DATA MODUL

SPECIFICATION

AUO Display+

P215HAN01.2

21.5" – FHD – LVDS

Version: 1.0
Date: 27.05.2022

Note: This specification is subject to change without prior notice

Model Name: P215HAN01.2

Issue Date: 2022/05/27

( )Preliminary Specifications
(*)Final Specifications

Customer Signature	Date	ADP	Date
Approved By _____		Approval By PM Director CT WU _____	
Note		Reviewed By RD Director Lamy Chen _____ Reviewed By Project Leader Pei YU Tsai _____	
		Prepared By PM Daphne Wu _____	

Contents

Record of Revision

Version	Date	Page	Description
0.0	2021/12/06	all	1st Preliminary spec release
0.1	2022/03/14	23	Update 2D drawing
1.0	2022/5/27	all	1st Final spec release

1. General Description

This specification applies to the 21.5 inch Color TFT-LCD Module P215HAN01.2. 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 P215HAN01.2 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	21.5	Inch	
Display Area	476.064 (H) x 267.79 (V)	mm	
Outline Dimension	495.6 (H)× 292.2 (V)×10.7(D)	mm	
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	0.24795×0.24795	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		
Frame Rate	60	Hz	
LED MTTF	30K	hrs	

Note:

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

Note 2:

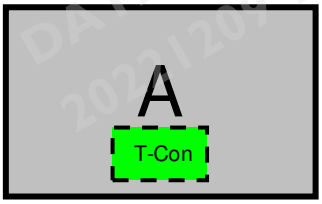
1. Landscape Mode:

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

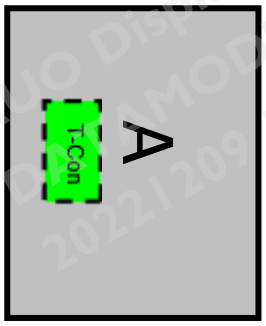
2. Portrait Mode:

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)



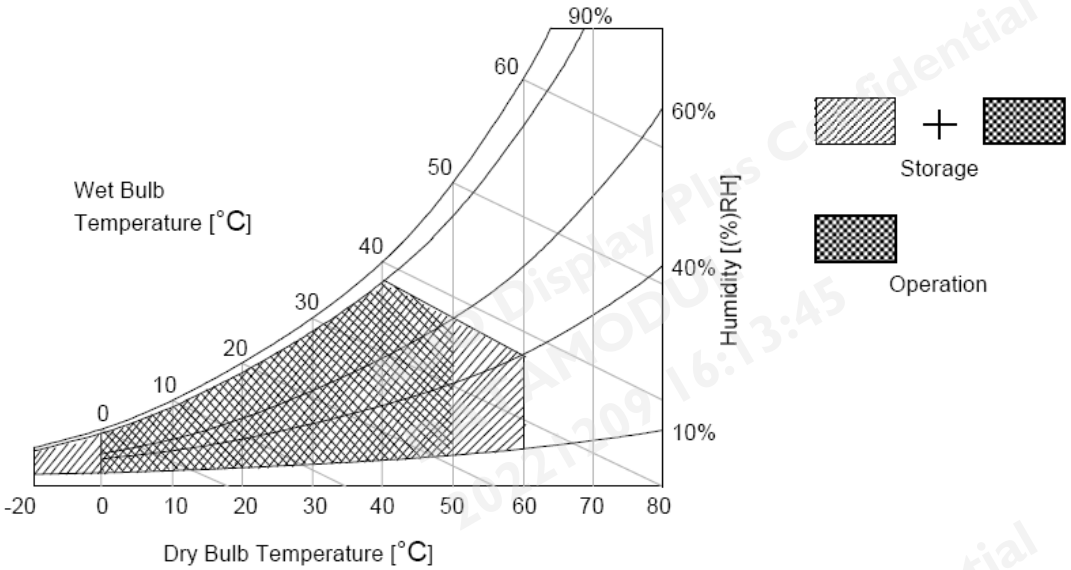
2. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[℃]	Note 1
Operating Humidity	HOP	10	90	[%RH]	Note 1
Storage Temperature	TST	-20	+60	[℃]	Note 1
Storage Humidity	HST	10	90	[%RH]	Note 1
Panel Surface Temperature	PST		65	[℃]	Note 2

Note 1 : 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℃.

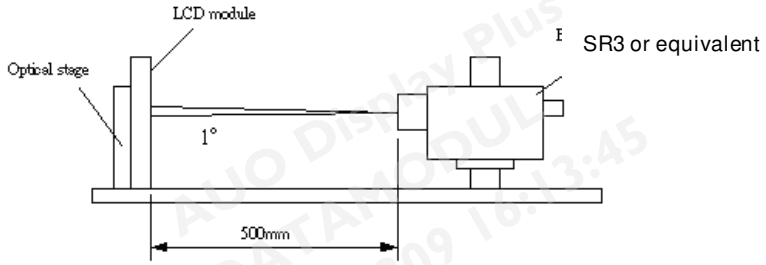
Note 2: Surface temperature is measured at 50℃ Dry condition



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		1000	--		1
Surface Luminance (White)		L_{WH}	240	300	--	cd/m^2	2
Luminance Variation		$\delta_{WHITE(9P)}$	--	--	1.33		3
Response Time (G to G)		Tγ	--	14	--	ms	4
Color Gamut		NTSC		72		%	
Color Coordinates							
	Red	R_X	Typ.-0.03	0.645	Typ.+0.03		
		R_Y		0.335			
	Green	G_X		0.312			
		G_Y		0.621			
	Blue	B_X		0.153			
		B_Y		0.053			
	White	W_X		0.313			
		W_Y		0.329			
Viewing Angle							5
	x axis, right(φ=0°)	θ_r	85	89	--	degree	
	x axis, left(φ=180°)	θ_l	85	89	--	degree	
	y axis, up(φ=90°)	θ_u	85	89	--	degree	
	y axis, down (φ=270°)	θ_d	85	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}=Lon5 where Lon5 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=60Hz 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.2 Luminance

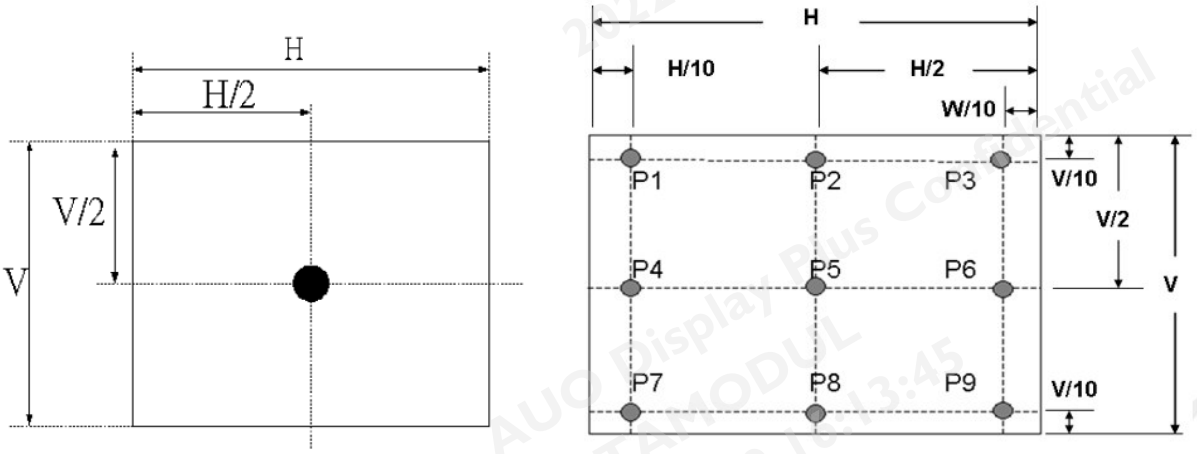
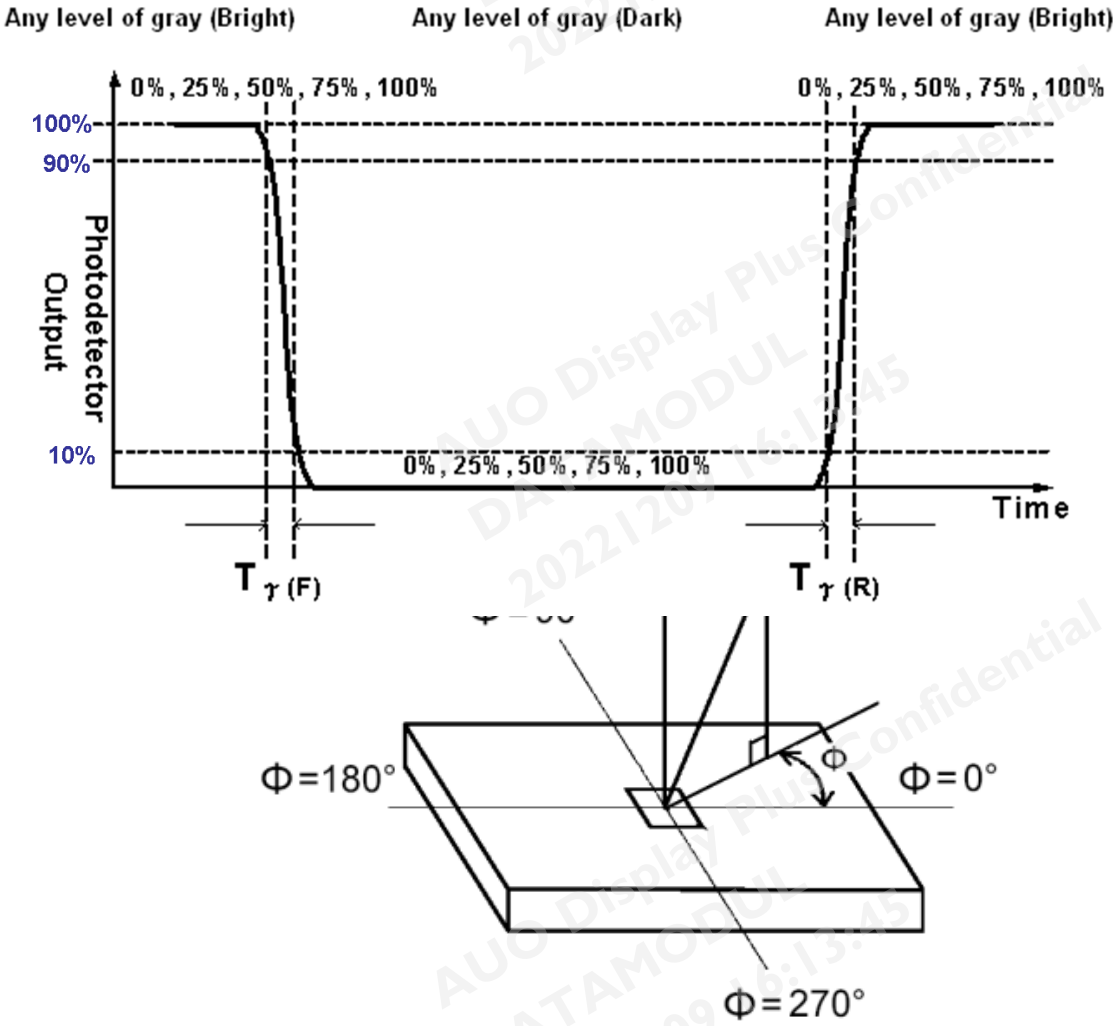


FIG.3 Response Time

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. Interface Specification

4.1. Input power

The P215HAN01.2 module requires power inputs which are employed to power the LCD electronics and to drive the TFT array and liquid crystal.

4.1.1 Absolute Maximum Rating

Permanent damage may occur if exceeding the following maximum rating

Symbol	Description	Min	Max	Unit	Remark
VDD	Power Supply Input Voltage	GND-0.3	6.0	[Volt]	Ta=25℃

4.1.2 Recommended Operating Condition

Symbol	Item		Min.	Typ.	Max.	Unit	Note
VDD	Power Supply Input Range		4.5	5	5.5	[Volt]	
IDD	Current of Power Supply@60Hz	White	-	0.5	0.6	[A]	Note2-1
		Black	-	0.4	0.5	[A]	
		H-stripe	-	0.9	1.0	[A]	
	Current of Power Supply@76Hz	White	-	0.5	0.6	[A]	
		Black	-	0.4	0.5	[A]	
		H-stripe	-	1.0	1.3	[A]	
PDD	VDD Power Consumption@60Hz		-	2.5	3.0	[Watt]	White
	VDD Power Consumption@76Hz		-	5.2	6.3	[Watt]	H-stripe
IRUSH	Inrush current		-	-	3	[A]	Note2-2
VDDrp	Allowable VDD Ripple Voltage				500	[mV]	VDD=5.0V, White Pattern @Maxi Frame rate

Note. 2-1 Test Condition:

(1) V_{DD} = Typical,

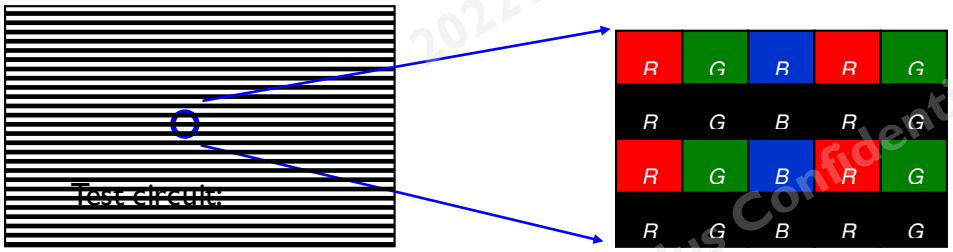
(2) Temperature = 25 ℃

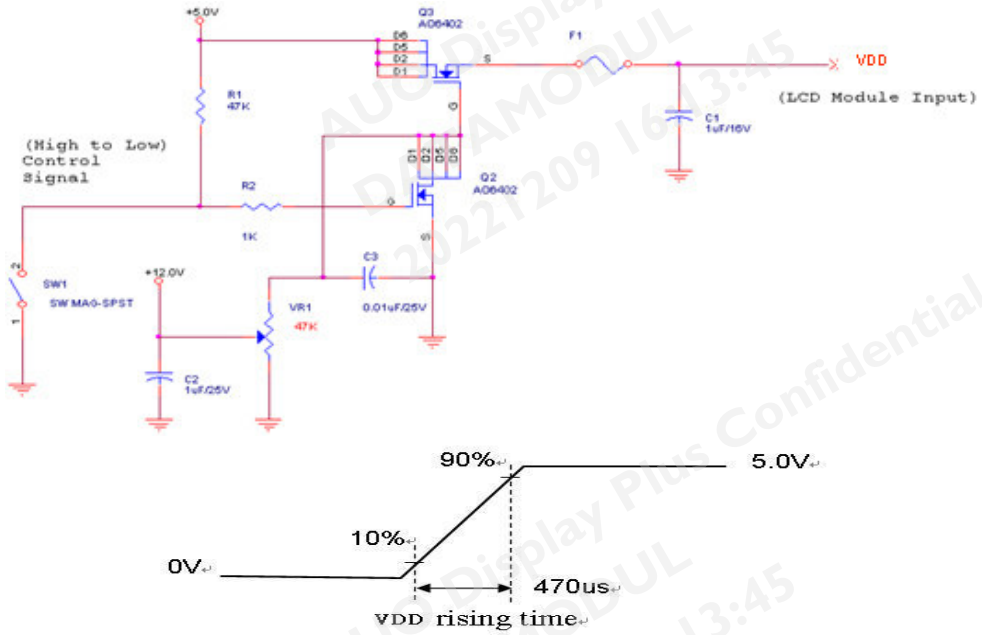
(3) Power dissipation check pattern (only for power design)

a. Black pattern

b. White pattern

c. H-Strip pattern





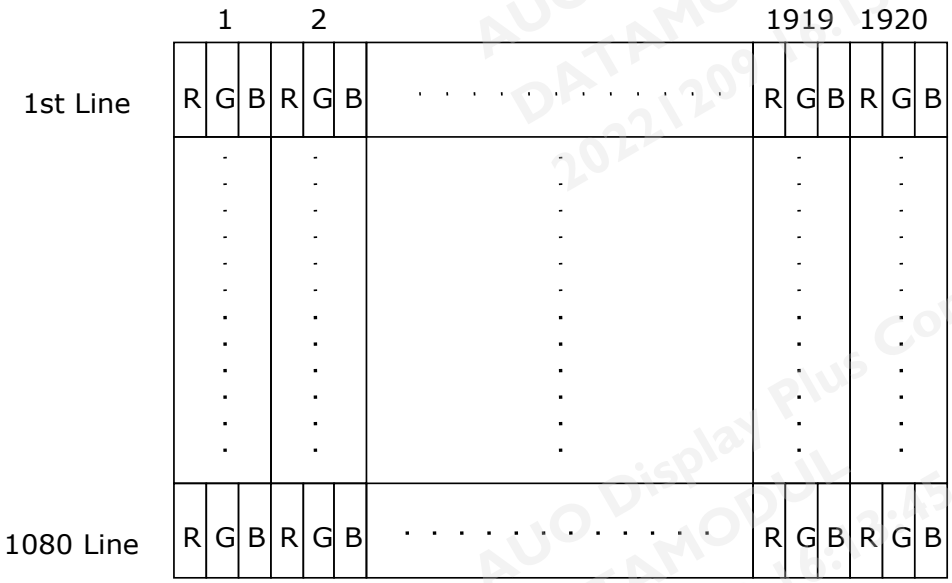
The duration of VDD rising time: 470us.

4.2. Interface Connections

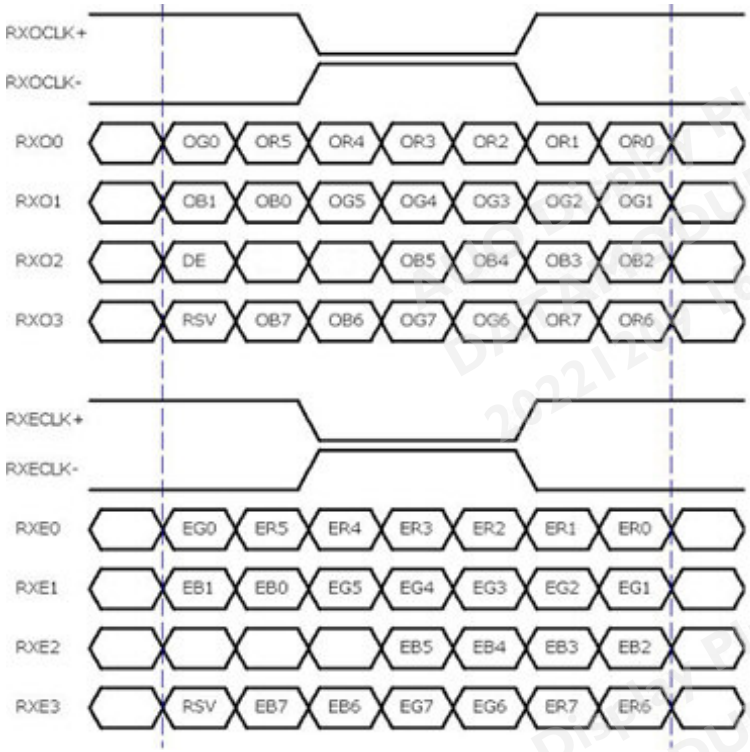
TFT-LCD Connector	Manufacturer	P-TWO	STM
	Part Number	187034-3009	MSBKT2407P30HB
Mating Connector	Manufacturer	JAE or Compatible	
	Part Number	FI-X30HL (Locked Type)	

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	Power 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	Power 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	NC	No connection (for AUO test only. Do not connect)	
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 +5V	
29	VDD	Power +5V	
30	VDD	Power +5V	

4.3. Input Data Format



4.3.1. LVDS Colour Date 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 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.

It only support DE mode, and the input timing are shown as the following table.

Signal	Item	Symbol	Min.	Typ.	Max	Unit	Remark
Vertical Section	Period	Tv	1094	1130	1836	Th	
	Active	Tdisp (v)	1080	1080	1080	Th	
	Blanking	Tblk (v)	14	50	756	Th	
	Frequency	Fv	49	60	76	Hz	
Horizontal Section	Period	Th	1000	1050	1678	Tclk	
	Active	Tdisp (h)	960	960	960	Tclk	
	Blanking	Tblk (h)	40	90	718	Tclk	
	Frequency	Fh	53.7	67.8	90.0	KHz	Note 1
LVDS Clock	Period	Tclk	11.2	14.0	18.6	ns	1/Fclk
	Frequency	Fclk	53.7	71.2	90.0	MHz	Note 2

Note 1 : The equation is listed as following. Please don't exceed the above recommended value.

Fh (Min.) = Fclk (Min.) / Th (Min.);

Fh (Typ.) = Fclk (Typ.) / Th (Typ.);

Fh (Max.)= Fclk (Max.) / Th (Min.);

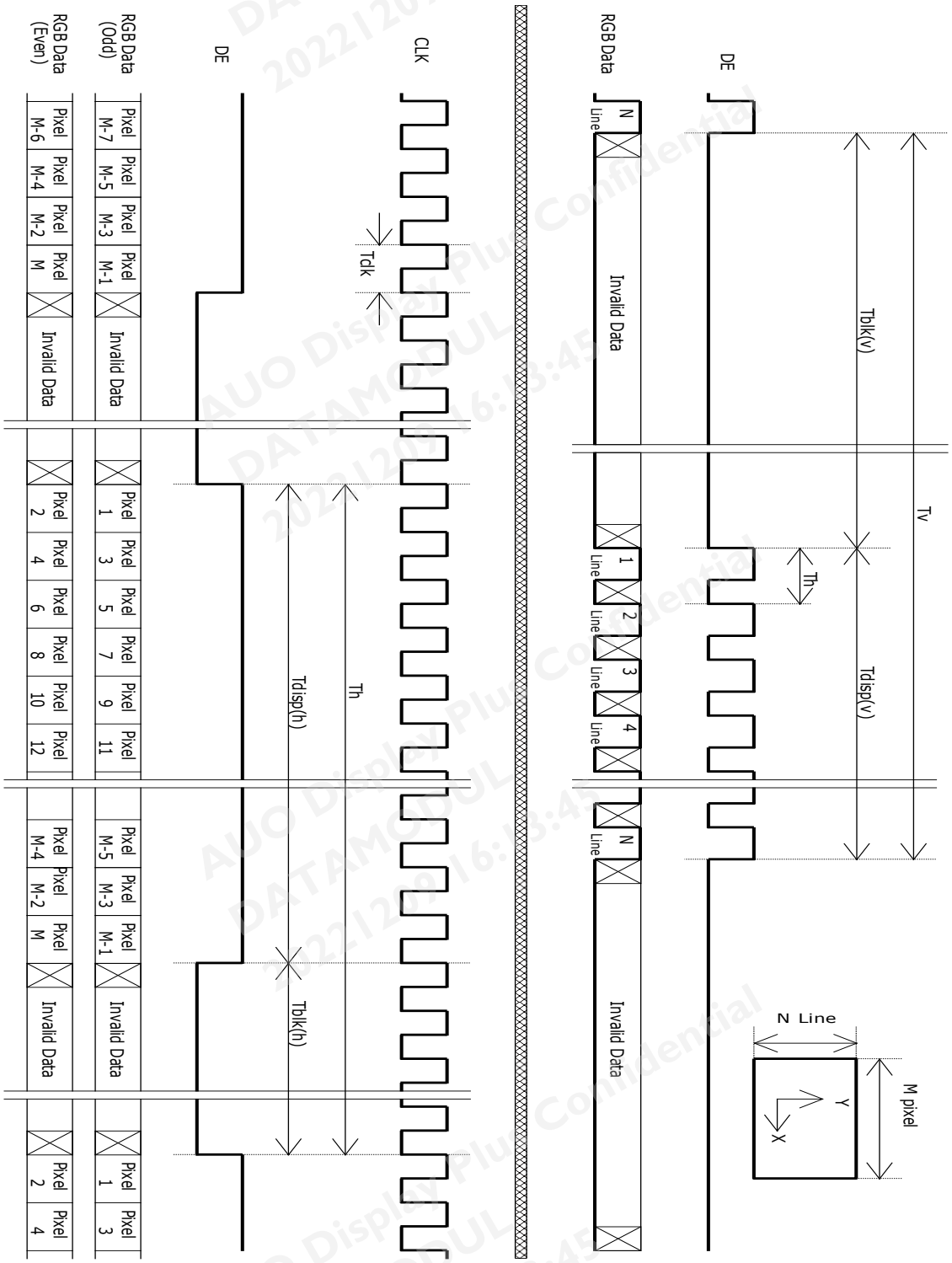
Note 2: The equation is listed as following. Please don't exceed the above recommended value.

Fclk (Min.) = Fv (Min.) x Th (Min.) x Tv (Min.);

Fclk (Typ.) = Fv (Typ.) x Th (Typ.) x Tv (Typ.);

Fclk (Max.) = Fv (Max.) x Th (Typ.) x Tv (Typ.);

4.3.4. Signal Timing Waveform



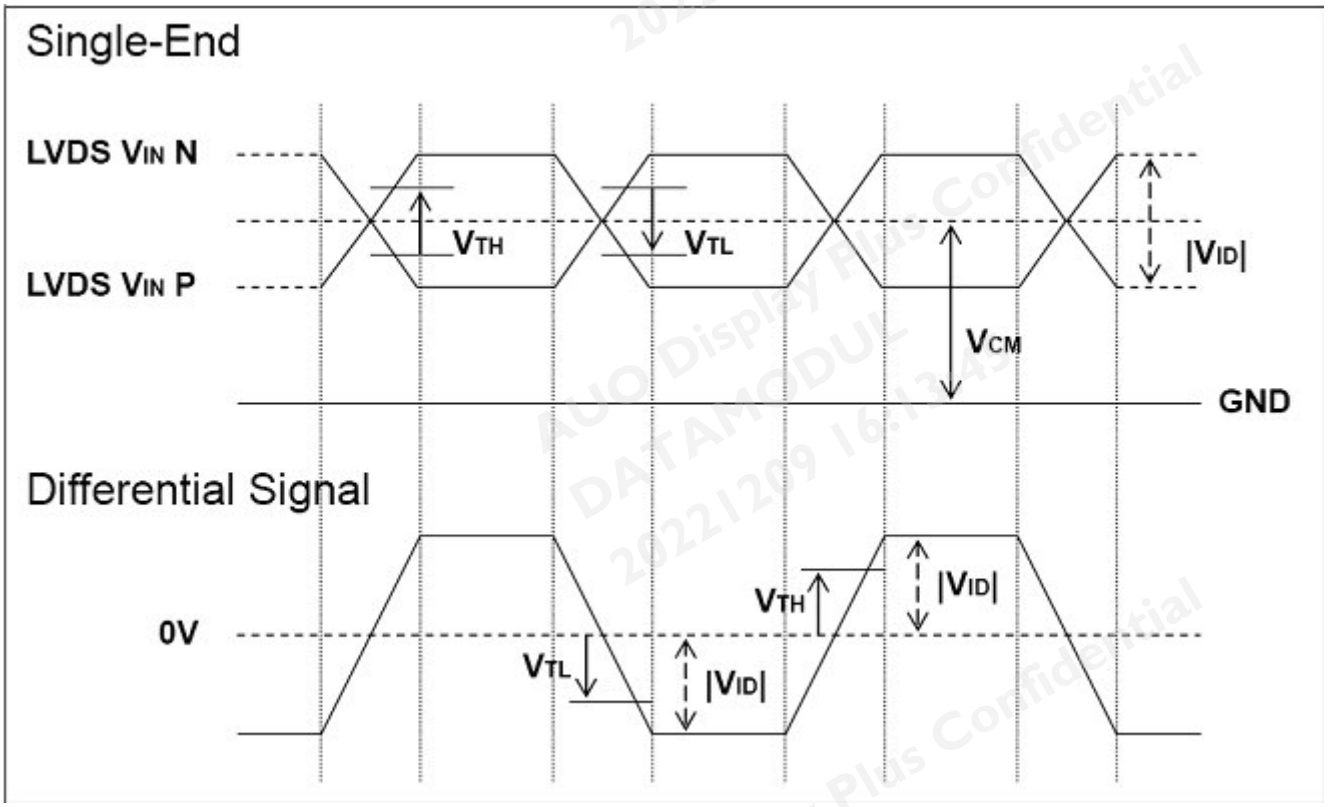
4.4. Input interface characteristics

4.4.1. DC Characteristics:

Symbol	Description	Min	Typ	Max	Units	Condition
V_{TH}	LVDS Differential Input High Threshold	-	-	+100	[mV]	V_{CM} = 1.2V
V_{TL}	LVDS Differential Input Low Threshold	-100	-	-	[mV]	V_{CM} = 1.2V
$\|V_{ID}\|$	LVDS Differential Input Voltage	100	-	600	[mV]	
V_{CM}	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	V_{TH}-V_{TL} = 200mV

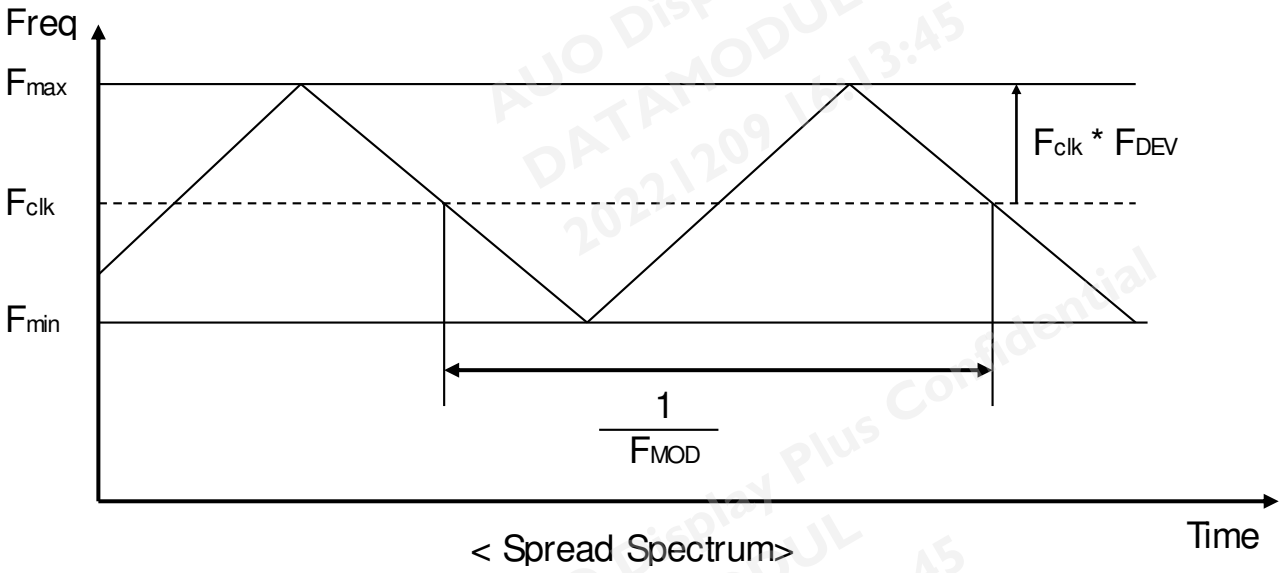
LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example.



4.4.2 AC Characteristics:

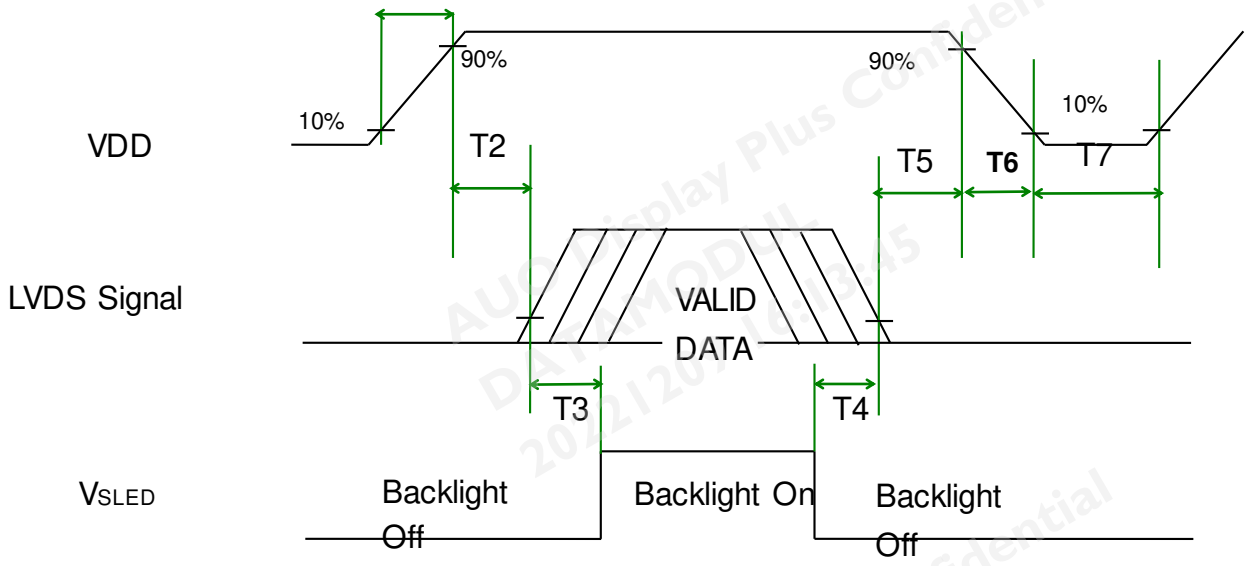
Symbol	Description	Min	Max	Unit	Remark
F_{DEV}	Maximum deviation of input clock frequency during Spread Spectrum	-	± 3	%	
F_{MOD}	Maximum modulation frequency of input clock during Spread Spectrum	-	200	KHz	



< Spread Spectrum>

4.5. Power Sequence

VDD power,LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.



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 1 Note 1
T6	0	-	200	[ms]	Note 2 Note 3
T7	1000	-	-	[ms]	

Note 1 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.
Note 2: During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.
Note 3: 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 21.5 inch Backlight Unit. And it includes 60 pcs LED in the LED light bar. (4 strings and 15 pcs LED of one string).

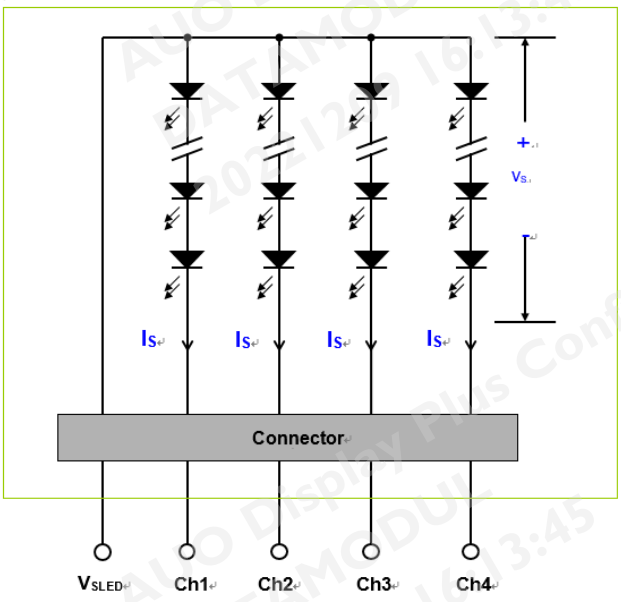
Parameter		Symbol	Values			Unit	Note
			Min	Typ	Max		
Forward Current (one light bar)	Anode	IF (anode)		260		mA	
	Cathode	IF (cathode)		65		mA	
Peak Forward Current		IFP			800	mA	<1msec.
Forward Voltage		VF		42.8	49.8	V	1
Maximum ΔVs Voltage Deviation of light bar		Δ Vs			3	V	6
Total Power Consumption (4 light bars)		PBL		11.4	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.
Note4: The lifetime is defined as the time which luminance of LED is 50% compared to its original value. [Operating condition: Continuous operating at Ta = 25±2°C]

Note 5: MTTF is a reference index, it is not representative of warranty.

Note 6: ΔVs (Max.) = ΔVF XLED No. (one string);

ΔVF: LED chip forward voltage deviation; (0.2 V , each Bin of LED VF)



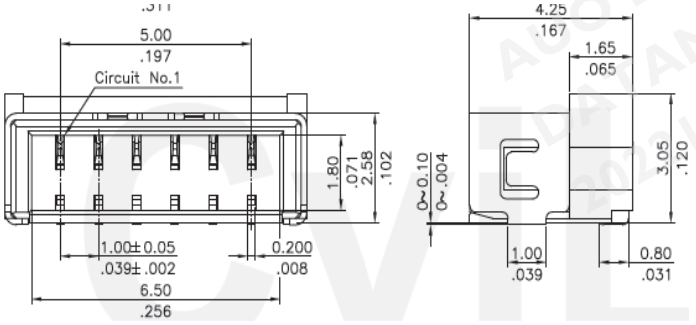
5.1. Interface Connection

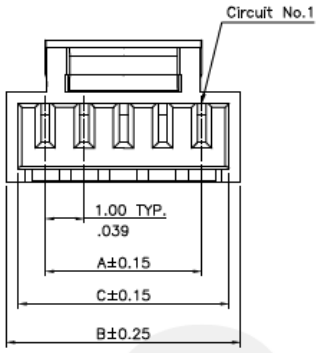
5.1.1. Connector Type:

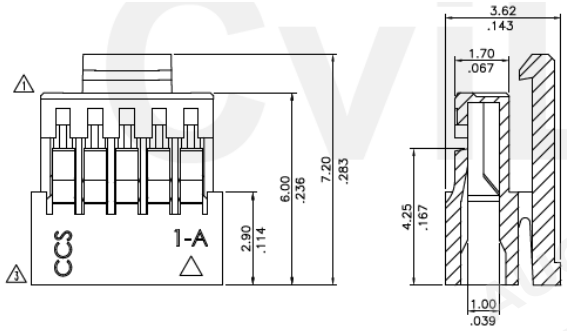
Backlight Connector	Manufacturer	CviLux
	Part Number	CI1406M1HRN-NH1
Mating Connector	Manufacturer	CviLux
	Part Number	CI1406SL000-NH (Lock type)

Backlight Connector dimension:

$H \times V \times D = \text{HxVxD} = 7.9\text{x}3.05\text{x}4.25, \text{Pitch} = 1.0(unit = mm)$

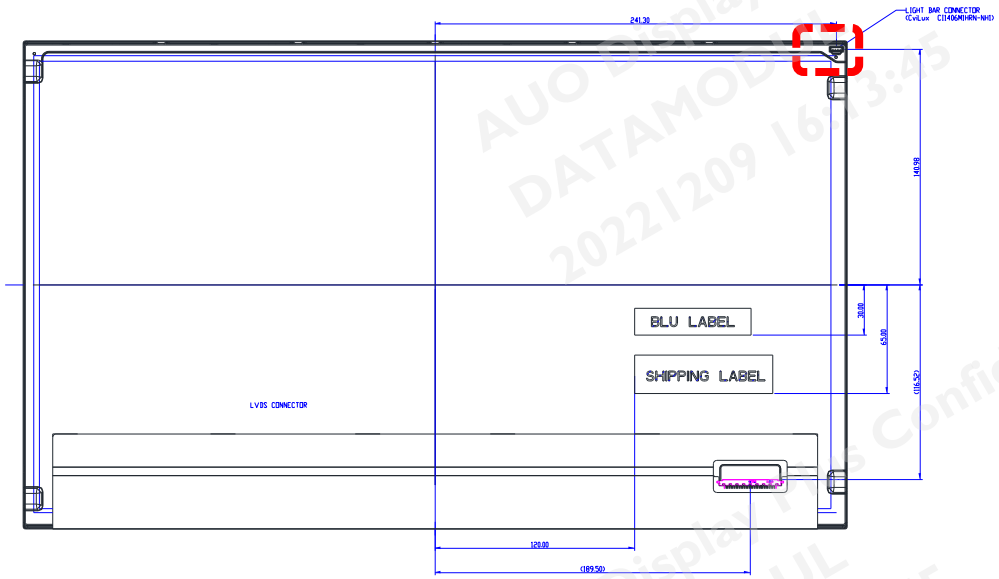


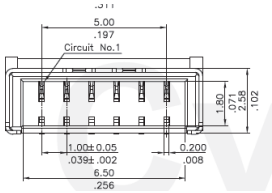




5.1.2. Connector Pin Assignment

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)	



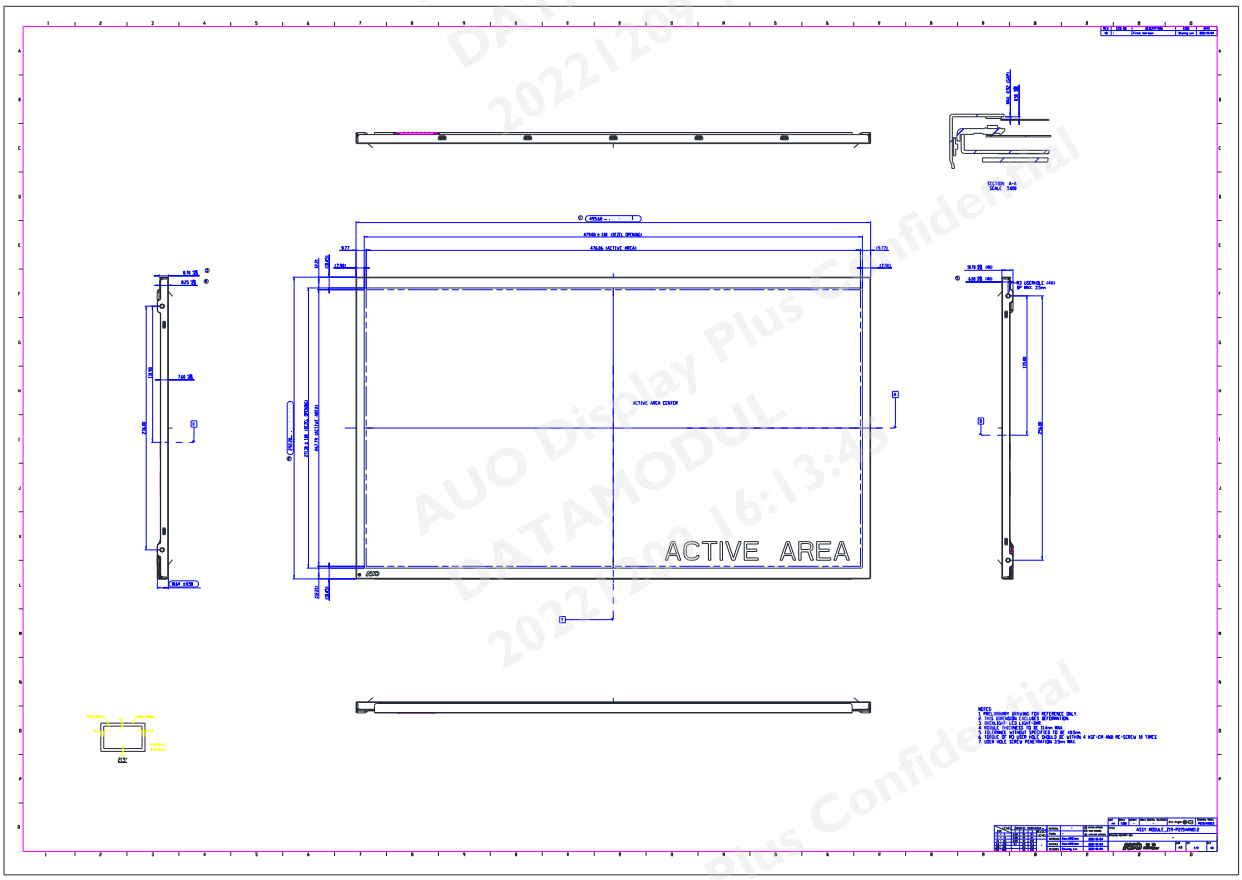


6. Mechanical Characteristics

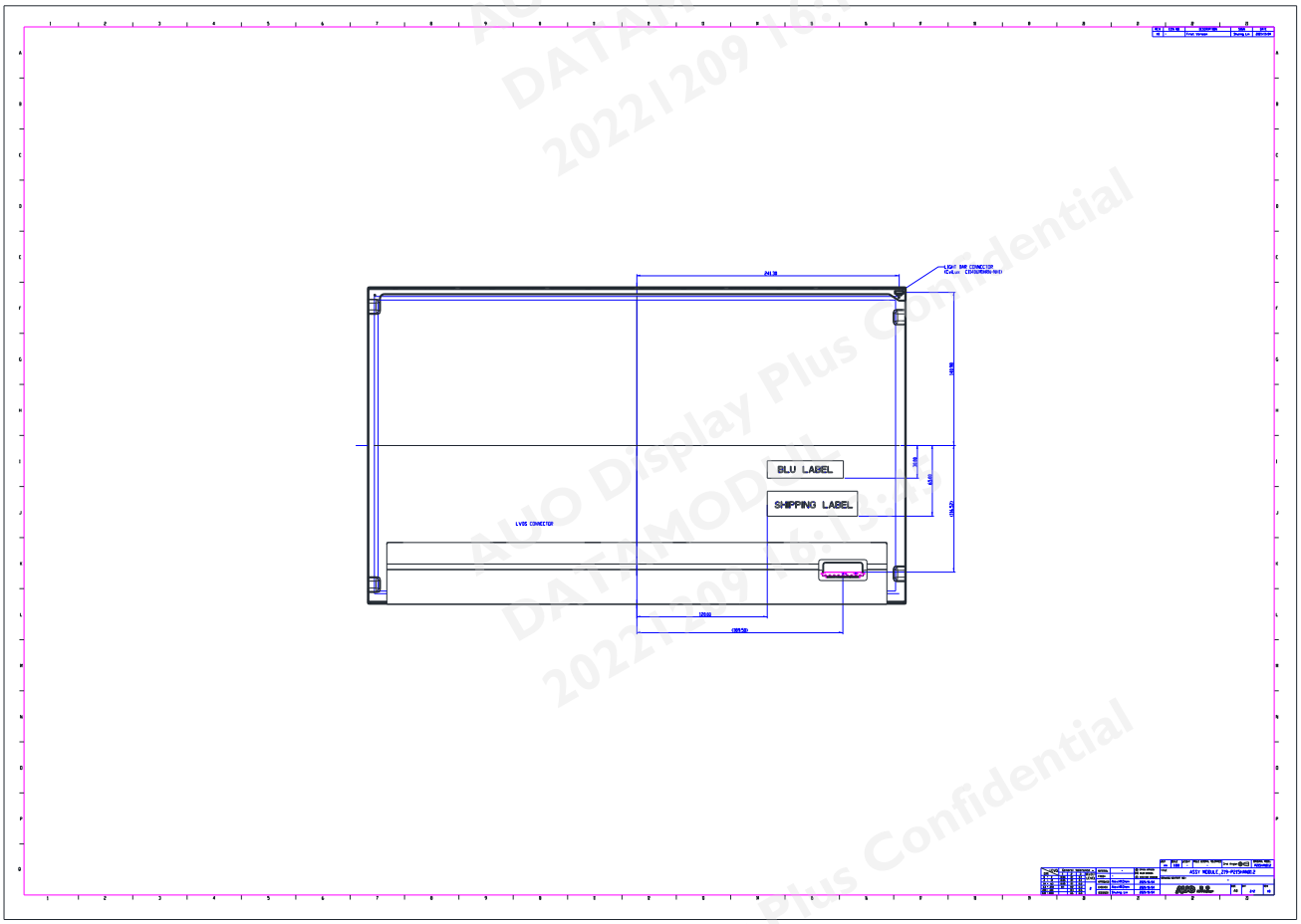
The contents provide general mechanical characteristics for the model P215HAN01.2. In addition, the figures in the next page are detailed mechanical drawing of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	495.6	mm	
	Vertical	292.2	mm	
	Depth (Dmin)	7.6	mm	Front bezel to Back Bezel
	Depth (Dmax)	10.7	mm	
	Bezel opening	479.8(H) x 271.3(V)	mm	
	Bezel Width	10.45/10.45/7.9/7.9	mm	U/D/L/R
	Display Area	476.06 (H) x 267.79(V)	mm	
Weight	1.8		Kg	

Front view



Back View



7. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60℃, 500hrs
2	Low temperature storage test	3	-20℃, 500hrs
3	High temperature operation test	3	50℃, 500hrs
4	High temperature and High humidity operation (THB)	3	50℃ 80%, 500hrs
5	Low temperature operation test	3	0℃, 500hrs
6	Vibration test (With carton)	1(PKG)	Random wave (1.04Grms 2~200Hz) Duration : X, Y, Z 30min per axes
7	Drop test (With carton)	1(PKG)	Height: 45.7 cm Direction: 1corner 3edges 6flats (ASTM D 4169 & D 5276)

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) 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 Electro technical Standardization. (CENELEC), 1998

9. Packing

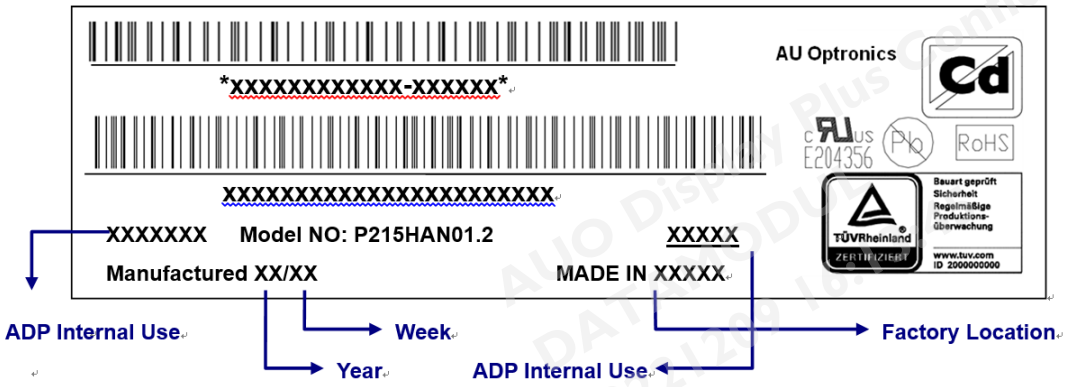
9.1. DEFINITION OF LABEL:

A. Panel Label:

XXXXXXXXXXXX-XXXX

Panel Unique ID

AUO Internal Use



Green mark description

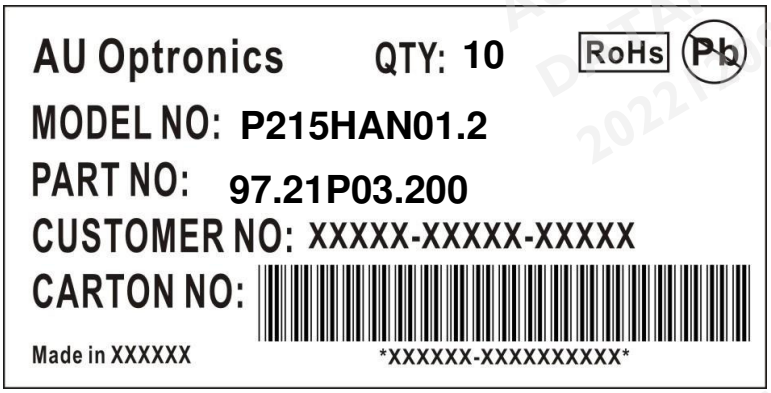
P215HAN01.2

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

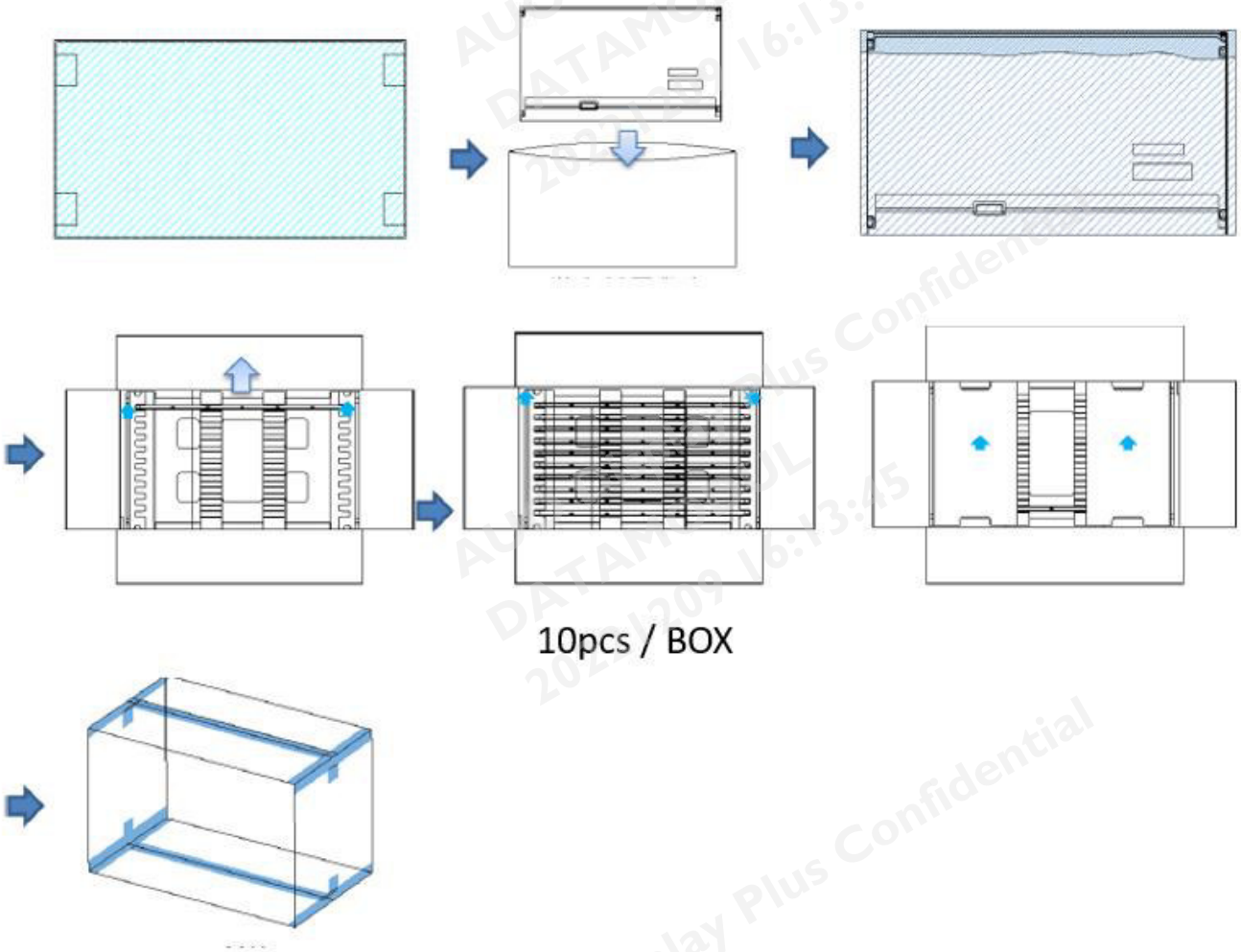
(2) For RoHs compatible products, AUO will add RoHS for identification.

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:

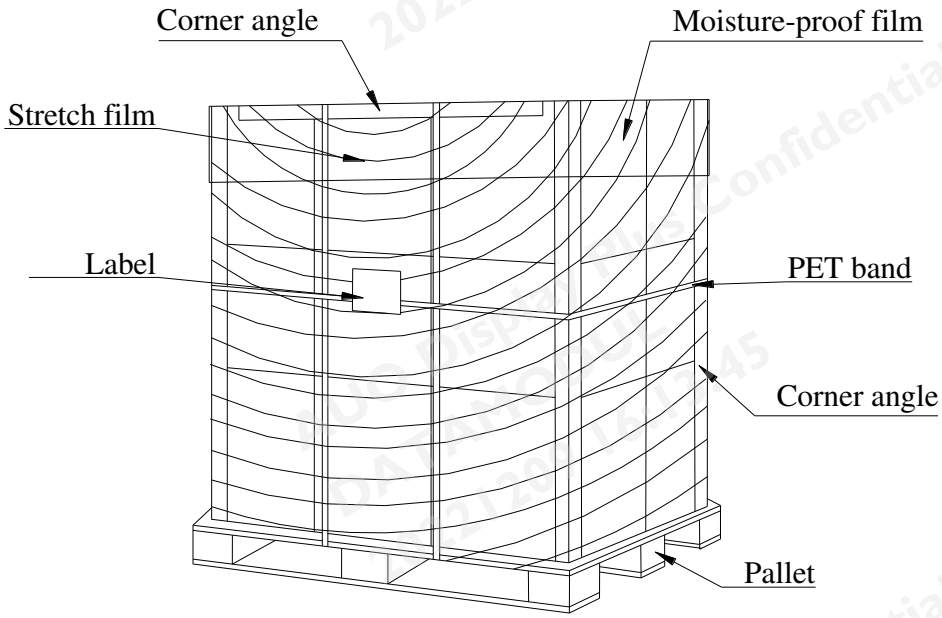


9.2. PACKING METHODS:



Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing Box	10pcs/box	565mm*345mm*375mm	19.4	With panel &Box & Cushion
2	Pallet	1	1150mm*1070mm*132mm	15.9	
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	349.2	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 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.

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=±200mV(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: 20 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.

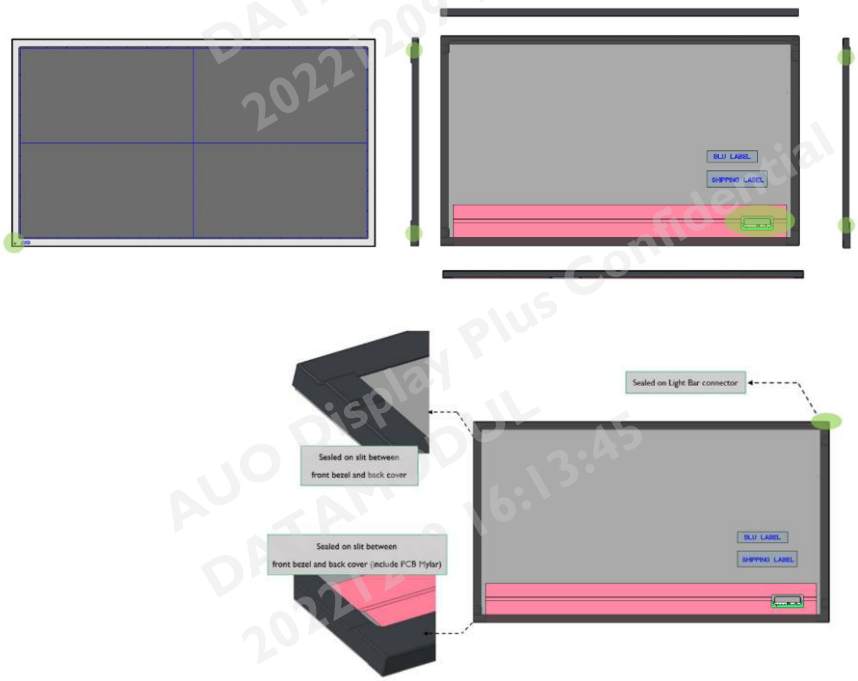
10.8. Dust Resistance

(1) ADP 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) ADP'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



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