Product Specification

AU OPTRONICS CORPORATION

( ) Preliminary Specifications
(V) Final Specifications

Module	15 Inch Color TFT-LCD
Model Name	G150XTN06.C

Customer	Date	Approved by	Date
		Derek Hsu	2022. 1. 23
Checked & Approved by	**Date**	**Prepared by**	**Date**
		Ginger Lin	2022. 1. 23

Note: This Specification is subject to change without notice.

General Display Business Unit / AU Optronics corporation

Contents

Record of Revision

Version and Date	Page	Old description	New Description
1.0 2020/01/10	All	Final Edition	
1.1 2020/02/26	P5	Modify Support Color typo	Correct Support Color :16.7M
		Modify : Surface Treatment，Add surface Hardness Rating	Surface Treatment,3H
		Modify Temperature Range typo Operating: -30 to +70 Storage (Non-Operating) -30 to +70	Correct Temperature Range Operating: -30 to +70 Storage (Non-Operating) : -30 to +80
	P25	add ax capacity per carton	ax capacity per carton : 20 pcs/Carton
2.0 2021/02/03	P26	Module by air: (2*3)*3 layers, one pallet put 20 boxes, total 360pcs module Module by sea: One pallet (2*3)*3 layers+ One pallet (2*3)*3 layers, total 720pcs module	Module by air: (2*3)*4 layers, one pallet put 20 boxes, total 480pcs module Module by sea: One pallet (2*3)*3 layers+ One pallet (2*3)*2 layers, total 600pcs module
3.0 2022/1/23	P13	5.2.1 Parameter guideline for LED 	Symbol	Parameter	Min	Typ	Max	Units	Remark
---	---	---	---	---	---	---
Fᴘᴡᴍ	PWM Dimming Frequency	200		20k	Hz	
	High Voltage	2.5	3.3	5.5	Volt	
	Low Voltage			0.7	Volt	
	Dimming Duty Cycle	5		100	%			5.2.1 Parameter guideline for LED | Symbol	Parameter	Min	Typ	Max	Units	Remark
---	---	---	---	---	---	---
Fᴘᴡᴍ	PWM Dimming Frequency	200		20k	Hz	
	High Voltage	2.5	3.3	5.5	Volt	
	Low Voltage			0.7	Volt	
	Dimming Duty Cycle, 200Hz~5KHz	5	-	100	%	
	Dimming Duty Cycle, 5KHz~20KHz	15	-	100	%		 *Updated PWM diming vs. frequency spec due to EC to new LED driver IC.

1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious and not to scratch it.

2) Be sure to turn off power supply when inserting or disconnecting from input connector.

3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.

5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.

6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.

7) Do not open nor modify the module assembly.

8) Do not press the reflector sheet at the back of the module to any direction.

9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED Reflector edge softly. Otherwise the TFT Module may be damaged.

10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.

12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950-1 or UL60950-1), or be applied exemption.

13) Severe temperature condition may result in different luminance, response time.

14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.

15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.

16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.

Product Specification

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2. General Description

G150XTN06.C is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display, a driver circuit, and a backlight system. The screen format is intended to support XGA (1024(H)x768(V)) screen and 16.7M colors. All input signals are eDP interface compatible. All design rules of this module can correspond to PSWG standard.

G150XTN06.C is designed for industrial display applications.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25℃ condition:

Items	Unit	Specifications
Screen Diagonal	[inch]	15
Active Area	[mm]	304.128(H) x 228.096(V)
Pixels H x V		1024x3(RGB) x 768
Pixel Pitch	[mm]	0.297 x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	12.23W
Weight	[Grams]	1000g (max.)
Physical Size	[mm]	326.5(H)x 253.5(V) x 10.0(D) (max.)
Electrical Interface		1 Lane eDP1.2
Surface Treatment		Anti-Reflection,3H
Support Color		16.7M

Temperature Range
    Operating
    Storage (Non-Operating)
	[℃]
	[℃]
		-30 to +70
		-30 to +80

RoHS Compliance		RoHS Compliance
Light Bar Unit		LED, non-replaceable

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2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

| Item	Unit	Conditions		Min.	Typ.	Max.	Note
White Luminance	[cd/m2]			640	800	-	1
Uniformity	%	9 Points		75	80	-	1, 2, 3
Contrast Ratio				400	800	-	4
Cross talk	%			-	1.2	1.5	5
Response Time	[msec]	Rising		-	5.7		6
	[msec]	Falling		-	2.3		
	[msec]	Raising + Falling		-	8		
Viewing Angle	[degree]	Horizontal	(Right)	70	80	-	7
	[degree]	CR = 10	(Left)	70	80	-	
	[degree]	Vertical	(Upper)	60	70	-	
	[degree]	CR = 10	(Lower)	70	80	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x		0.547	0.597	0.647	
		Red y		0.289	0.339	0.389	
		Green x		0.279	0.329	0.379	
		Green y		0.546	0.596	0.646	
		Blue x		0.104	0.154	0.204	
		Blue y		0.003	0.053	0.103	
		White x		0.263	0.313	0.363	
		White y		0.279	0.329	0.379	
Color Gamut	%				60	-	

Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

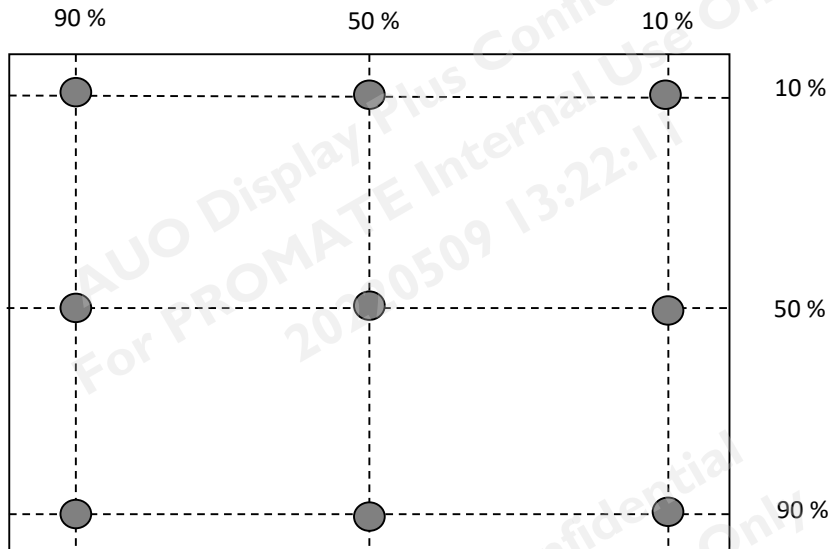　　　Aperture　　　1∘with 50cm viewing distance

　　　Test Point　　　Center

　　　Environment　　　*< 1 lux*

LCD Module

SR_3 or equivalent

Measuring distance

Module Driving Equipment
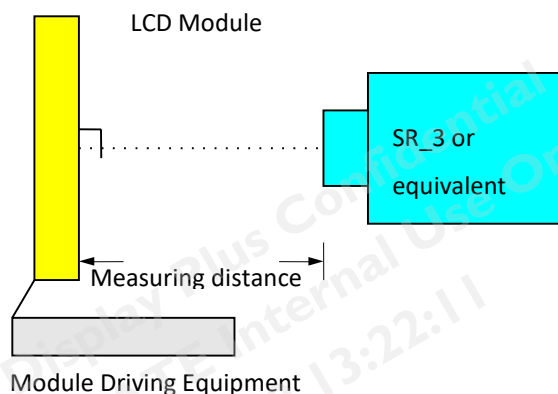
Note 2: Definition of 9 points position (Display active area : 304.128(H) x 228.096(V))

Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

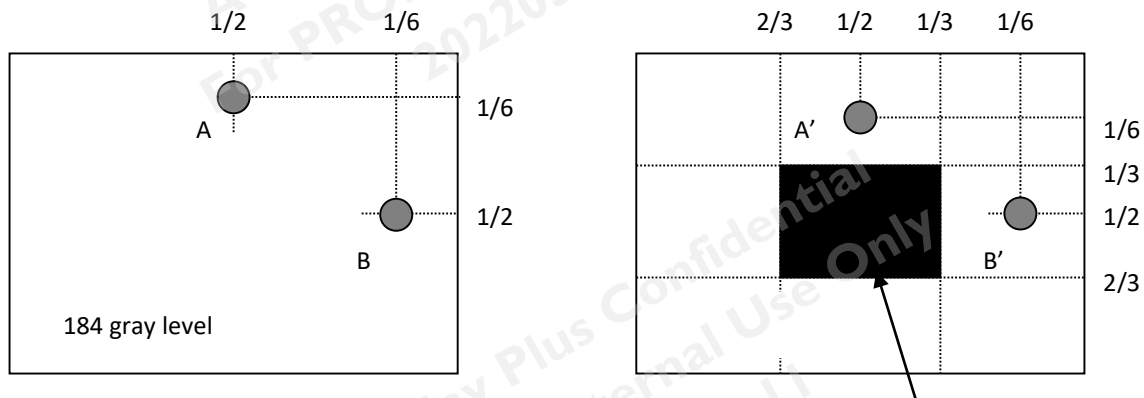$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 5： Definition of cross talk (CT)

$$CT = |\, YB - YA \,| / YA \times 100 \ (\%)$$

Where

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

YB = Luminance of measured location with gray level 0 pattern (cd/m2)

Ver. 3.0

7

Note 6: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.
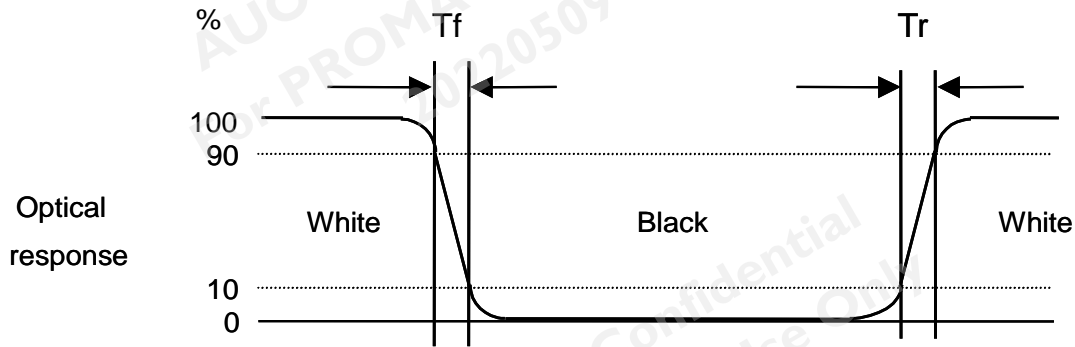

Note 7: Definition of viewing angle

Viewing angle is the measurement of contrast ratio $\geq$10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.

3. Functional Block Diagram

The following diagram shows the functional block of the 15 inch color TFT/LCD module:

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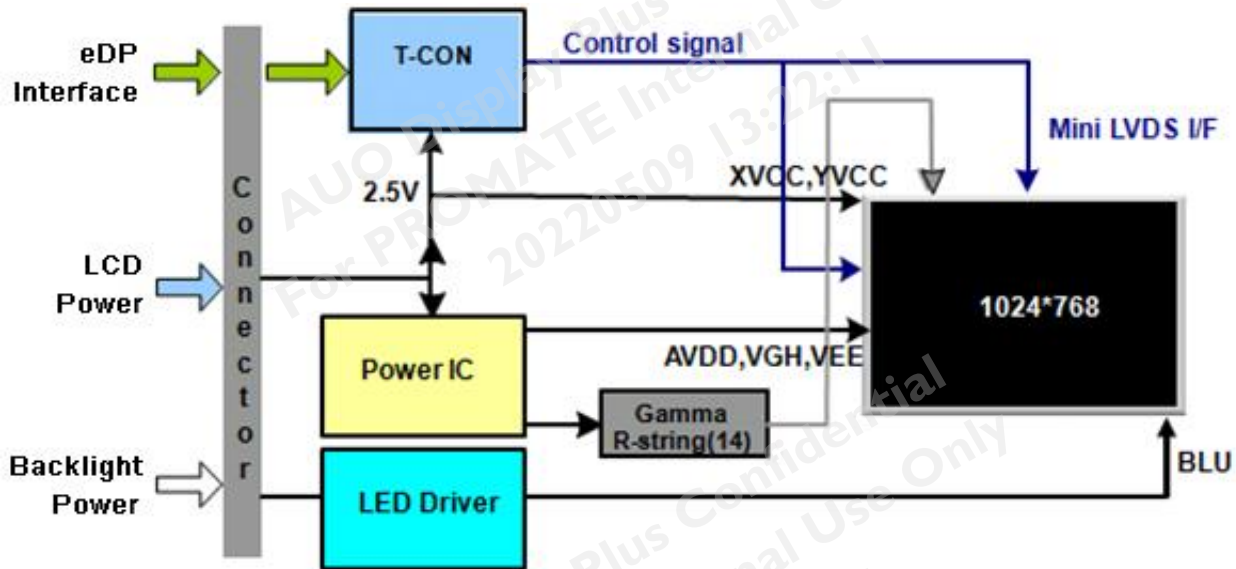
4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	VDD	-0.3	+3.6	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+70	[℃]
Operation Humidity	HOP	8	90	[%RH]
Storage Temperature	TST	-30	+80	[℃]
Storage Humidity	HST	8	90	[%RH]

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

Product Specification

AU OPTRONICS CORPORATION
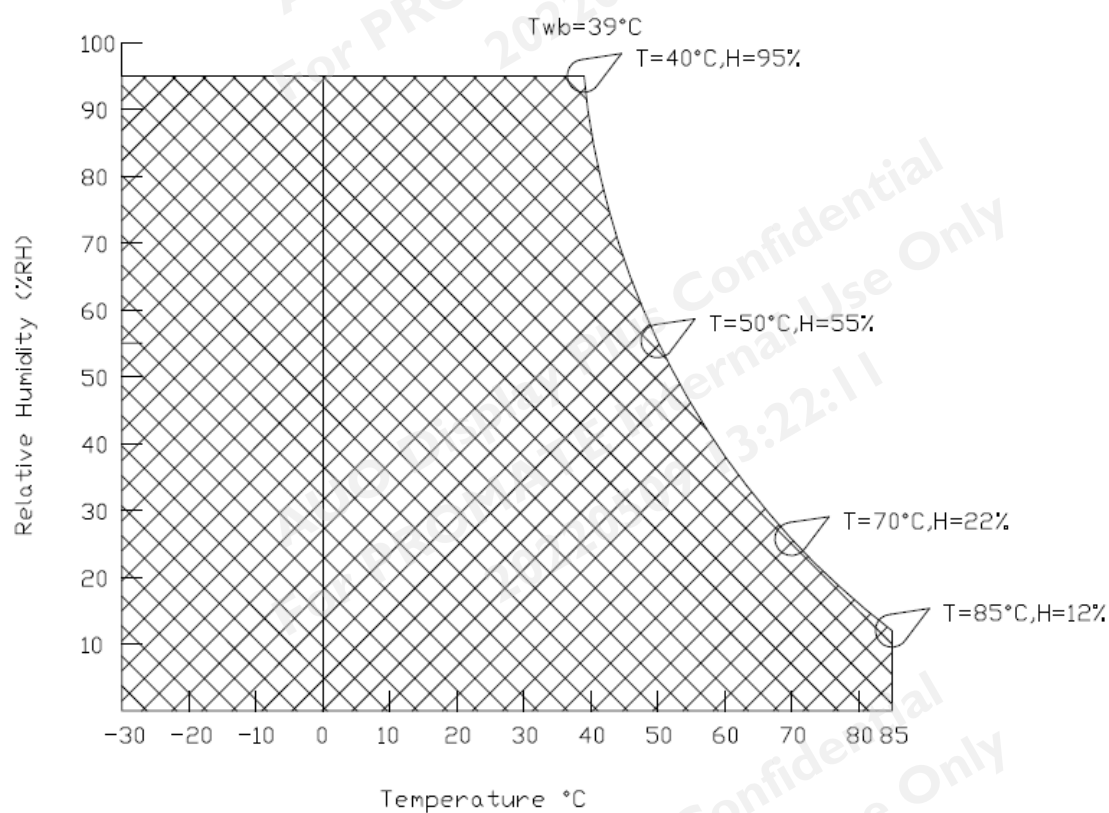
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.1	3.3	3.6	[Volt]	±10%
IDD	VDD Current	-	1	1.2	[A]	Black pattern VDD=Typ.3.3 V, at 60Hz)
Irush	LCD Inrush Current	-	-	2	[A]	Note 1
PDD	VDD Power	-	3.3	3.96	[Watt]	Black pattern VDD=Typ.3.3 V, at 60Hz)

Note 1: Measurement condition:

VDD rising time
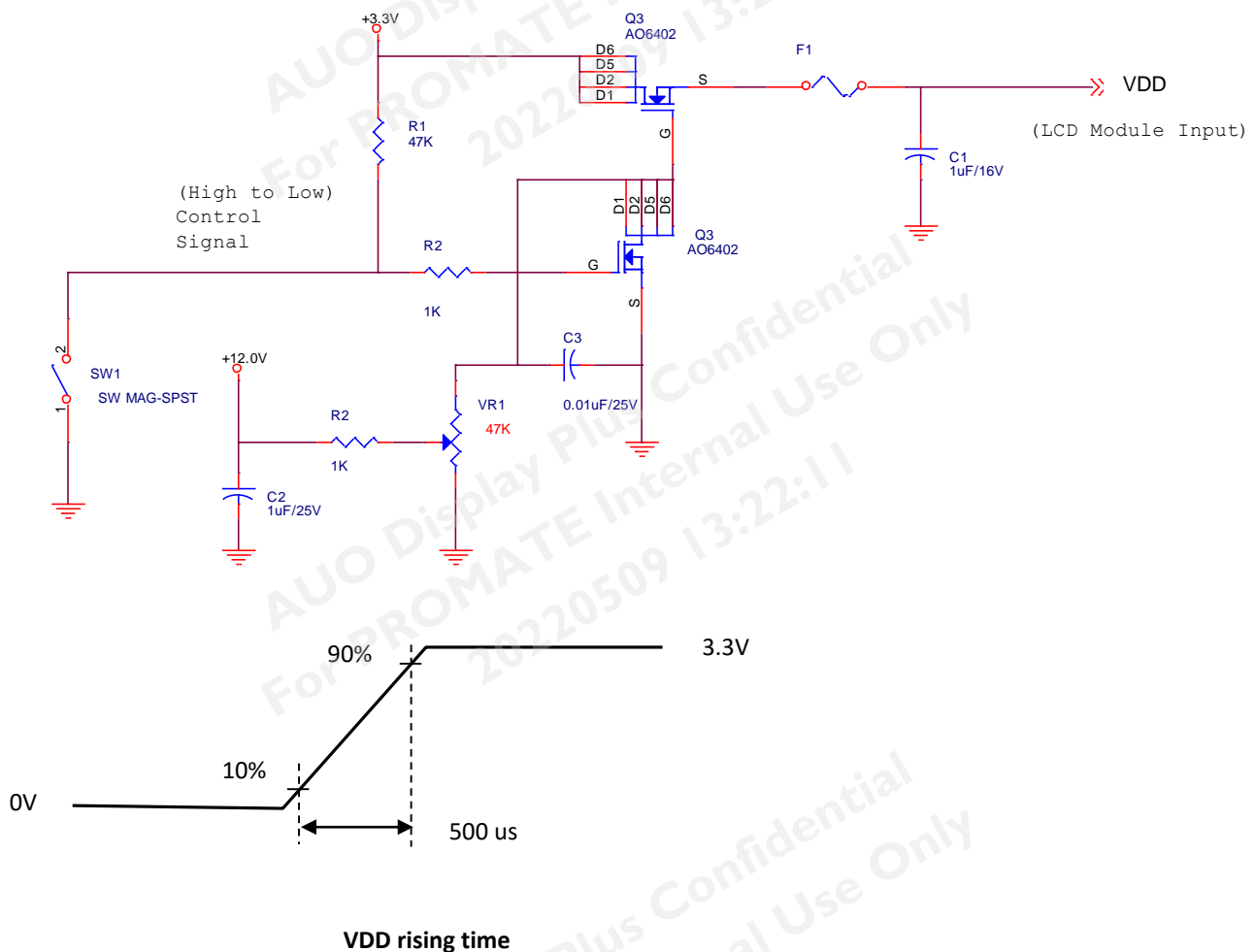
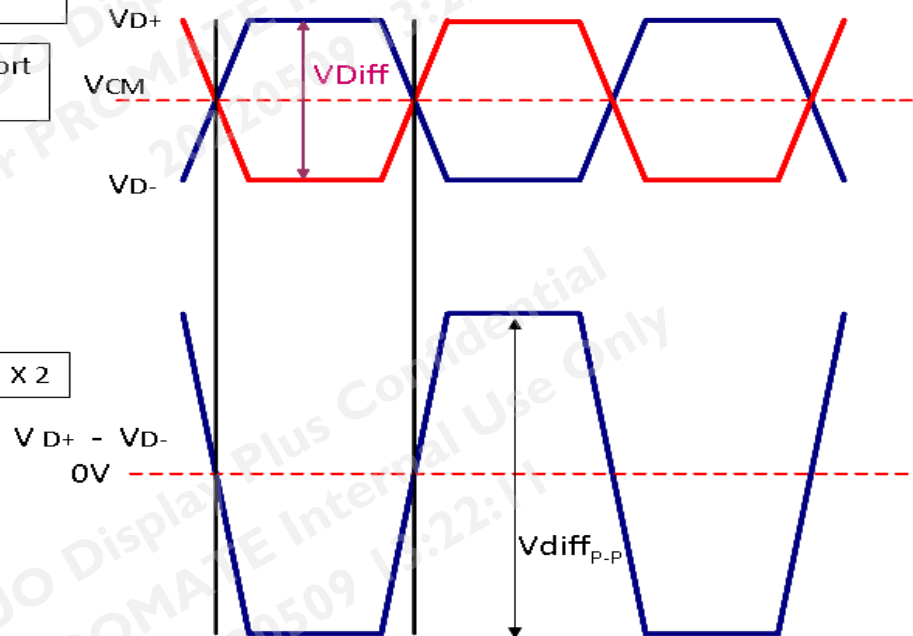## 5.1.2 Signal Electrical Characteristics

Signal electrical characteristics are as follows:

Display Port main link signal:

Differential pair VD+ , VD-
Which is one Display port Main link

VCM of Display port Main link

VD+
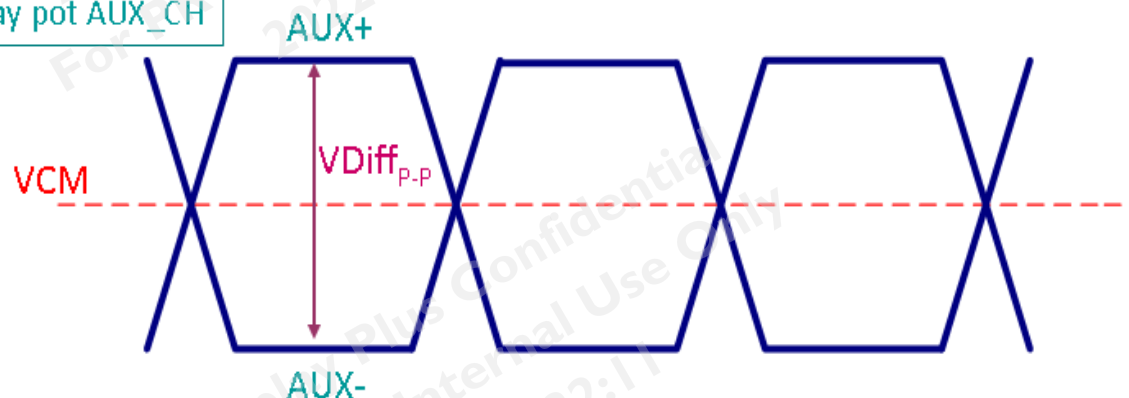
VCM

VD-

VDiff

$$Vdiff_{P-P} = [(VD+) - (VD-)] \times 2$$

V D+ - VD-

0V

Vdiff$_{P-P}$

Display port main link		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage		0		V
VDiff$_{P-P}$	Peak-to-peak Voltage at a receiving Device	150		1320	mV

Follow as VESA display port standard V1.1a

Display Port AUX_CH signal:

Differential AUX+ , AUX-
Which is Display pot AUX_CH

AUX+

VCM

VDiff$_{P-P}$

AUX-

Display port AUX_CH					
		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage		0		V
VDiff$_{P-P}$	AUX Peak-to-peak Voltage at a receiving Device	0.4	0.6-	0.8	V

Follow as VESA display port standard V1.1a.

Display Port VHPD signal:

Display port VHPD					
		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25	-	2.75	V

Follow as VESA display port standard V1.1a.

5.2 Backlight Unit

5.2.1 Parameter guideline for LED

Following characteristics are measured under stable condition using a LED driving board at 25℃ (Room Temperature).

Symbol	Parameter	Min	Typ	Max	Units	Remark
VLED	Input Voltage	10.8	12	13.2	Volt	
I$_{VLED}$	Input Current	-	0.74	0.82	A	100% Dimming
P$_{LED}$	Power Consumption	-	8.93	9.79	Watt	100% Dimming
Irush	Inrush Current			3	A	
V$_{LED on/off}$	On Control Voltage	2.5	3.3	5.5	Volt	
	Off Control Voltage			0.7	Volt	
F$_{PWM}$	PWM Dimming Frequency	200		20k	Hz	
	High Voltage	2.5	3.3	5.5	Volt	
	Low Voltage			0.7	Volt	
	Dimming Duty Cycle, 200Hz~5KHz	5	-	100	%	
	Dimming Duty Cycle, 5KHz~20KHz	15	-	100	%	
I$_F$	LED Forward Current		36		mA	Ta = 25ºC
LED Life		50,000			Hrs	Ta = 25ºC

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: If G150XTN06.C module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: LED life means brightness goes down to 50% initial brightness. Min. operating life time is estimated data.

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.
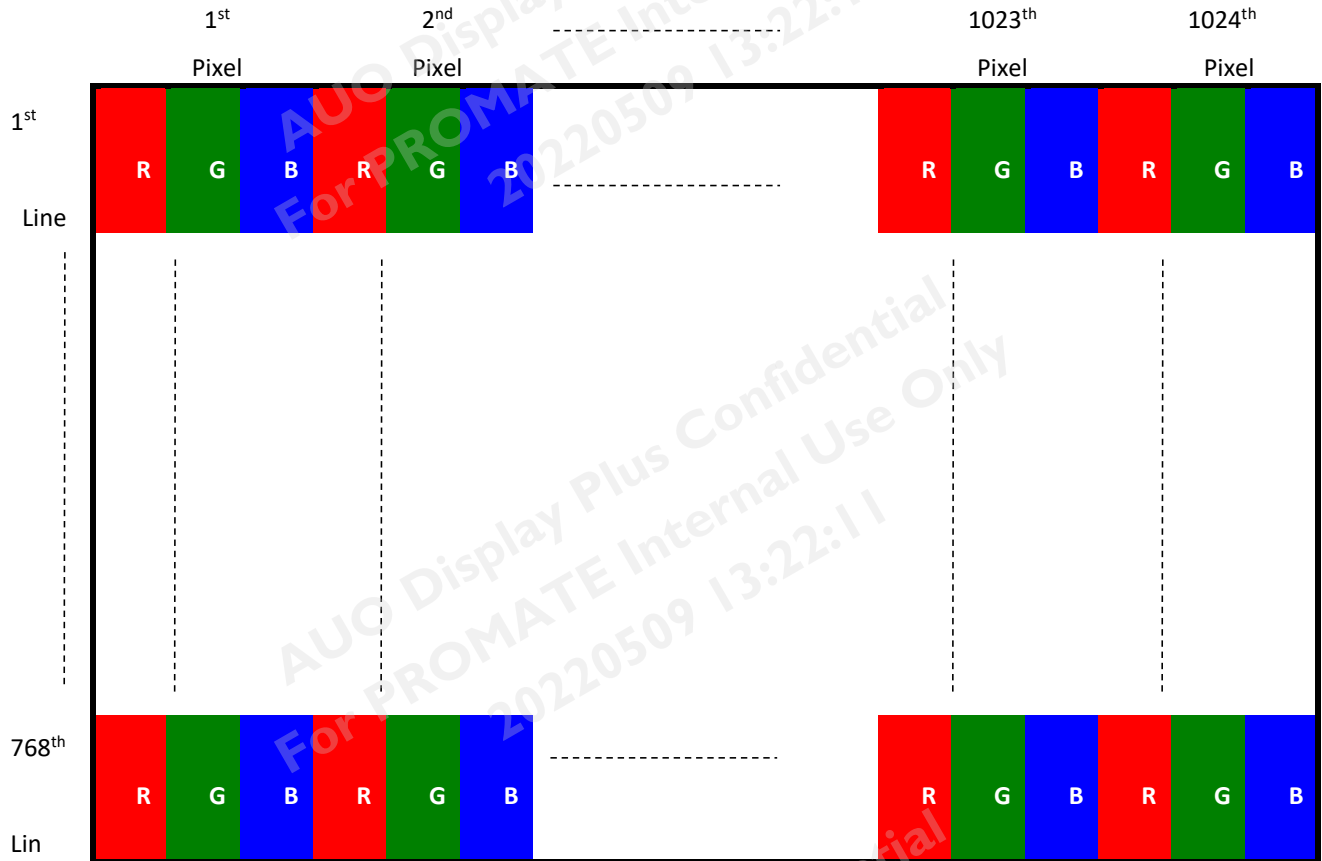
6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

6.3 Signal Description

6.3.1 Timing Characteristics

Basically, interface timings should match the 1024x768 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-		60	-	Hz
Clock frequency		1/ T_{Clock}	50	65	81	MHz
Vertical Section	Period	T_V	783	806	968	T_{Line}
	Active	T_{VD}		768		
	Blanking	T_{VB}	15	38	200	
Horizontal Section	Period	T_H	1224	1344	1720	T_{Clock}
	Active	T_{HD}		1024		
	Blanking	T_{HB}	200	320	696	

Note 1 : DE mode only

Note 2 : The maximum clock frequency = T_V*T_H*60 < 81MHz
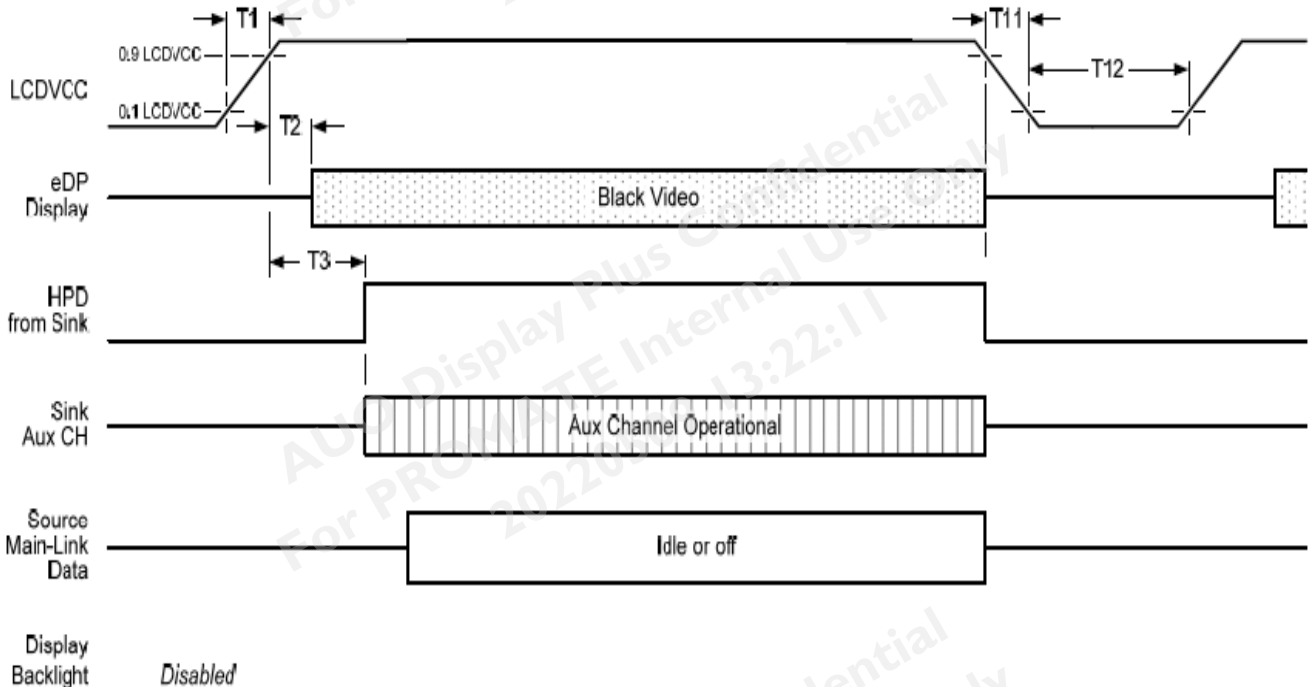
Ver. 3.0

15

6.4 Power ON/OFF Sequence

Display Port panel power sequence:
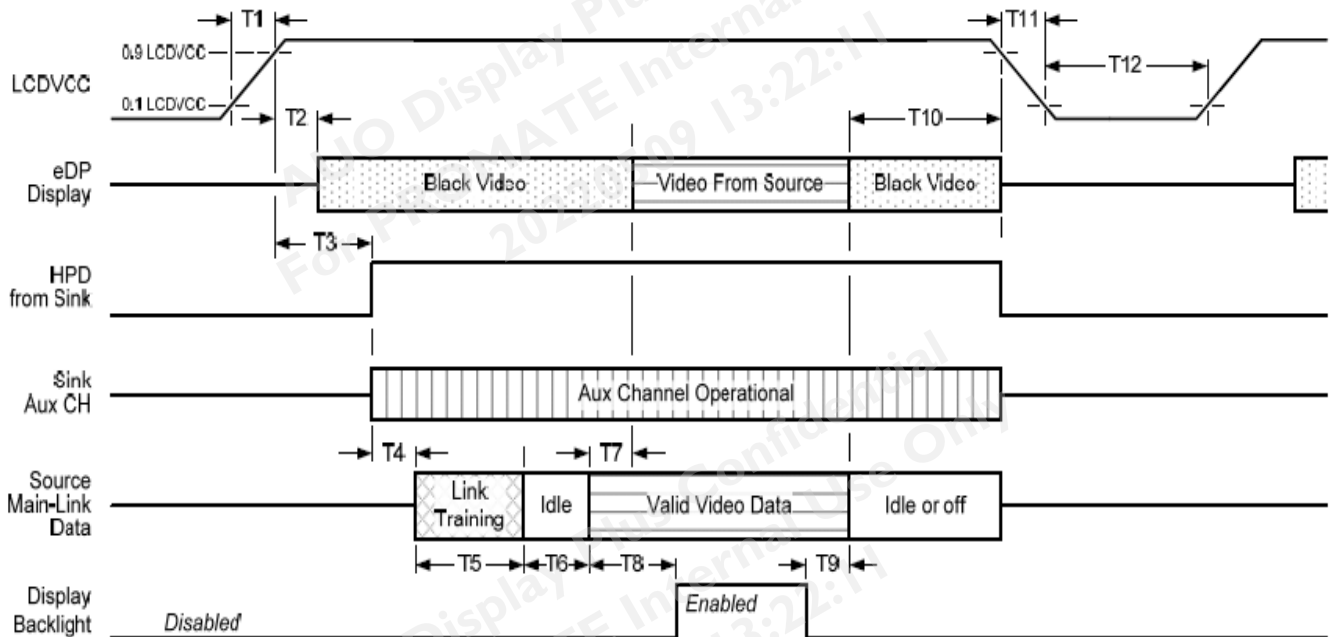
Display port interface power up/down sequence, normal system operation

Display Port AUX_CH transaction only:

Display port interface power up/down sequence, AUX_CH transaction only

Display Port panel power sequence timing parameter:

| Timing parameter	Description	Reqd. by	Limits Min.	Limits Typ.	Limits Max.	Notes
T1	power rail rise time, 10% to 90%	source	0.5ms		10ms	
T2	delay from LCDVDD to black video generation	sink	0ms		200ms	prevents display noise until valid video data is received from the source
T3	delay from LCDVDD to HPD high	sink	0ms		200ms	sink AUX_CH must be operational upon HPD high.
T4	delay from HPD high to link training initialization	source				allows for source to read link capability and initialize.
T5	link training duration	source				dependant on source link to read training protocol.
T6	link idle	source				Min accounts for required BS-Idle pattern. Max allows for source frame synchronization.
T7	delay from valid video data from source to video on display	sink	0ms		50ms	max allows sink validate video data and timing.
T8	delay from valid video data from source to backlight enable	source				source must assure display video is stable.
T9	delay from backlight disable to end of valid video data	source				source must assure backlight is no longer illuminated.
T10	delay from end of valid video data from source to power off	source	0ms		500ms	
T11	power rail fall time, 905 to 10%	source			10ms	
T12	power off time	source	500ms			

Note1: The sink must include the ability to generate black video autonomously. The sink must automatically enable black video under the following conditions:
  -upon LCDVDD power on (with in T2 max)-when the "Novideostream_Flag" (VB-ID Bit 3) is received from the source (at the end of T9).
  -when no main link data, or invalid video data, is received from the source. Black video must be displayed within 64ms (typ) from the start of either condition. Video data can be deemed invalid based on MSA and timing information, for example.

Note 2: The sink may implement the ability to disable the black video function, as described in Note 1, above, for system development and debugging purpose.

Note 3: The sink must support AUX_CH polling by the source immediately following LCDVDD power on without causing damage to the sink device (the source can re-try if the sink is not ready). The sink must be able to respond to an AUX_CH transaction with the time specified within T3 max.

Display Port panel B/L power sequence timing parameter:
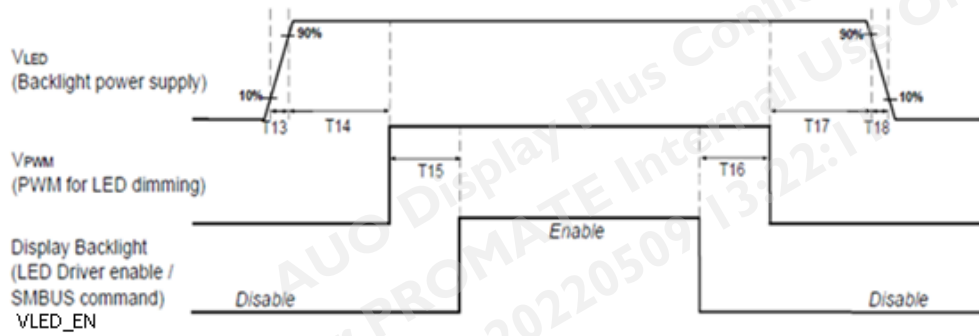
Note : When the adapter is hot plugged, the backlight power supply sequence is shown as below.
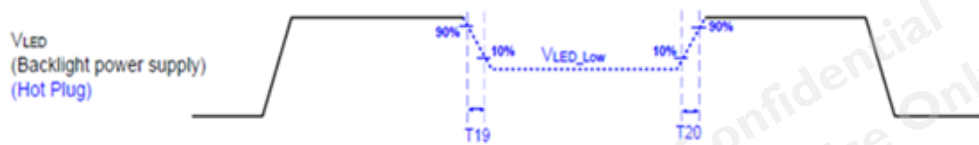
	Min (ms)	Max (ms)
T13	0.5	10
T14	10	-
T15	10	-
T16	10	-
T17	10	-
T18	0.5	10
T19	1*	-
T20	1*	-

Seamless change: $T19/T20 = 5 \times T_{PWM}*$

$*T_{PWM} = 1/\text{PWM Frequency}$

7. Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 Connector Description

Connector Name / Designation	For Signal Connector
Manufacturer	IPEX or Compatible
Type / Part Number	IPEX 20765-030E-11A or Compatible
Mating Housing/Part Number	IPEX 20453-030T-11 or Compatible

7.1.1 Connector Illustration
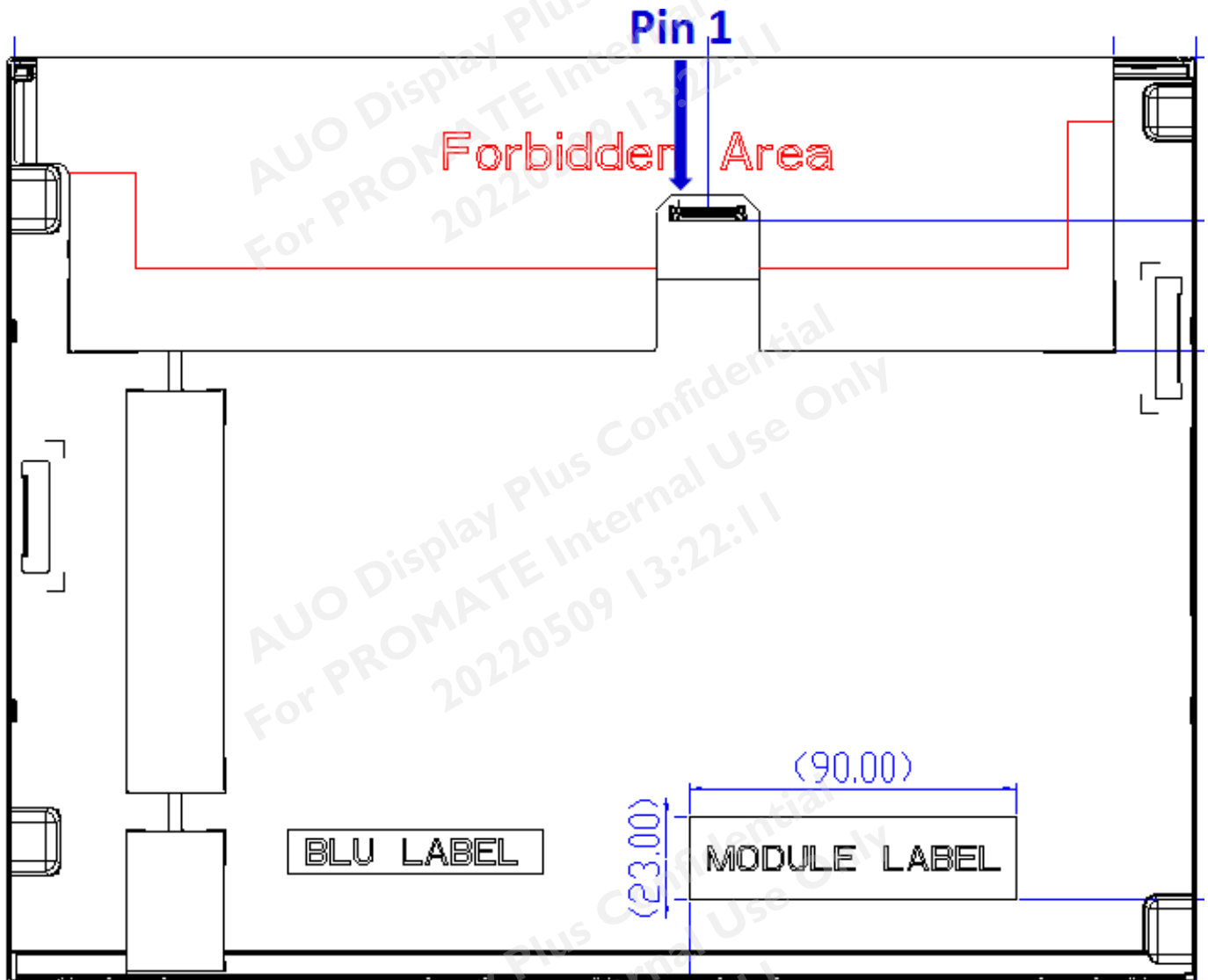
7.2 Pin Assignment (1 Lane)

eDP lane is a differential signal technology for LCD interface and high speed data transfer device.

PIN NO	Symbol	Function
1	NC	No Connect
2	VLED	Backlight power (10.8V~13.2V)
3	VLED	Backlight power (10.8V~13.2V)
4	VLED	Backlight power (10.8V~13.2V)
5	VLED	Backlight power (10.8V~13.2V)
6	NC	No connect
7	NC	No connect
8	V$_{PWM}$	System PWM signal Input
9	VLED_EN	Backlight On / Off
10	BL_GND	Backlight_ground
11	BL_GND	Backlight_ground
12	BL_GND	Backlight_ground
13	BL_GND	Backlight_ground
14	HPD	HPD signale pin
15	LCD GND	LCD logic and driver ground
16	LCD GND	LCD logic and driver ground
17	NC	No connect
18	VDD	LCD logic and driver power
19	VDD	LCD logic and driver power
20	H_GND	High Speed Ground
21	AUX_CH_N	Comp Signal Auxiliary Ch.
22	AUX_CH_P	True Signal Auxiliary Ch.
23	H_GND	High Speed Ground
24	Lane0_P	True Signal Link Lane 0
25	Lane0_N	Comp Signal Link Lane 0
26	H_GND	High Speed Ground
27	Lane 1_P	NC
28	Lane 1_N	NC
29	H_GND	High Speed Ground
30	NC	No Connect

Ver. 3.0

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	50℃/80%,300 hours	
High Temperature Operation	70℃,300 hours	
Low Temperature Operation	-30℃,300 hours	
Hot Storage	80℃,300 hours	
Cold Storage	-30℃,300 hours	
Thermal Shock Test	-20℃/30 min ,60℃/30 min ,100cycles	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, P-P), 30 mins/axis (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	Note 1
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	

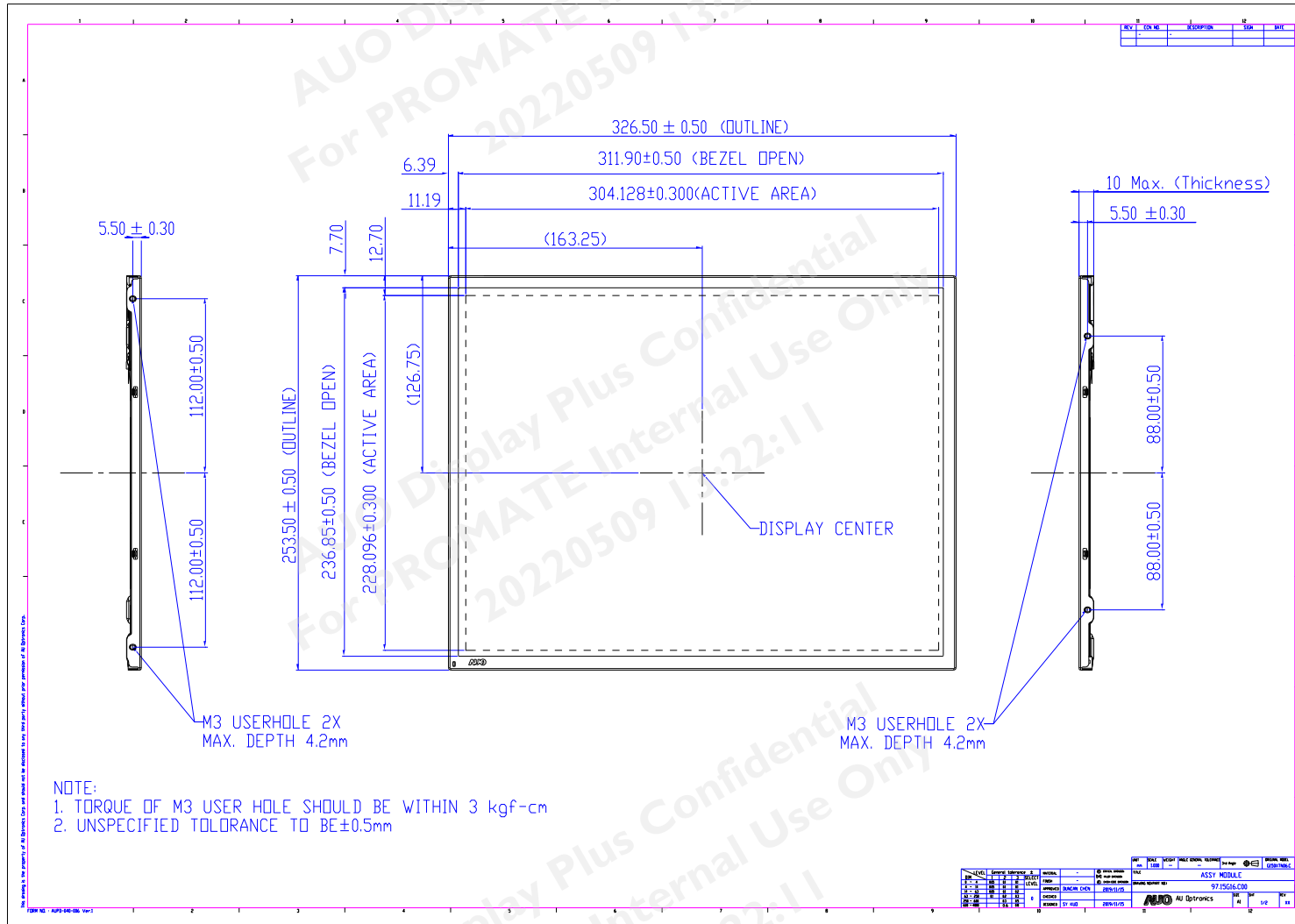Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost

. Self-recoverable. No hardware failures.

Note 2:

● Water condensation is not allowed for each test items.

● Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.

● The reliability test is performed only to examine the TFT-LCD module capability.

● To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

● No function failure occurs. Mura shall be ignored after high temperature reliability test

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9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View and back view)

NOTE:
1. TORQUE OF M3 USER HOLE SHOULD BE WITHIN 3 kgf-cm
2. UNSPECIFIED TOLERANCE TO BE±0.5mm

Ver. 3.0

23

AUO

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(324.58)

134.37 ± 1.00 (CNT)

(22.76)

44.34 ± 1.00 (CNT)

(80.30)

Forbidden Area

(230.75)

(90.00)

(23.00)

BLU LABEL   MODULE LABEL

(139.35)

NOTE:
1. TORQUE OF M3 USER HOLE SHOULD BE WITHIN 3 kgf-cm
2. UNSPECIFIED TOLORANCE TO BE ±0.5mm

ASSY MODULE

97.15G16.C00

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Ver. 3.0

24

10. Label and Packaging

10.1 Shipping Label (on the rear side of TFT-LCD display)

Manufactured XX/XX
Model No : G150XTN06.C
AU Optronics
MADE IN XXXXXX (XXX)

XXXXXXXXXXXX－XXXXXX
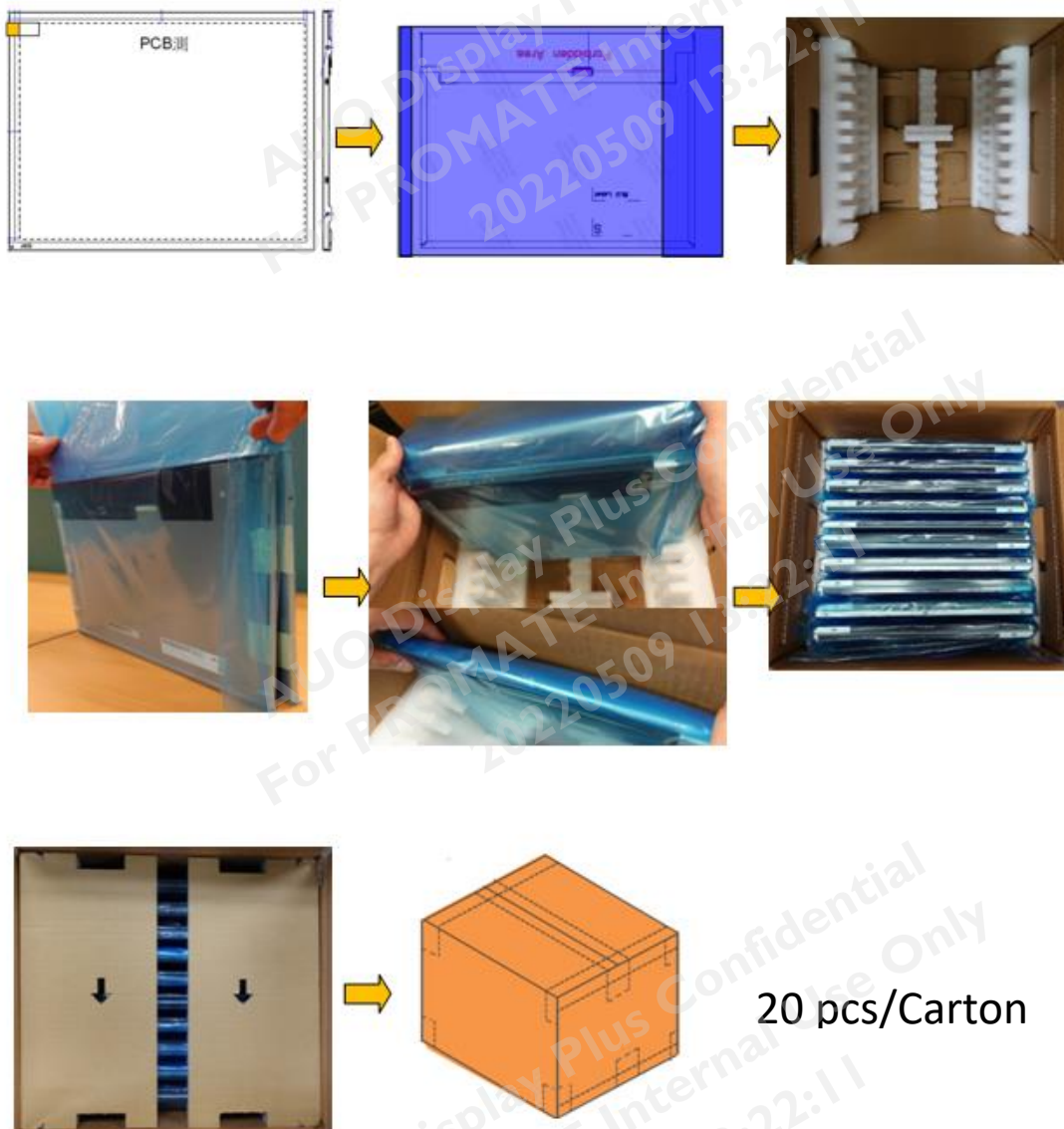
Customer P/N: 009-0036109

23 mm

90 mm
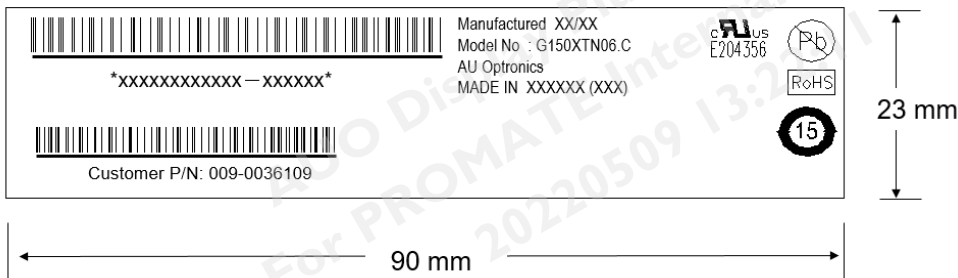
10.2 Carton Package

Max capacity ： 20 TFT-LCD module per carton
Max weight: 21 kg per carton
Outside dimension of carton: 413mm(L)* 380mm(W)*356mm(H)
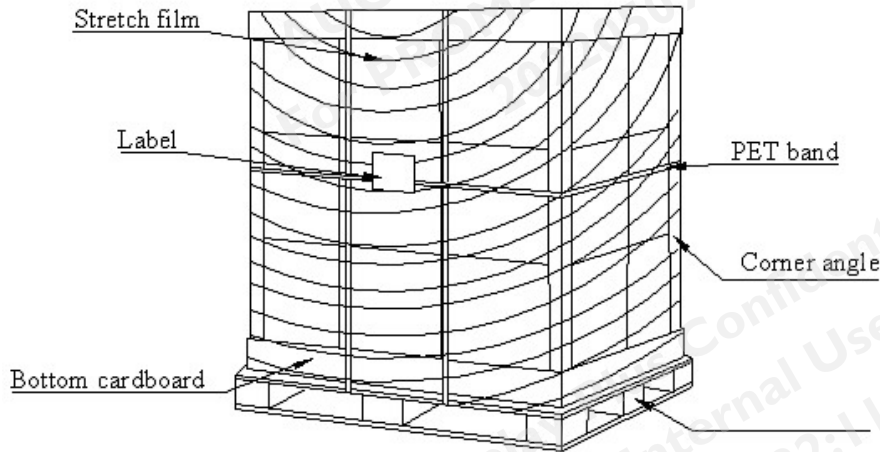Pallet size ： 1150 mm * 840 mm * 132mm

20 pcs/Carton

10.3 Palletizing

Module by air ： (2 *3) *4 layers，one pallet put 20 boxes，total 480pcs module

Module by sea：One pallet (2 *3) *3 layers + One pallet　(2 *3) *2 layers，total 600pcs module

Module by sea_ HQ : One pallet (2 *3) *3 layers + One pallet　(2 *3) *3 layers, total 720pcs module

Stretch film

Label

PET band

Corner angle

Bottom cardboard

11 Safety

11.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

11.2 Materials

11.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

11.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

11.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

11.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

UL 60950-1, Second Edition   U.S.A. Information Technology Equipment