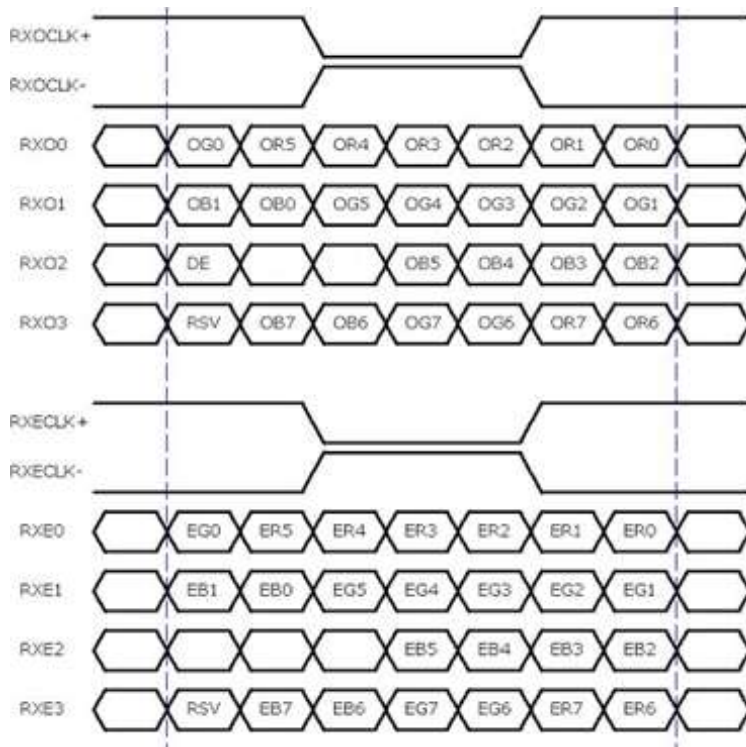
Note 1: All GND (ground) pins should be connected together and should also be connected to the LCD's metal frame.

Note 2: All V_{DD} (power input) pins should be connected together.

Note 3: All NC (no connection) pins should be open without voltage input.

4.3. Input Data Format

4.3.1. LVDS Colour Data Mapping



8 Bit Color Bit Order			
MSB	R7	G7	B7
	R6	G6	B6
	R5	G5	B5
	R4	G4	B4
	R3	G3	B3
	R2	G2	B2
	R1	G1	B1
LSB	R0	G0	B0

4.3.2. 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.

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

Color	Gray Level	Color Input Data																								Remark
		RED data (MSB :R7, LSB :R0)								GREEN data (MSB :G7, LSB :G0)								BLUE data (MSB :B7, LSB :B0)								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
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	
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	
Gray 127	-	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	
Red	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	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	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	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	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

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)

Vertical Frequency Range (60Hz)

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	1100	1160	1837	Th
	Active	Tdisp (v)	1080	1080	1080	Th
	Blanking	Tblk (v)	20	80	757	Th
Horizontal Section	Period	Th	1034	1050	1100	Tclk
	Active	Tdisp (h)	960	960	960	Tclk
	Blanking	Tblk (h)	74	90	140	Tclk
Clock	Frequency	Fclk=1/Tclk	54.6	73.1	94	MHz
Vertical Frequency	Frequency	Fv	48	60	76	Hz
Horizontal Frequency	Frequency	Fh	52.9	69.6	88.1	KHz

Notes:

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

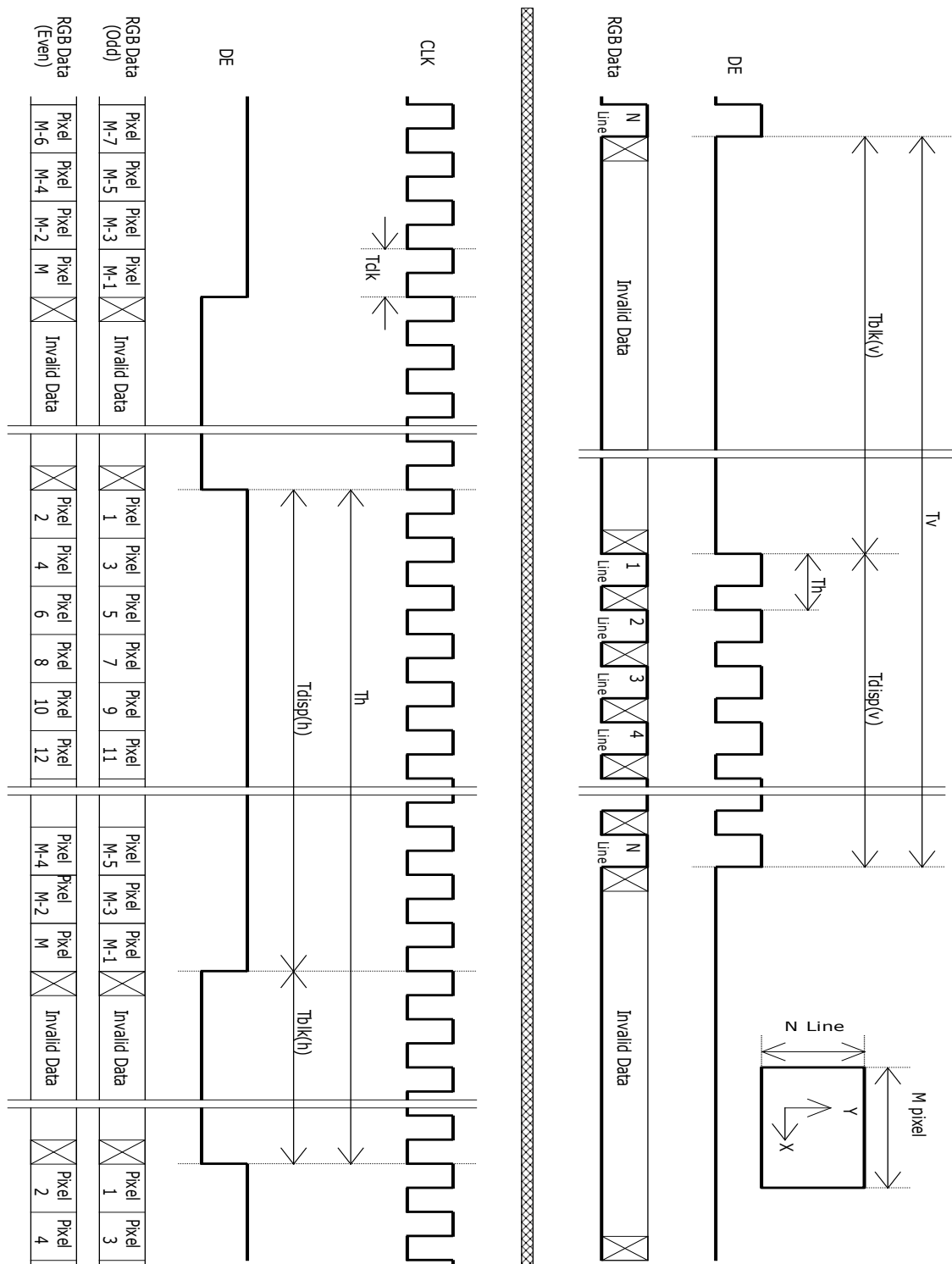
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(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.

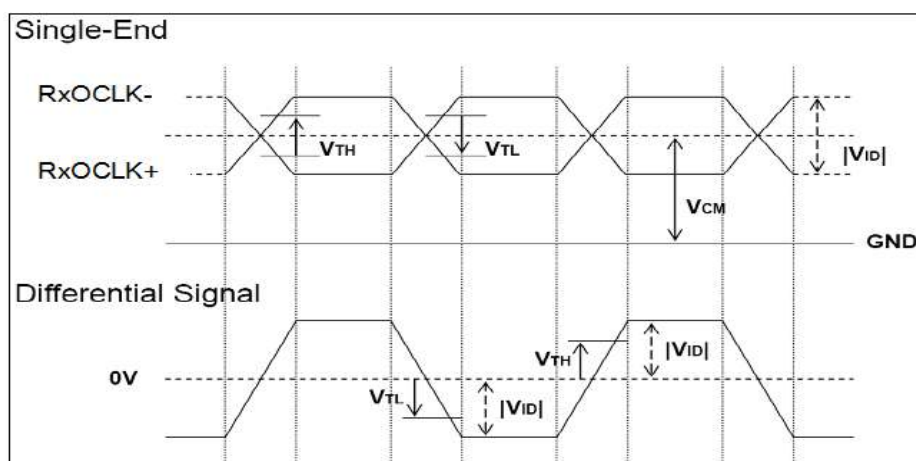
4.3.4. Signal Timing Waveform



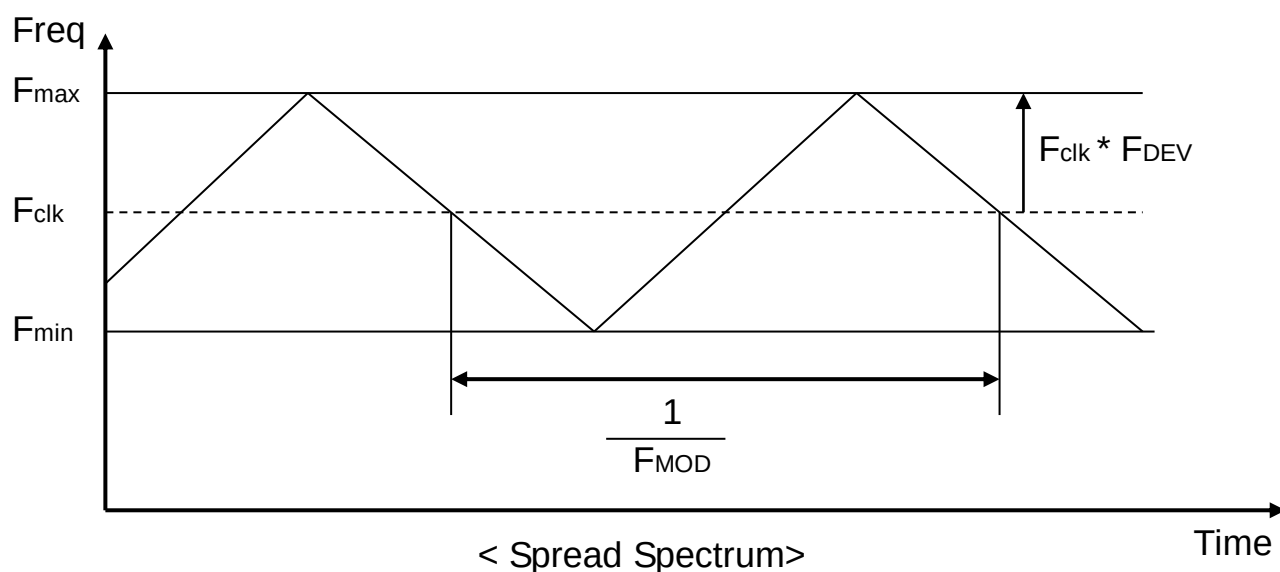
4.4. Input interface characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LVDS Interface	Input Differential Voltage	$ V_{ID} $	100		600	mV _{DC}	1
	Differential Input High Threshold Voltage	V_{TH}	--	--	+100	mV _{DC}	1
	Differential Input Low Threshold Voltage	V_{TL}	-100	--	-	mV _{DC}	1
	Input Common Mode Voltage	V_{ICM}	+1.0	+1.2	+1.5	V _{DC}	1
	Receiver Clock : Spread Spectrum Modulation range	Fclk_ss	Fclk -3%	--	Fclk +3%	MHz	2
	Receiver Clock : Spread Spectrum Modulation frequency	Fss	30	--	200	KHz	2

Note1. $V_{ICM} = 1.2V$

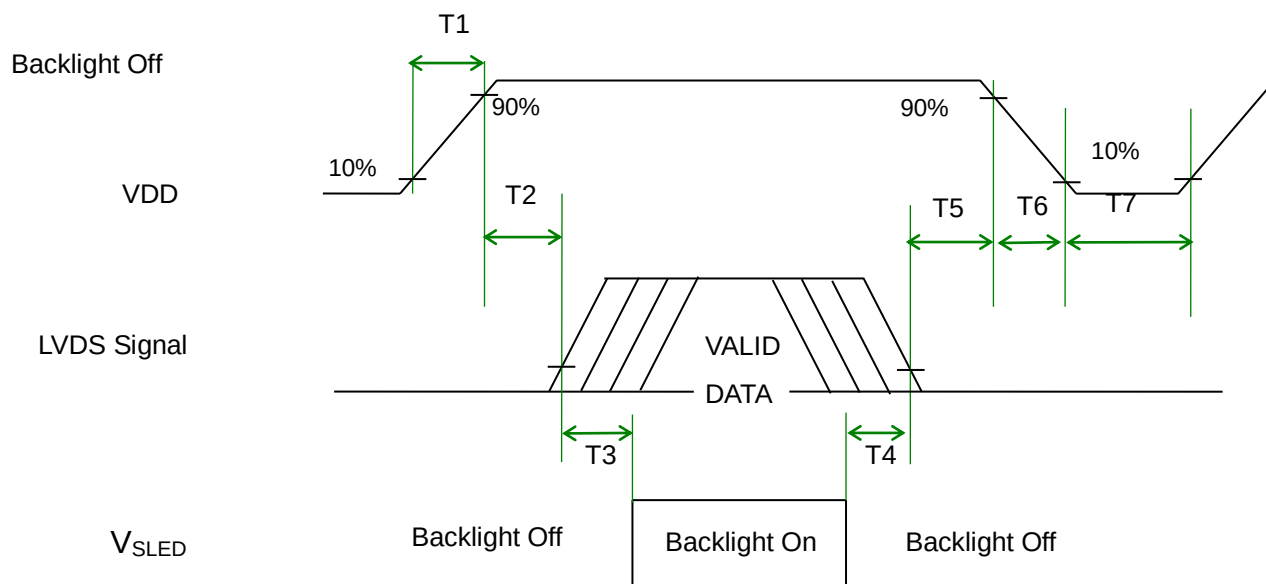


Note2. LVDS Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures.



4.5. Power Sequence

Power sequence of LCD



Power Sequence Timing

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0		50	[ms]	Note 3-6 Note 3-7
T6	0	-	200	[ms]	Note 3-7 Note 3-8
T7	1000	-	-	[ms]	

Note 3-6 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note 3-7 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

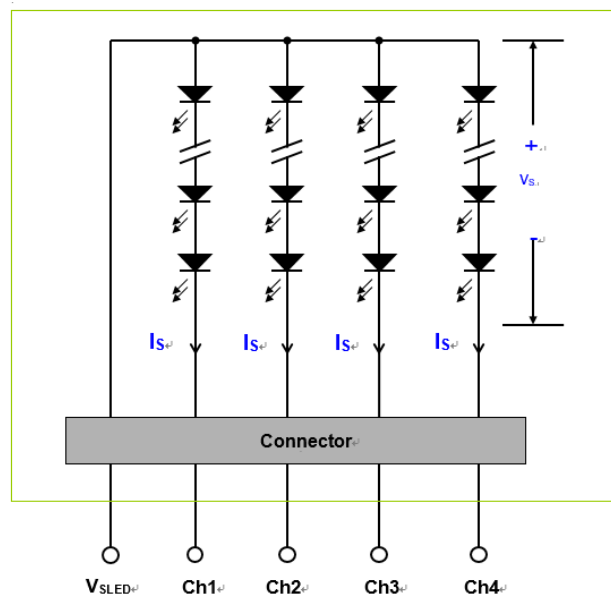
Note 3-8 : Voltage of VDD must decay smoothly after power-off. (customer system decide this value)

5. Backlight Specification

The following shows the block diagram of the 21.45 inch Backlight Unit. And it includes 60 pcs LED in the LED light bar. (4 strings and 15 pcs LED of one string).

Parameter		Symbol	Values			Unit	Note
			Min	Typ	Max		
Forward Current (one light bar)	Anode	IF (anode)		260		mA	
	Cathode	IF (cathode)		65		mA	
Peak Forward Current		IFP			800	mA	<1msec.
Forward Voltage		VF		42.8	49.8	V	1
Maximum ΔV_s Voltage Deviation of light bar		ΔV_s			3	V	6
Total Power Consumption (1 light bar)		PBL		11.12	12.95	W	2,3
LED MTTF		LTLED	30000			Hr	4, 5

- Note 1: The recommended power forward voltage capacity of converter/lips design should reserve 10% upper margin for successful light bar driving under different ambient temperature variation range (5~40°C) application and the corresponding environmental stress continued by time.
- Note 2: Each LED string should be driven by independent current control/feedback circuit.
- Note 3: Fuse protection should be added into LIPS circuit to have better LED driving protection.
- Note 4: The lifetime is defined as the time which luminance of LED is 50% compared to its original value.
[Operating condition: Continuous operating at $T_a = 25 \pm 2^\circ\text{C}$]
- Note 5: MTTF is a reference index, it is not representative of warranty.
- Note 6: ΔV_s (Max.) = $\Delta V_F \times \text{LED No. (one string)}$;
 ΔV_F : LED chip forward voltage deviation; (0.2 V , each Bin of LED VF)



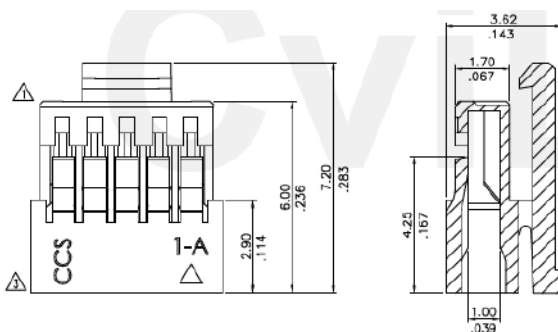
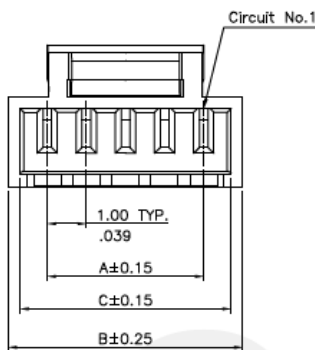
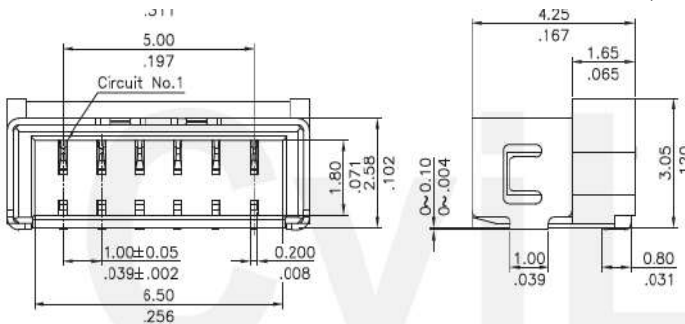
5.1. Interface Connection

5.1.1. Connector Type:

Backlight Connector	Manufacturer	CviLux
	Part Number	CII406MIHRN-NHI
Mating Connector	Manufacturer	CviLux
	Part Number	CII406SL000-NH (Lock type)

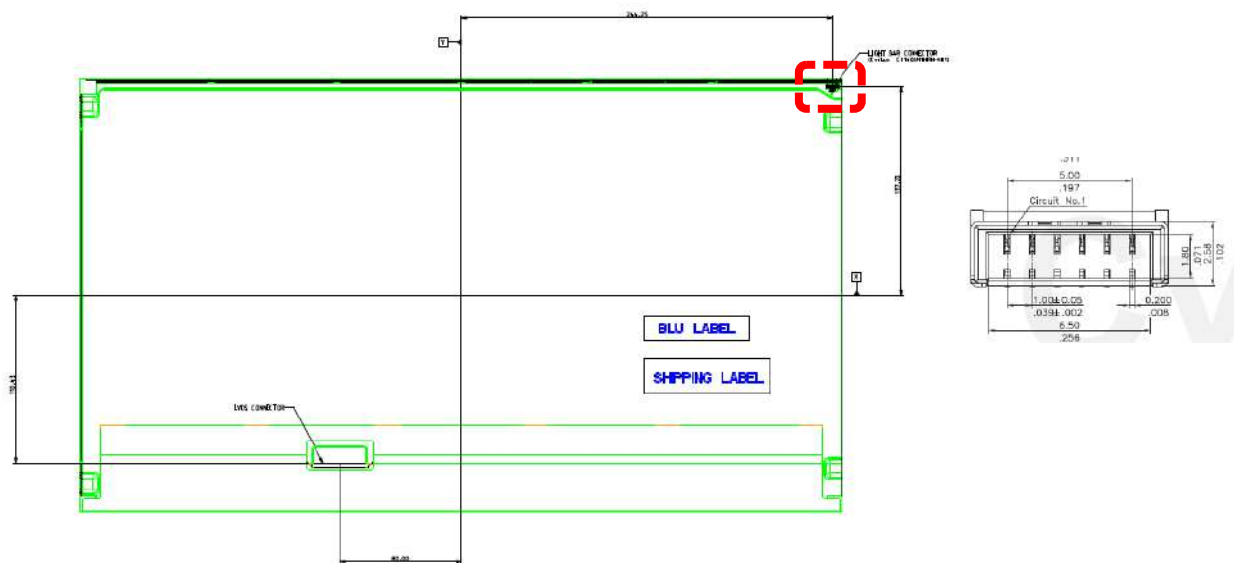
Backlight Connector dimension:

$H \times V \times D = H \times V \times D = 7.9 \times 3.05 \times 4.25$, Pitch = 1.0(unit = mm)



5.1.2. Connector Pin Assignment

Pin#	Symbol	Description	Remark
1	Ch1	LED Current Feedback Terminal (Channel 1)	
2	Ch2	LED Current Feedback Terminal (Channel 2)	
3	V _{SLED}	LED Power Supply Voltage Input Terminal	
4	V _{SLED}	LED Power Supply Voltage Input Terminal	
5	Ch3	LED Current Feedback Terminal (Channel 3)	
6	Ch4	LED Current Feedback Terminal (Channel 4)	

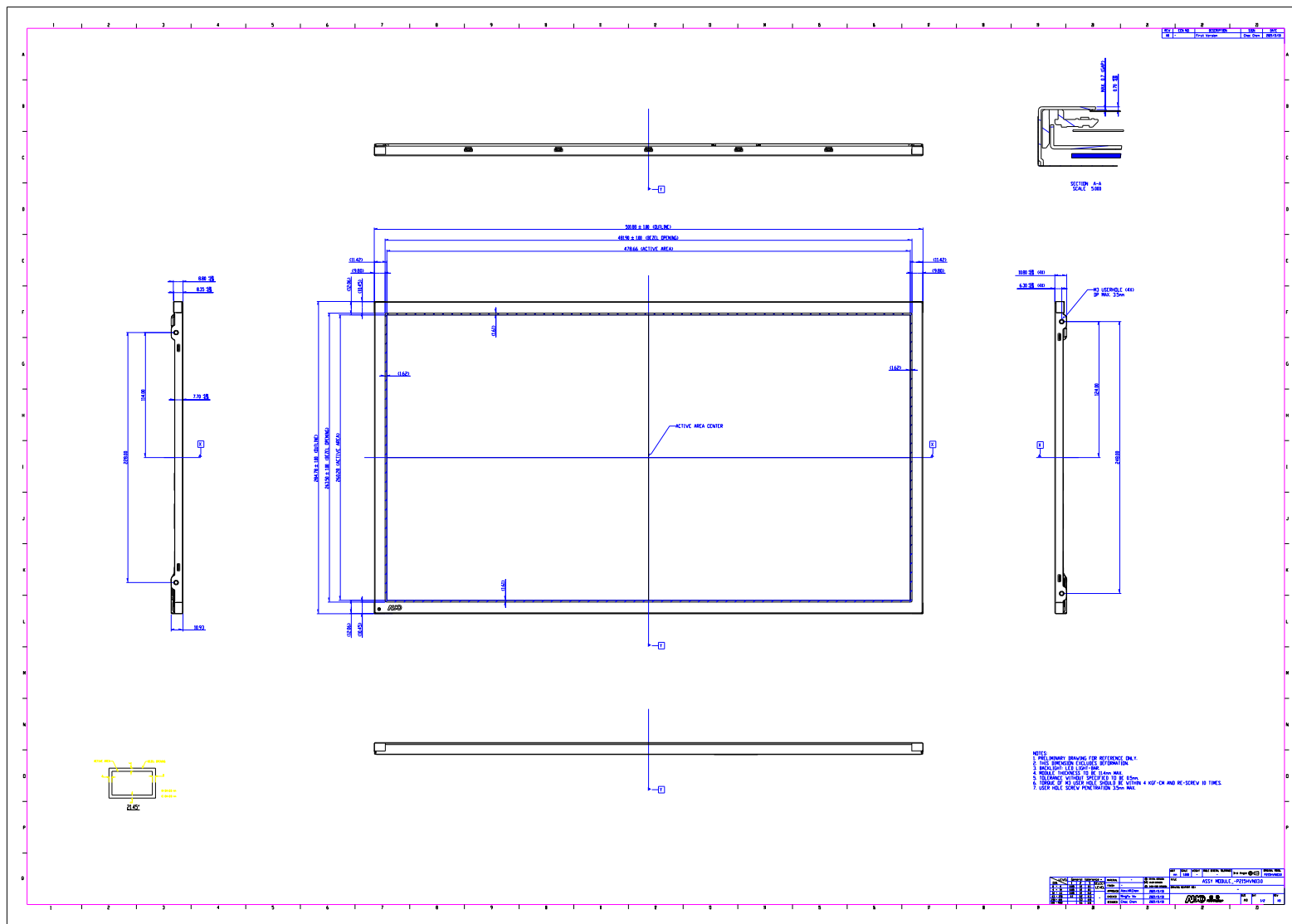


6. Mechanical Characteristics

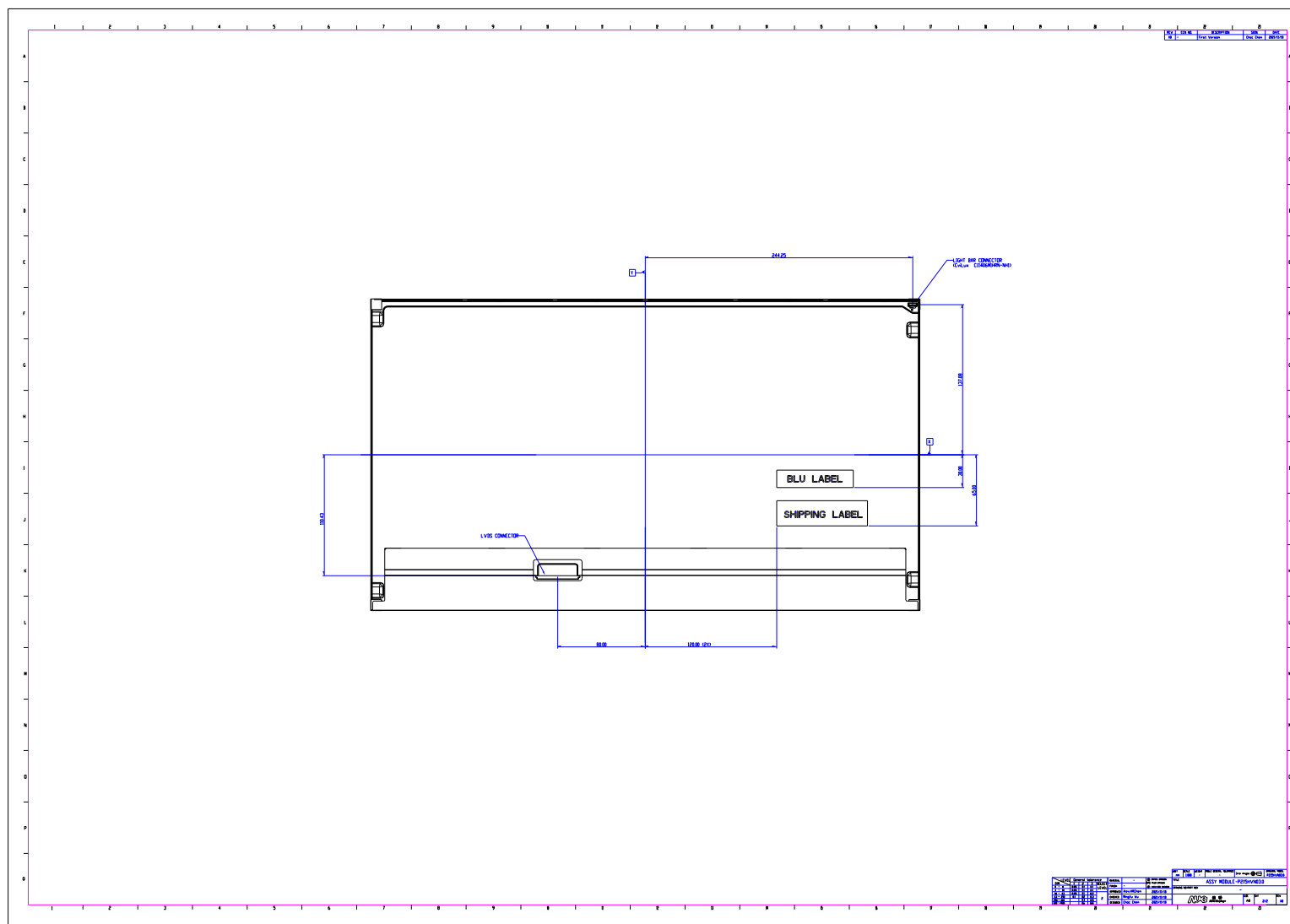
The contents provide general mechanical characteristics for the model P215HVN02.0. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	501.9	mm	
	Vertical	284.8	mm	
	Depth (Dmin)	7.7	mm	Front bezel to Back Bezel
	Depth (Dmax)	10.9	mm	Front Bezel to CB Cover
	Bezel opening	481.9(H) x 263.5(V)	mm	
	Bezel Width	10.45/10.45/9.8/9.8	mm	U/D/L/R
	Display Area	478.66(H) x 260.28(V)	mm	
Weight	1.7		Kg	

Front View



Back View (I)



7. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C, 500hrs
2	Low temperature storage test	3	-20°C, 500hrs
3	High temperature operation test	3	50°C, 500hrs
4	High temperature and High humidity operation (THB)	3	50°C 80%, 500hrs
5	Low temperature operation test	3	0°C, 500hrs
6	Vibration test (With carton)	1(PKG)	Random wave (0.77Grms 3~200Hz) Duration : Z 180min per axes
7	Drop test (With carton)	1(PKG)	Height: 45.7 cm Direction: 1corner 3edges 6flats (ASTM D 4169 & D 5276)
8	Vibration (without carton)	3	Wave form: random Vibration Level: 1.5G RMS Bandwidth: 10~200Hz Duration: X,Y,Z 30min per axes

8. International Standard

8.1. Safety

- (1) UL 62368-1 : Audio/video, information and communication technology equipment – Part 1: Safety requirements
- (2) IEC 62368-1 : Audio/video, information and communication technology equipment –Part 1: Safety requirements
- (3) EN 62368-1 : Audio/video, information and communication technology equipment –Part 1: Safety requirements

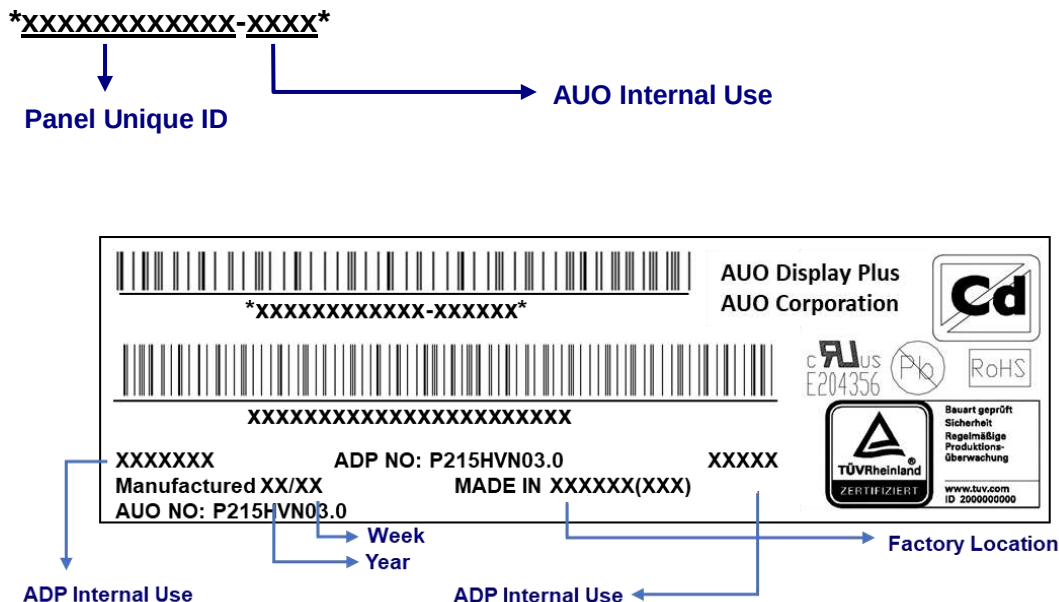
8.2. EMC

- (1) CISPR 32 “Electromagnetic compatibility of multimedia equipment - Emission requirements”
- (2) EN 55032 “Electromagnetic compatibility of multimedia equipment - Emission requirements”

9. Packing

9.1. DEFINITION OF LABEL:

A. Panel Label:



Green mark description

(1) For Pb Free Product, AUO wil



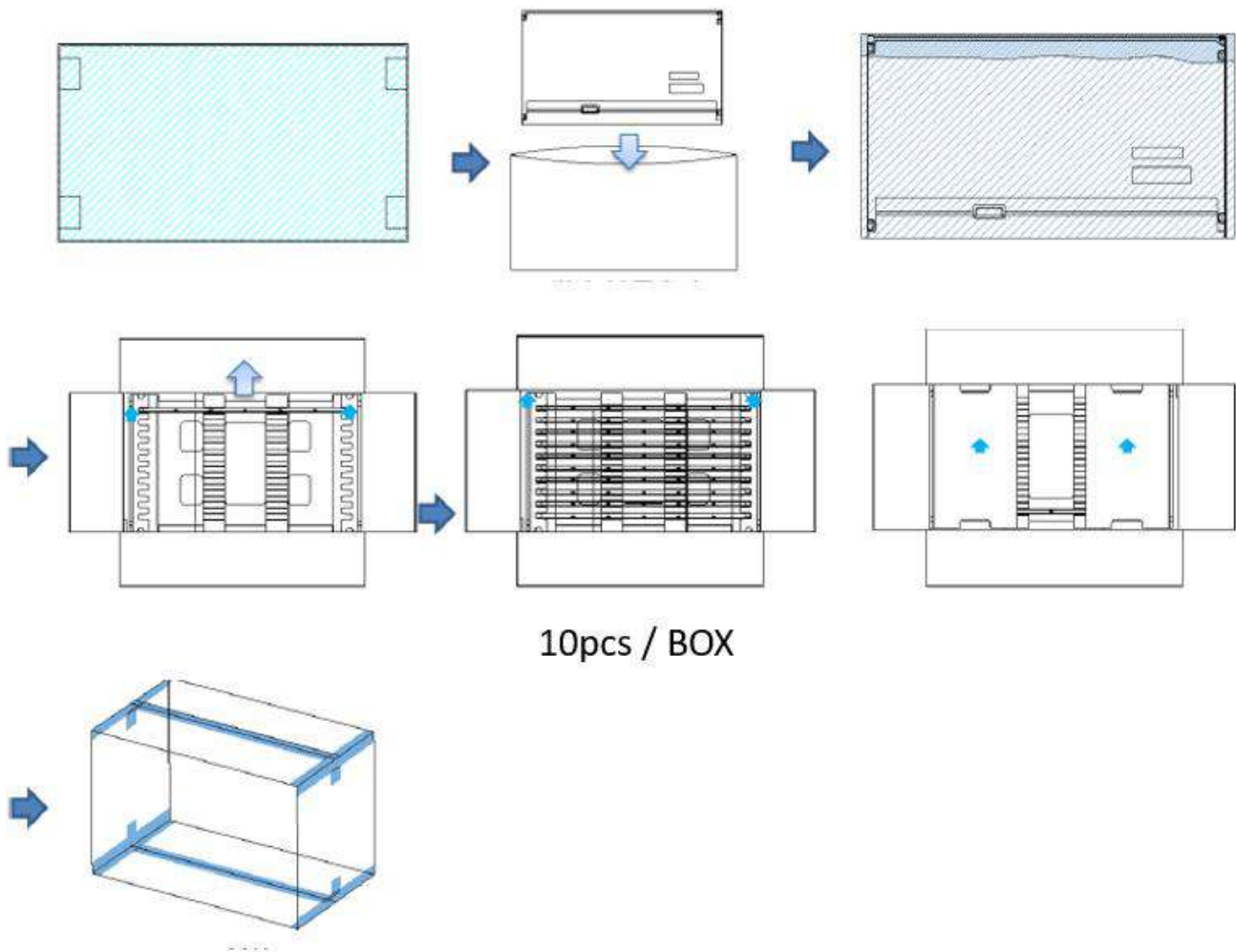
(2) For RoHs compatible products, AUO will add **RoHS** for identification.

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:

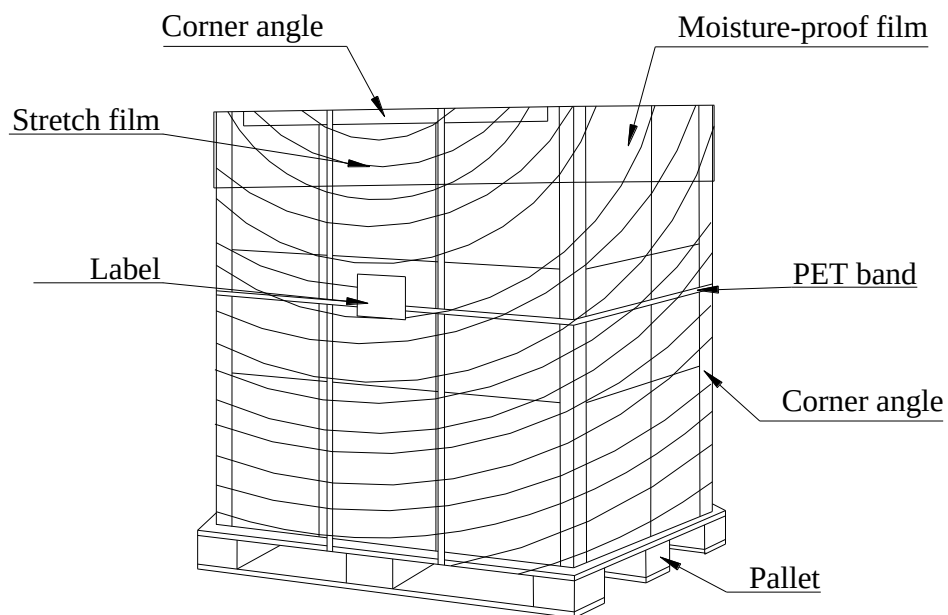
AUO Display Plus	QTY: 10pcs	RoHs	Pb
MODEL NO : P215HVN03.0			
PART NO : 97D21P10.0XX			
AUO Corporation			
MODEL NO : P215HVN03.0			
PART NO : 97.21P10.0XX			
CUSTOMER NO: XXXXX-XXXXX-XXXXX			
CARTON NO:			
Made in XXXXXX	*XXXXXXXXXXXXXX*		

9.2. PACKING METHODS:



Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing Box	10pcs/box	565mm*345mm*375mm	18.95.	With panel & Box & Cushion
2	Pallet	1	1150mm*1070mm*132mm	14.2	
3	Boxes per Pallet	18 Box per Pallet			
4	Panels per Pallet	180pcs/pallet			
5	Pallet after packing	180pcs/pallet (by Air)	1150(L)mm x 1070(W)mm x 1257(H)mm	410	With Pallet
	Pallet after packing	180pcs/pallet (by Sea)	1150(L)mm x 1070(W)mm x 1257(H)mm		With Pallet



10. PRECAUTIONS

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

10.1. 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 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 soaked 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.

10.2. OPERATING PRECAUTIONS

- (1) The device listed in the product specification sheets was designed and manufactured for PID application
- (2) The spike noise causes the miss-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 LED 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.

10.3. Operating Condition for Public Information Display

The device listed in the product specification is designed and manufactured for PID (Public Information Display) application. To optimize module's lifetime and function, below operating usages are required.

(1) Normal operating condition

1. Operating temperature: 0~40℃
2. Operating humidity: 10~90%
3. Display pattern: dynamic pattern (Real display).

Note) Long-term static display would cause image sticking.

(2) Operation usage to protect against image sticking due to long-term static display.

- (1) Suitable operating time: 24 hours a day or less.

(* The moving picture can be allowed for 24 hours a day)

- (2) Liquid Crystal refresh time is required. Cycling display between 5 minutes' information (static) display and 10 seconds' moving image.

- (3) Periodically change background and character (image) color.

- (4) Avoid combination of background and character with large different luminance.

(3) Periodically adopt one of the following actions after long time display.

- A. Running the screen saver (motion picture or black pattern)

- B. Power off the system for a while

- (4) LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.

- (5) Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions, such as high temperature/ humidity, display stationary patterns, or long operation time etc..., it is strongly recommended to contact AUO for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

10.4. 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.

10.5. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

10.6. 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.
- (3) Storage condition is guaranteed under packing conditions.
- (4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition.

10.7. 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.

10.8. Dust Resistance

- (1) AUO module dust tests are conducted with marked areas (e.g., holes and slits around the front bezel and back cover) sealed, to comply with JIS D0207 (see Figure 1).
- (2) To prevent particles from entering the module, please ensure the set has all the highlighted areas (holes and slits) adequately sealed or covered by set mechanism.
- (3) AUO's testing procedure cannot replicate all real world operation scenarios. It is up to the module user to apply the most appropriate dust resistance solution for its particular application.

Figure 1

