FORTEC GROUP

Datasheet

AUO

G133HAN03.1

UP-02-282

FORTEC UNITED STATES

FORTEC INTEGRATED

FORTEC UNITED KINGDOM

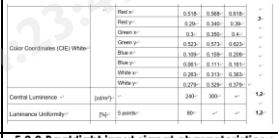
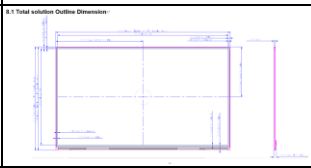
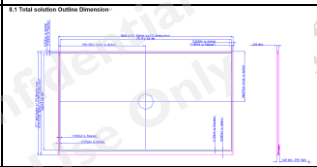
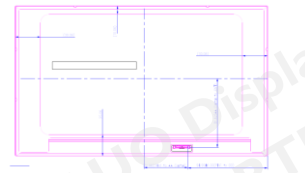
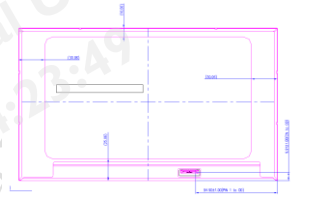
() Preliminary Specifications
(V) Final Specifications

Module	13.3 Inch Color TFT-LCD
Model Name	G133HAN03.1
Note	LED Backlight with driving circuit design

Company		**Approved by**	**Date**
		Ginger Lin	2024/7/19
Checked & Approved by	**Date**	**Prepared by**	
		CH Tsai	2024/7/19
		General Display Business Unit / AUO Display Plus Corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description
0.1 2022/12/15	All	First Preliminary Edition	
1.0	6		
	14	5.2.2 Backlight input signal characteristics Parameter / Symbol / Min / Typ / Max / Units / Remark LED Power Supply / VLED (Note 1) / 5 / 12.0 / 21.0 / [Volt]	5.2.2 Backlight input signal characteristics Parameter / Symbol / Min / Typ / Max / Units / Remark LED Power Supply / VLED (Note 1) / 10.8 / 12.0 / 13.2 / [Volt]
	16	28 BL_PWR Backlight power 29 BL_PWR Backlight power 30 CM_EN CM enable function	28 BL_PWR Backlight power 29 BL_PWR Backlight power 30 NC Reserve for LCD supplier
	22		
	23		
1.1	5	LCD Power Consumption / [Watt] / 4.0W (Include Logic and BLU power)	LCD Power Consumption / [Watt] / 4.8W (Include Logic and BLU power)
	14	5.2.1 LED characteristics Parameter / Symbol / Min / Typ / Max / Units / Condition Backlight Power Consumption / PLED / / / 2.4 / [Watt] / (Ta=25℃), Note 1	5.2.1 LED characteristics Parameter / Symbol / Min / Typ / Max / Units / Condition Backlight Power Consumption / PLED / / / 3.2 / [Watt] / (Ta=25℃), Note 1
1.2	4	LCD Power Consumption / [Watt] / 4.8W (Include Logic and BLU power)	LCD Power Consumption / [Watt] / 4.4W (Include Logic and BLU power)
	14	Note 1 : Recommend system pull up/down resistor no bigger than 10kohm	Note 1 : Measured in panel VLED Note 2 : Recommend system pull up/down resistor no bigger than 10kohm
	16		

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 or abnormal display .
It's recommended to use screen saver or power off panel periodically.

2. General Description

This specification applies to the 13.3 inch Color a-Si TFT-LCD Module G133HAN03.1. The display supports the FHD_1920(H)x1080(V) screen format and 16.2M colors (RGB 6-bits +FRC). All input signals are eDP interface and this module contains with an LED driver for backlight.

2.1 Display Characteristics

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

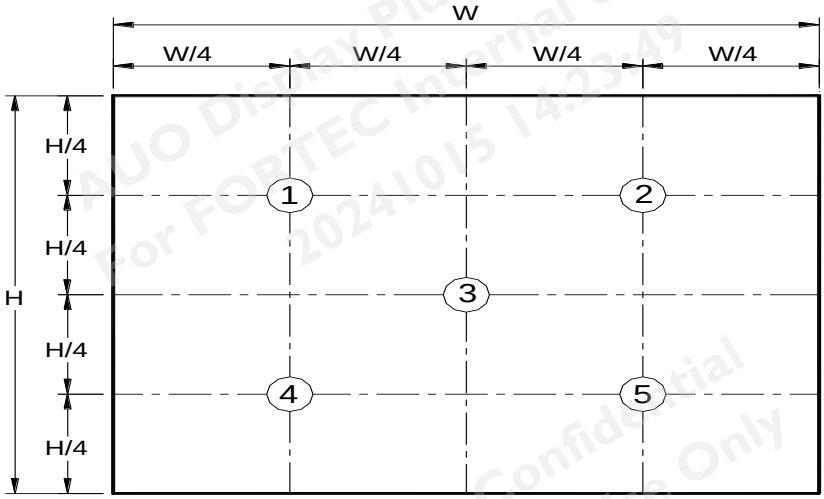
Items	Unit	Specifications
Screen Diagonal	[inch]	13.3
Active Area	[mm]	293.76(H) x 165.24(V)
Pixels H x V		1920x3(RGB) x 1080
Pixel Pitch	[mm]	0.153 x 0.153
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		AHVA, Normally Black
Normal Input Voltage VDD	[Volt]	3.3 (Typ.)
LCD Power Consumption	[Watt]	4.4W (Include Logic and BLU power)
Weight (Total)	[Grams]	250 (max)
Physical Size (Total)	[mm]	300.26(W)X177.47(H) Typ.
Thickness (Total)	[mm]	5.0 (Max.)
Electrical Interface		eDP 1.2
Support Color		16.2M (6bit+FRC)
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	0 to +50℃ -20℃ to +60℃
RoHS Compliance		RoHS Compliance
Light Bar Unit		LED, Non-replaceable

2.2 Optical Characteristics

The optical characteristics are measured with total sulotion under stable conditions at 25 ºC:

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing Angle	[degree]	Horizontal (Right) CR = 10 (Left)	80 80	89 89	- -	***3,6***
		Vertical (Up) CR = 10 (Down)	80 80	89 89	- -	
Contrast ratio		Normal Direction	500	600	-	***3,4***
Response Time		Raising + Falling	-	27	35	**3,5**
Color Coordinates (CIE) White		Red x	0.518	0.568	0.618	***3***
		Red y	0.29	0.340	0.39	
		Green x	0.3	0.350	0.4	
		Green y	0.523	0.573	0.623	
		Blue x	0.109	0.159	0.209	
		Blue y	0.061	0.111	0.161	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Central Luminance	[cd/m^2]		240	300	-	**1,2**
Luminance Uniformity	[%]	5 points	80	-	-	**1,2**
NTSC	[%]		-	45	-	

Note 1: 5 points' position (Ref: Active area)

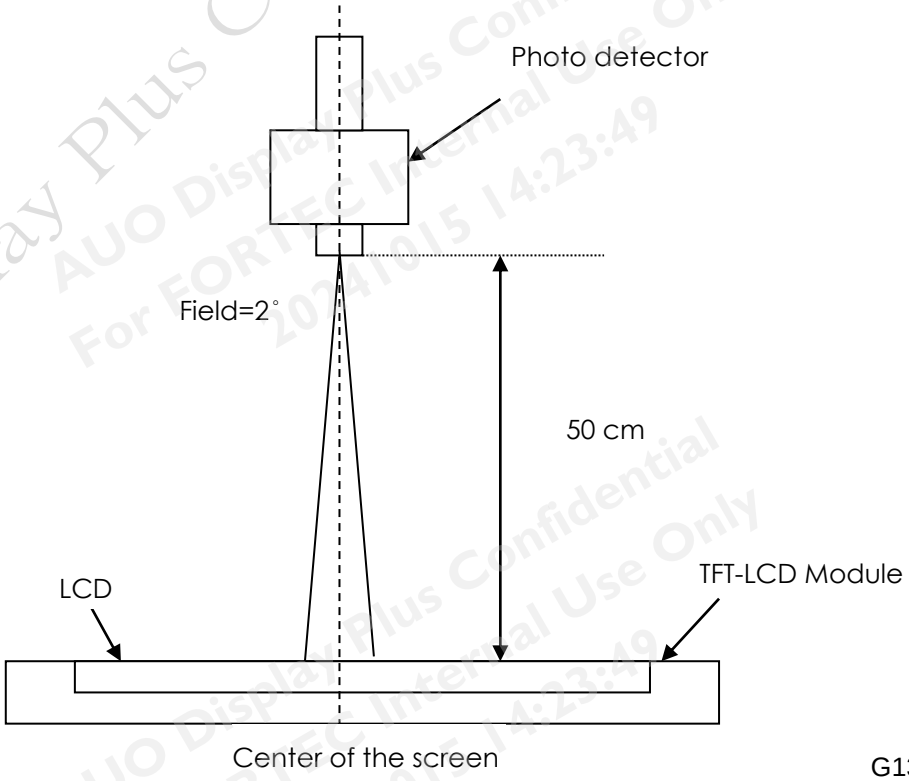


Note 2: The luminance uniformity of 5 points is defined by dividing the maximum luminance values by the minimum test point luminance

$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

Note 3: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room, and it should be measured in the center of screen.



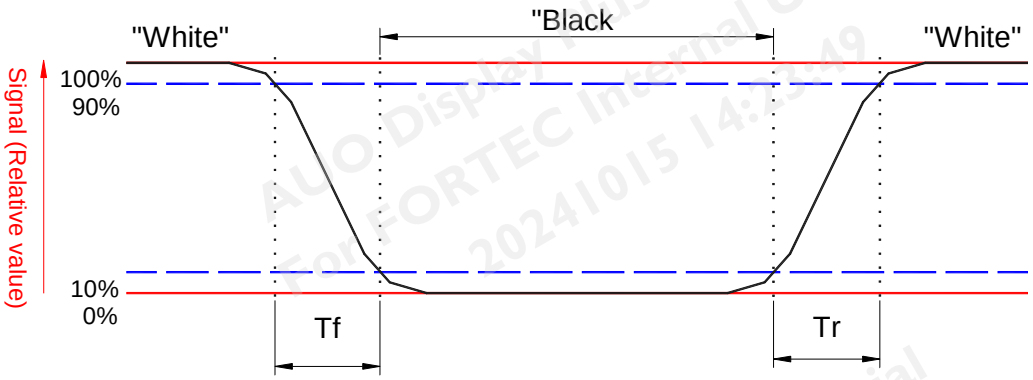
Note 4: Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

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

Note 5: Definition of response time:

The output signals of BM-7 or equivalent are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time interval is between the 10% and 90% of amplitudes. Refer to figure as below.



N

1

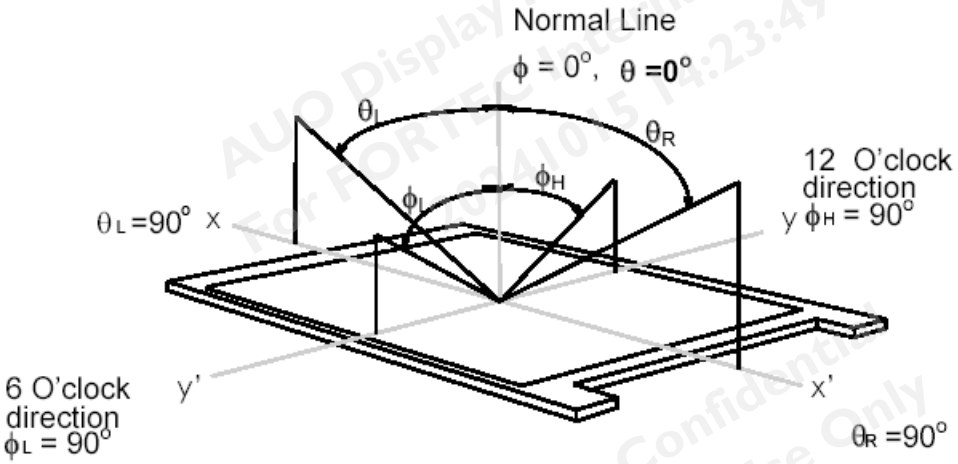
(

30° horizontal and

own as follows; 90°

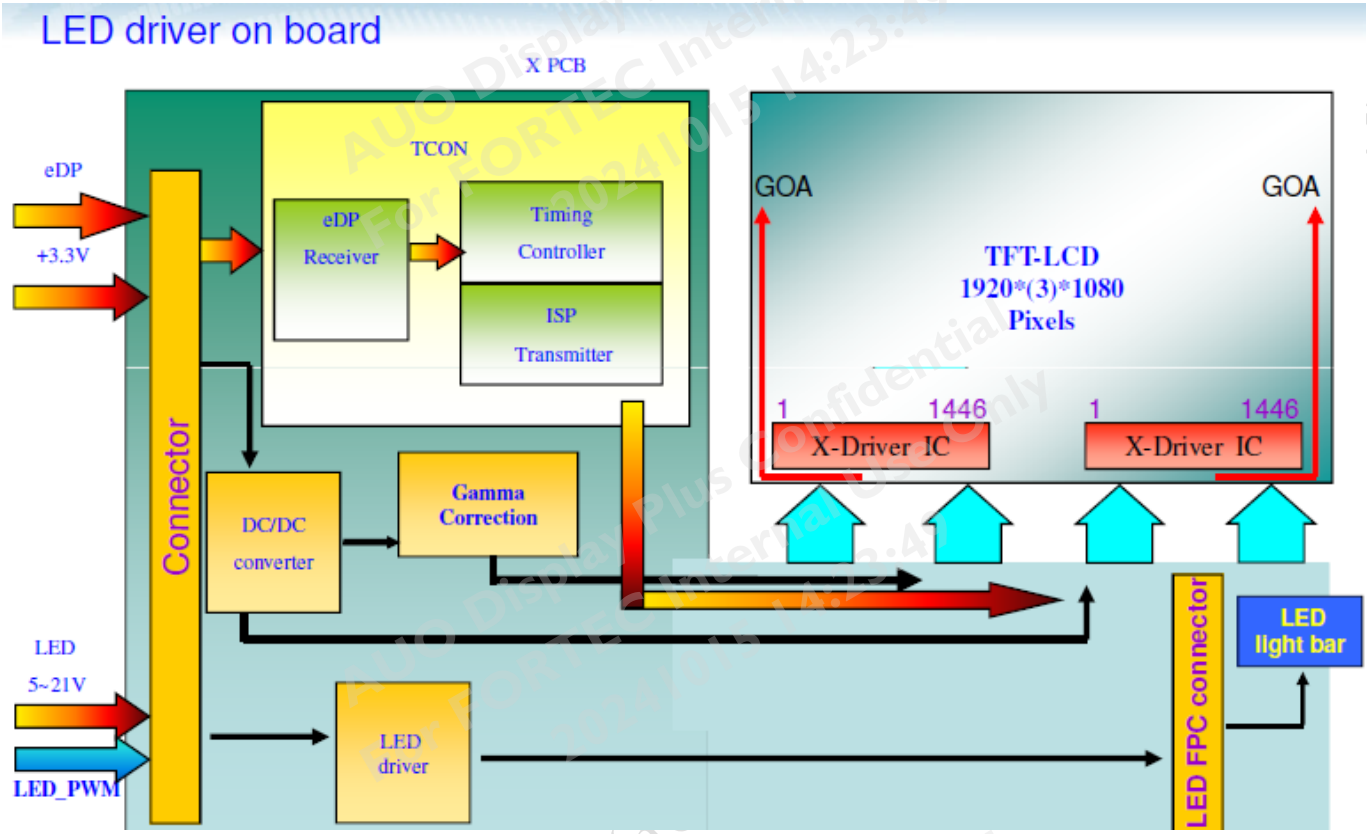
ent direction is

typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



3. Functional Block Diagram

The following diagram shows the functional block of the 13.3 inch color TFT/LCD module:



4. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

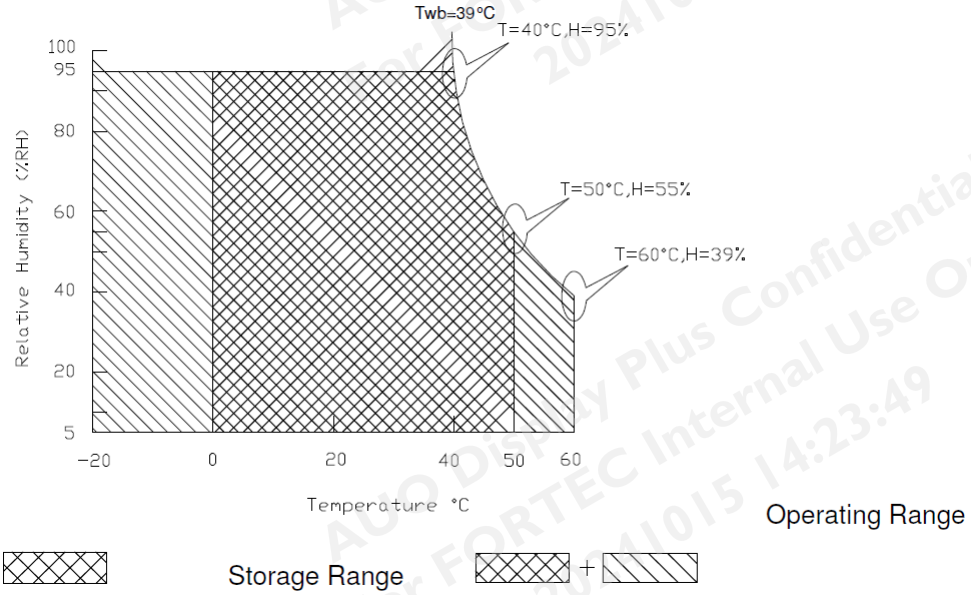
4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	+4.0	[Volt]	Note 1,2

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Conditions
Operating Temp.	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25℃)
Note 2: Permanent damage to the device may occur if exceed maximum values
Note 3: LED specification refer to section 5.2
Note 4: For quality performance, please refer to AUO IIS (Incoming Inspection Standard)



5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

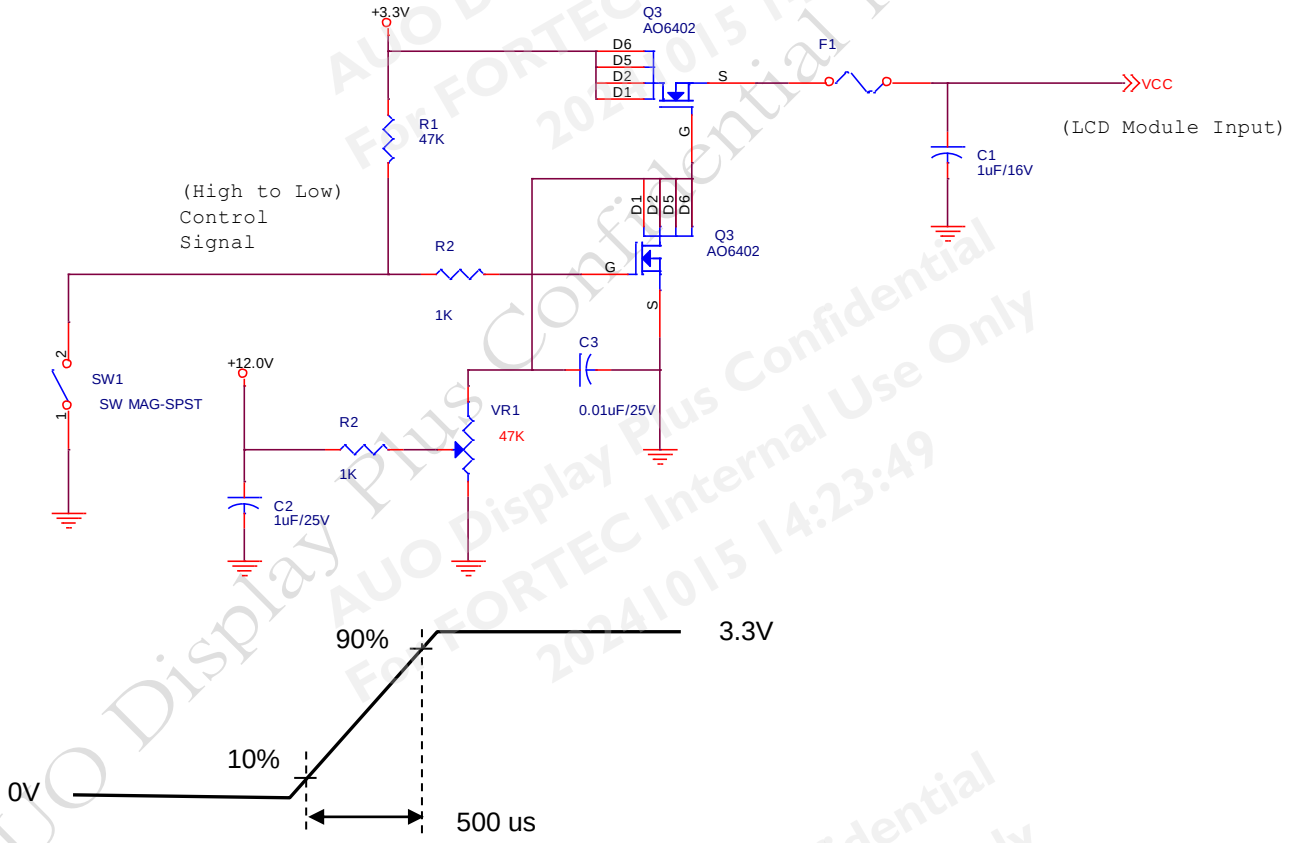
Input power specifications are as follows;

The power specification are measured under 25°Cand frame frequency under 60Hz

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	_	0.8	1.2	[Watt]	Note 1
IDD	IDD Current	-	-	400	[mA]	Note 1
IRush	Inrush Current	-	-	1500	[mA]	Note 2
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	

Note 1: PDD(typ)@ mosaic pattern Maximum Power; PDD(Max)@ R/G/B pattern Maximum Power
IDD(Max)=PDD(Max) / VDD(Min)

Note 2: Measure Condition



VDD rising time

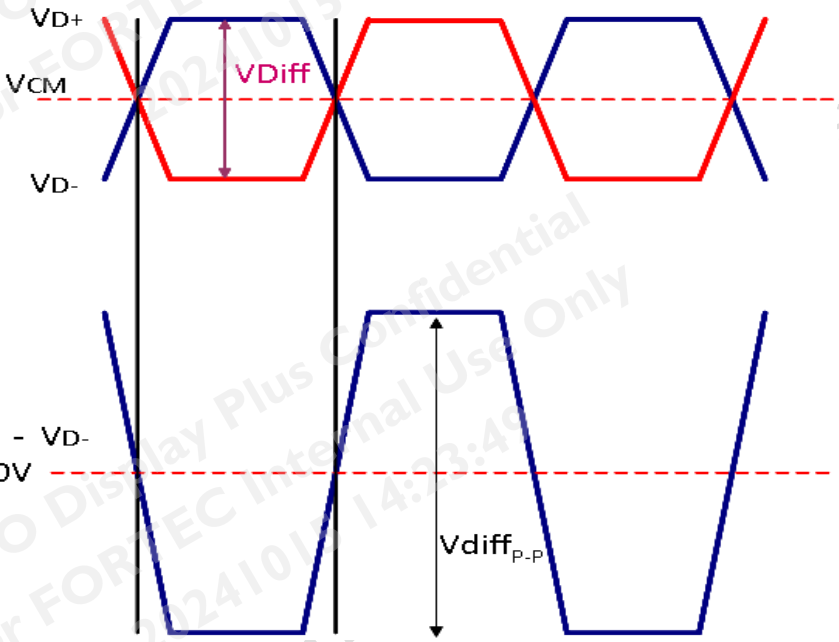
5.1.2 Signal Electrical Characteristics

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

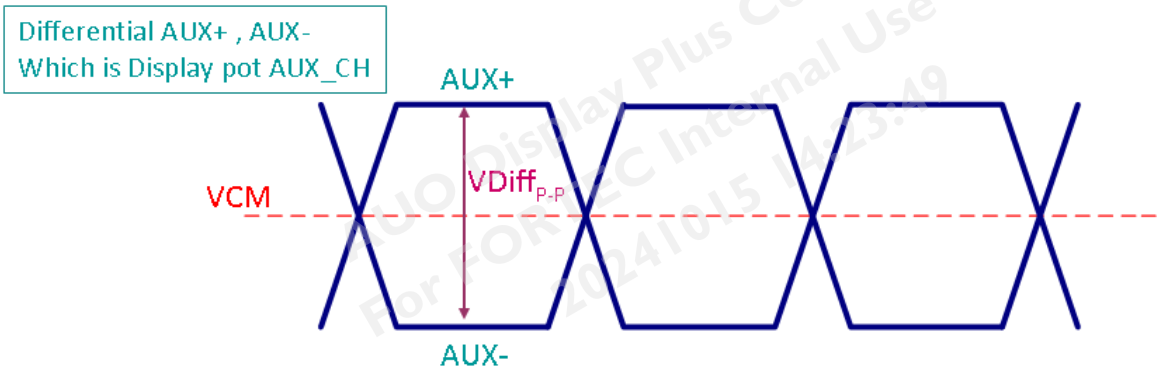


$Vdiff_{P-P} = [(VD+) - (VD-)] \times 2$

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 V1.4

Display Port AUX_CH signal:



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	270		800	mV

Follow as VESA display port standard V1.3

Display Port V_{HPD} signal:

Display port V_{HPD}					
		Min	Typ	Max	unit
V_{HPD}	HPD Voltage (input impedance 1KΩ)	2.25	-	3.6	V

Follow as VESA display port standard V1.3

5.2 Backlight Unit

5.2.1 LED characteristics

Parameter	Symbol	Min	Typ	Max	Units	Condition
Backlight Power Consumption	PLED	-	-	3.2	[Watt]	(Ta=25℃, Note 1
LED Life-Time	N/A	-	30,000	-	Hour	(Ta=25℃, Note 2

Note 1: Calculator value for reference P_{LED} = V_F (Normal Distribution) * I_F (Normal Distribution) / Efficiency

Note 2: The LED life-time define as the estimated time to 50% degradation of initial luminous.

5.2.2 Backlight input signal characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply	VLED (Note 1)	10.8	12.0	13.2	[Volt]	Define as Connector Interface (Ta=25℃)
LED Enable Input High Level	VLED_EN (Note 2)	2.5	-	5.5	[Volt]	
LED Enable Input Low Level		-	-	0.5	[Volt]	
PWM Logic Input High Level	VLED_PWM (Note 2)	2.5	-	5.5	[Volt]	
PWM Logic Input Low Level		-	-	0.5	[Volt]	
PWM Input Frequency	FPWM	200	1K	10K	Hz	
PWM Duty Ratio	Duty	5 (Note 3)	--	100	%	

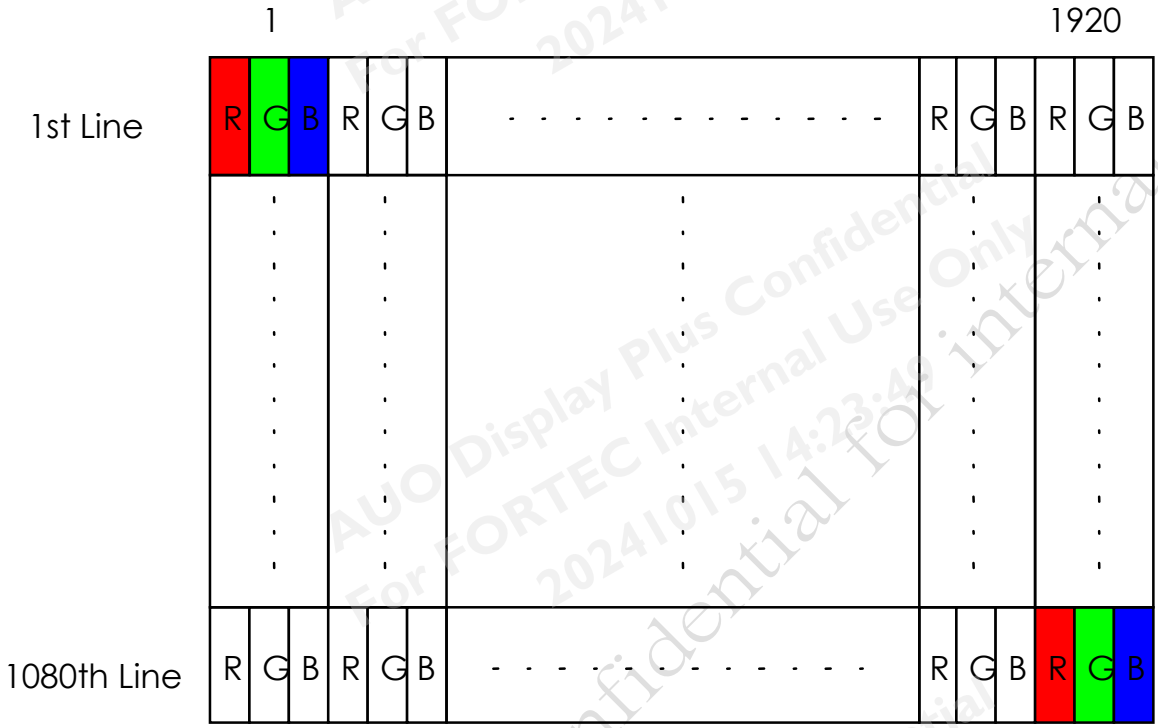
Note 1 : Measured in panel VLED

Note 2 : Recommend system pull up/down resistor no bigger than 10kohm

6. Signal Interface Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



6.2 Integration Interface Requirement

6.2.1 Connector Description (LCM)

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

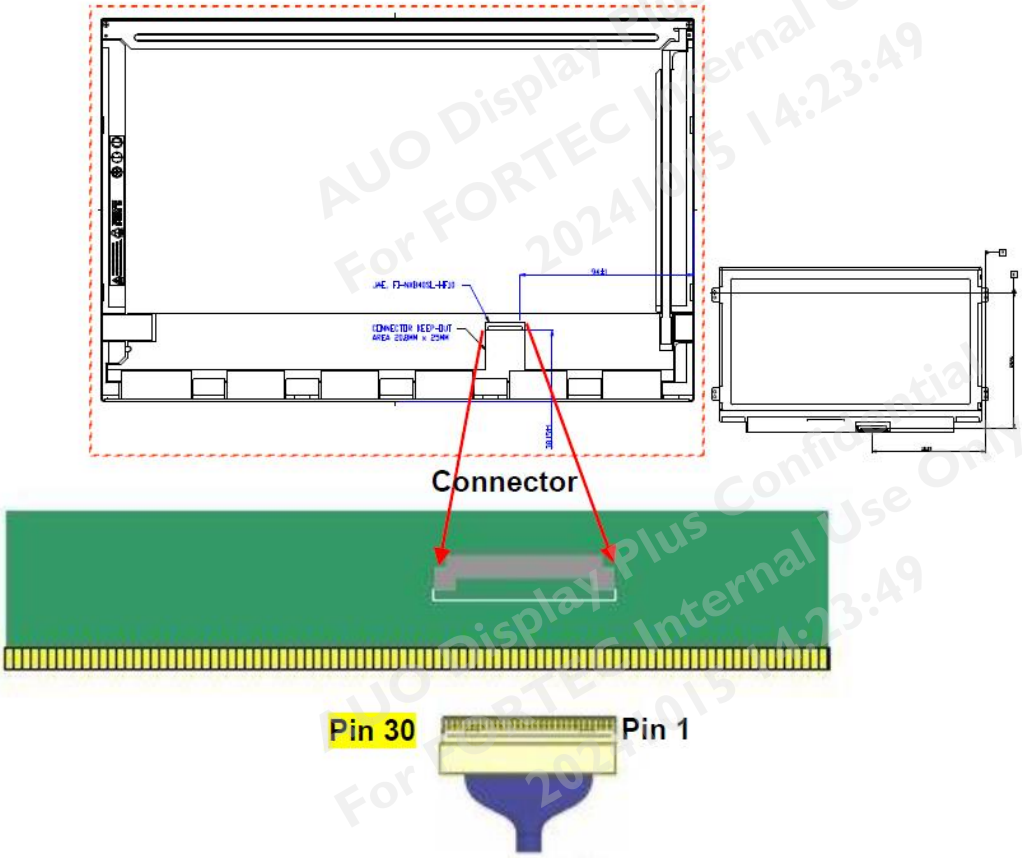
Connector Name / Designation	For Signal Connector
Manufacturer	STM or compatible
Type / Part Number	STM MSAK24025P30M or compatible
Mating Housing/Part Number	I-PEX 20704-030T-13 or compatible

6.2.2 Pin Assignment

Pin	Symbol	Description
1	NC	No connect
2	H_GND	High Speed Ground
3	Lane1_N	Comp Signal Link Lane 1
4	Lane1_P	True Signal Link Lane 1
5	H_GND	High Speed Ground
6	Lane0_N	Comp Signal Link Lane 0
7	Lane0_P	True Signal Link Lane 0
8	H_GND	High Speed Ground
9	AUX_CH_P	True Signal Auxiliary Ch.
10	AUX_CH_N	Comp Signal Auxiliary Ch.
11	H_GND	High Speed Ground
12	VDD	LCD logic and driver power
13	VDD	LCD logic and driver power
14	LCD_Self_Test	LCD Panel Self Test Enable
15	LCD_GND	LCD logic and driver ground
16	LCD_GND	LCD logic and driver ground
17	HPD	HPD signal pin
18	BL_GND	Backlight ground
19	BL_GND	Backlight ground
20	BL_GND	Backlight ground
21	BL_GND	Backlight ground
22	VLED_EN	Backlight On / Off
23	VLED_PWM	System PWM signal Input
24	NC	No connect
25	NC	No connect
26	VLED	Backlight power
27	VLED	Backlight power
28	VLED	Backlight power
29	VLED	Backlight power

30	NC	Reserve for LCD supplier

6.2.5 Connector Pin 1 Locations



6.3 Interface Timing

6.3.1 Timing Characteristics

Basically, interface timings should match the 1920x1080 /60Hz manufacturing guide line timing.

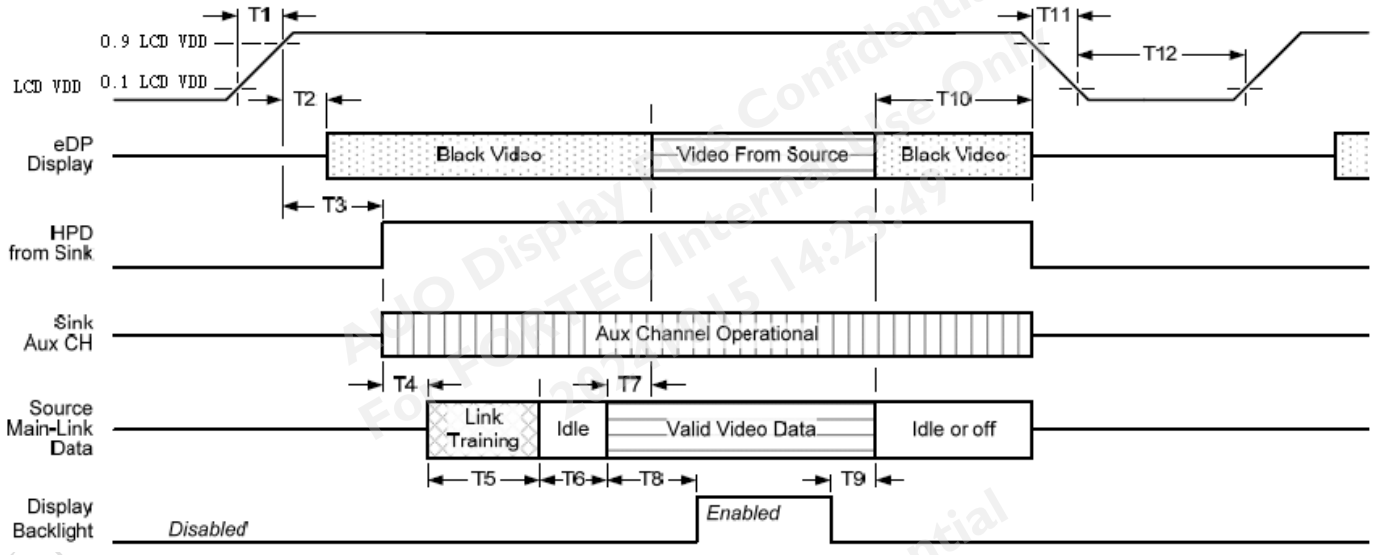
Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-		60		Hz
Clock frequency		1/ T_{Clock}		140		MHz
Vertical Section	Period	T_V	1110	1112	1080+A	T_{Line}
	Active	T_{VD}		1080		
	Blanking	T_{VB}	20	32	A	
Horizontal Section	Period	T_H	2080	2098	1920+B	T_{Clock}
	Active	T_{HD}		1920		
	Blanking	T_{HB}	160	178	B	

Note 1 : The above is as optimized setting
Note 2 : The maximum clock frequency = (1920+B)*(1080+A)*60<160MHz

6.4 Power ON/OFF Sequence

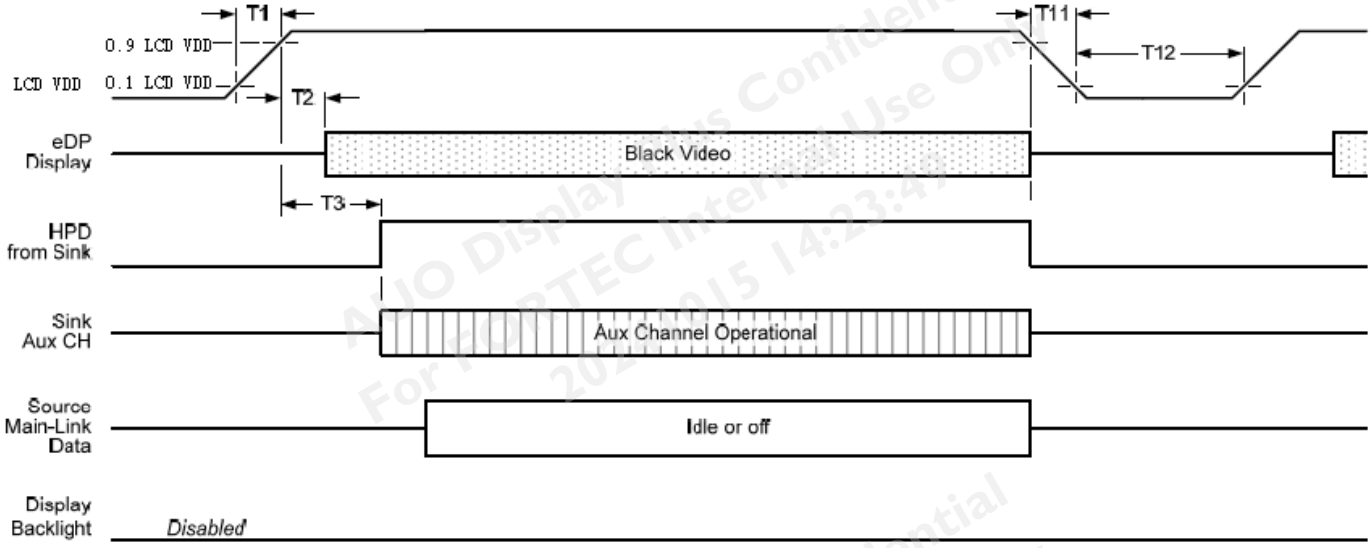
Power on/off sequence is as follows. Interface signals and LED on/off sequence are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off

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			Notes
			Min.	Typ.	Max.	
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 LCD VDD power on (with in T2 max)-when the "Novideostream_Flag" (VB-ID Bit 3) is received from the source (at

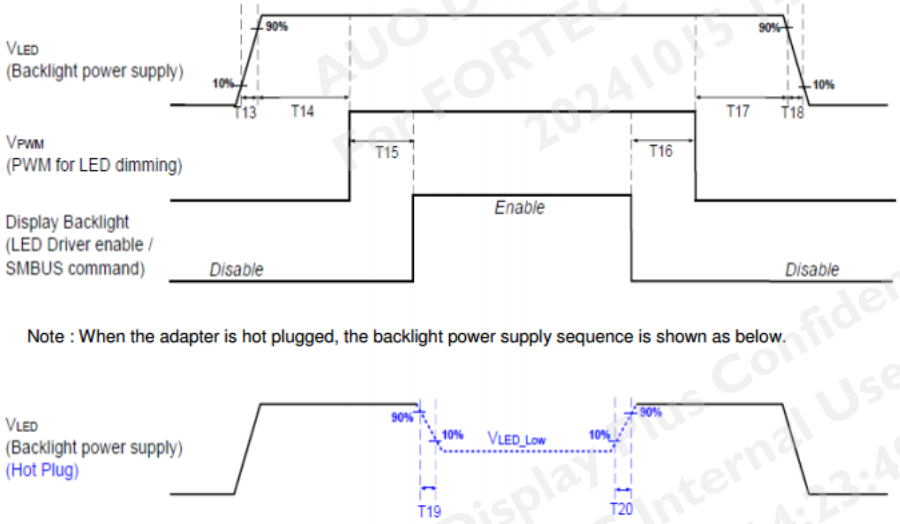
the end of T9).

-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 LCD VDD 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:



	Min (ms)	Max (ms)
T13	0.5	10
T14	10	-
T15	0	-
T16	0	-
T17	10	-
T18	0.5	10
T19	1*	-
T20	1*	-

Seamless change: T19/T20 = 5xT_{PWM}*

*T_{PWM}= 1/PWM Frequency

Note 1 : If T14,T15,T16,T17<10ms，The display garbage may occur. We suggest T14,T15,T16,T17>10ms to avoid the display garbage.

Note 2：If T13 or T18<0.5ms，the inrush current may cause the damage of fuse. If T13 or T18<0.5ms，the inrush current I^2t is under typical melt of fuse Spec.，there is no mentioned problem.

7. Panel Reliability Test

7.1 Vibration Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 1.5 G
- Frequency: 10 - 500Hz Random
- Sweep: 30 Minutes each Axis (X, Y, Z)

7.2 Shock Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 220 G , Half sine wave
- Active time: 2 ms
- Pulse: X,Y,Z .one time for each side

7.3 Reliability Test

Items	Required Condition	Note
Temperature Humidity Bias	**Ta= 40℃, 90%RH, 300h**	
High Temperature Operation	**Ta= 50℃, 300h**	
Low Temperature Operation	**Ta=0℃, 300h**	
High Temperature Storage	**Ta= 60℃, 300h**	
Low Temperature Storage	**Ta= -20℃, 250h**	
Thermal Shock Test	**Ta=-20℃(30min) ~60℃(30min), 100cycles condition.**	
ESD	**Contact: ±8 KV** **Air : ±15 KV**	**Note 1**

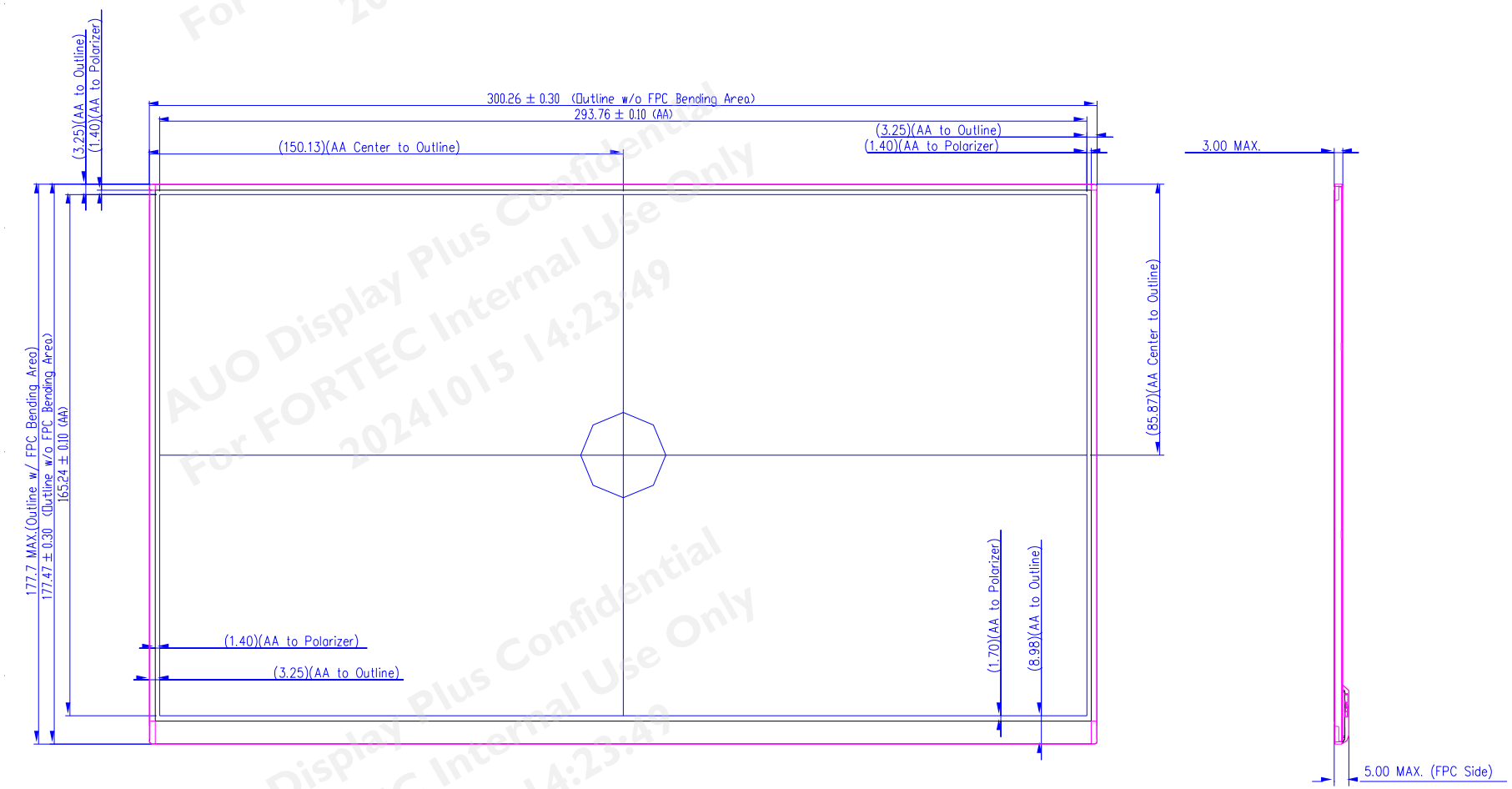
Note1: According to EN 61000-4-2, ESD class B: Some performance degradation allowed. No data lost

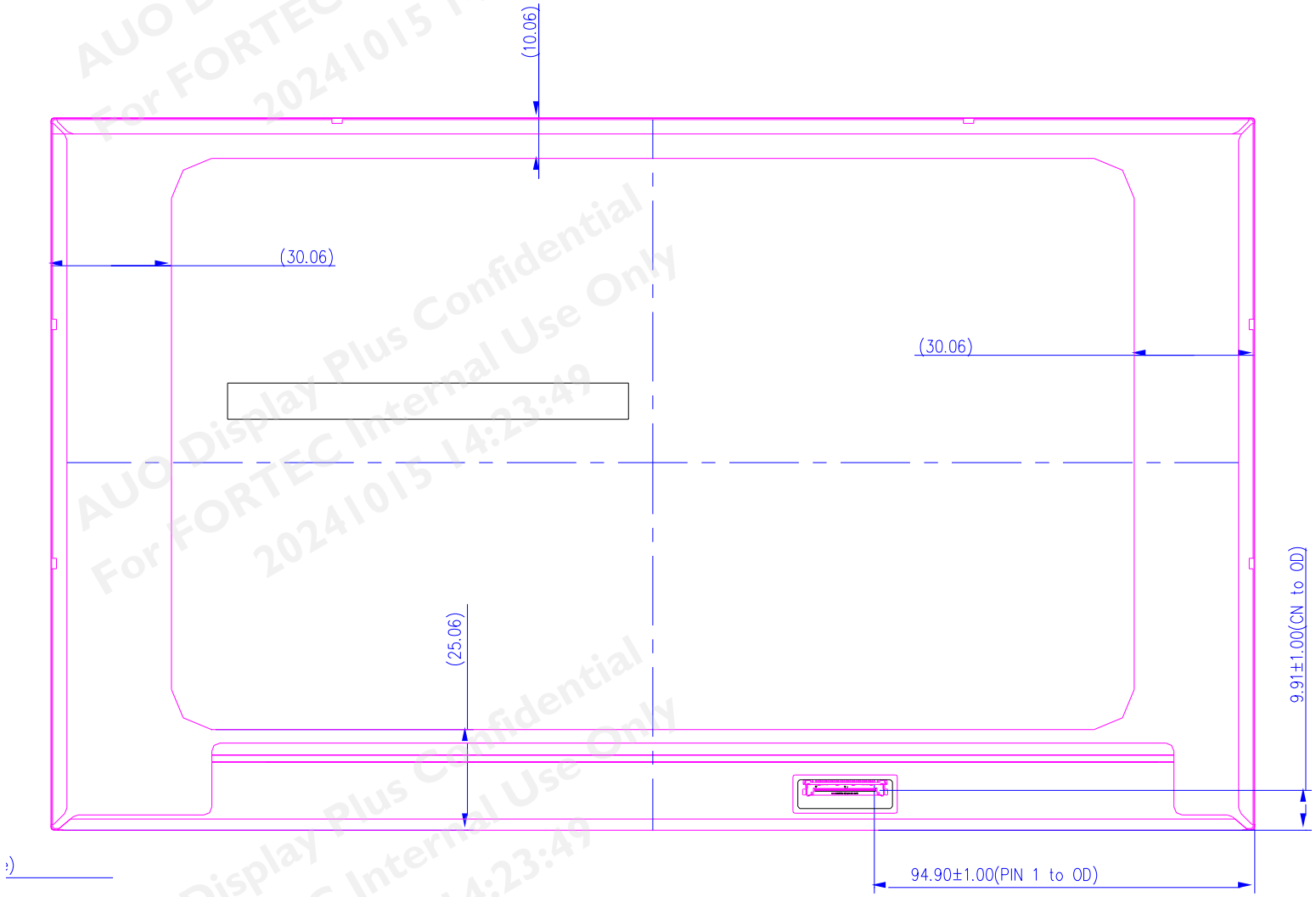
. Self-recoverable. No hardware failures.

Remark: MTBF (Excluding the LED): 30,000 hours with a confidence level 90%

8. Mechanical Characteristics

8.1 Total solution Outline Dimension

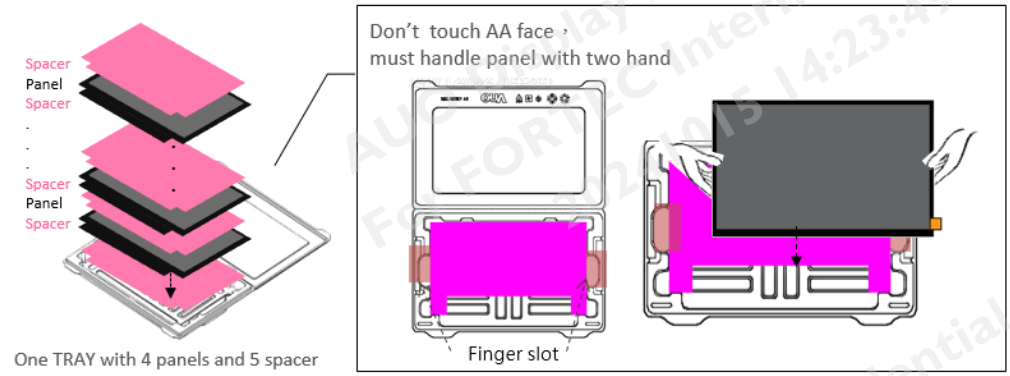


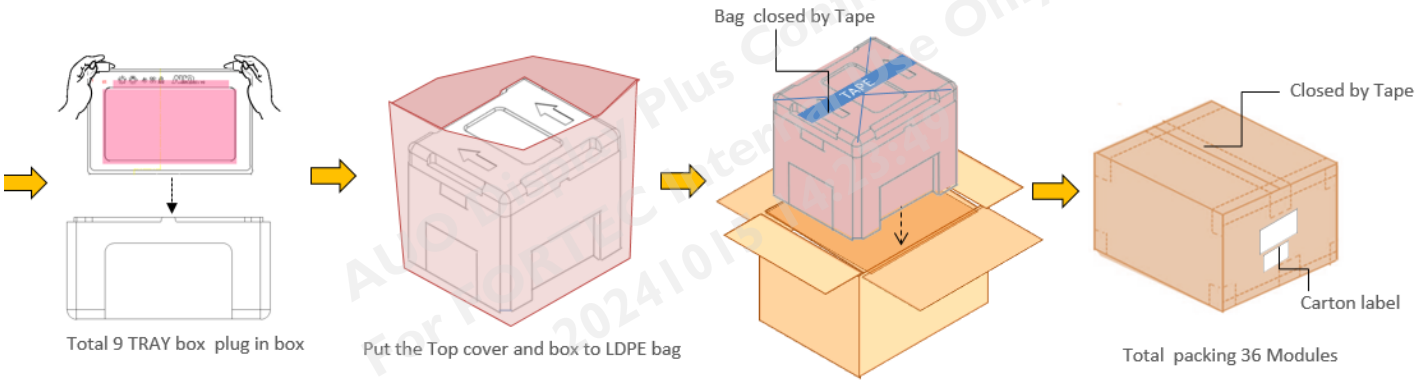


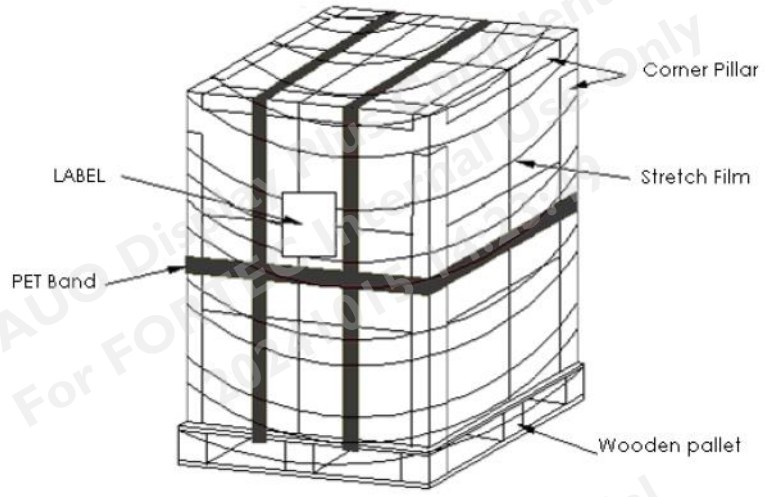
9. Label and Packaging

9.1 Shipping Label

9.2 Carton Package







Item	Specification			Remark
	Q'ty	Dimension	Weight (kg)	
Packing Material	1	446(L)mm x373(W)mm x 293(H)mm	1.5	TRAY +Box
Packing	36pcs/carton	446(L)mm x373(W)mm x 293(H)mm	10.87	with panel & cushion
Pallet	1	1150(L)mm x 910(W)mm x 132(H)mm	14	
1 Pallet after Packing	boxes/pallet	1150(L)mm x 910(W)mm x 1304(H)mm	277	(3*2)*4 layer=24 cartons

10 Safety

10.1 Keen Edge Requirements

There will be no keen edges or corners on the display assembly that could cause injury.

10.2 Materials

10.2.1 Toxicity

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

10.2.2 Flammability

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.

10.3 Capacitors

If any polarized capacitors are used in the TFT-LCD module, provisions will be made to keep them from being inserted backwards.

10.4 International Safety Standard Compliance

The TFT-LCD Module will satisfy all requirements for compliance to IEC/UL 62368-1.

FORTEC
GROUP

Our company network supports you worldwide with offices in Germany, Austria, Switzerland, the UK and the USA. For more information please contact:

FORTEC
GROUP

FORTEC Elektronik AG | Augsburger Straße 2b | 82110 Germering
+49 89 894450-0
info@fortecag.de | www.fortecag.de

FORTEC
INTEGRATED

FORTEC Integrated GmbH | Augsburger Straße 2b | 82110 Germering
+49 89 894363-0
info@fortec-integrated.de | www.fortec-integrated.de

FORTEC
POWER

FORTEC Power GmbH | Lise-Meitner-Straße 3 | 64560 Riedstadt
+49 6158 8285-0
weborder@fortec-power.de | www.fortec-power.de

FORTEC
EGYPT

FORTEC Electronic Design and Solution Egypt SMLC | Linx Business Park
Unit B318 | Smart Village | Giza Governorate
info@fortec-integrated.de | www.fortec-integrated.de

Autronic Steuer- und Regeltechnik GmbH | Siemensstraße 17
74343 Sachsenheim
+49 7147 24-0
vertrieb@autronic.de | www.autronic.de

FORTEC
CZECH REPUBLIC

FORTEC Czech Republic s.r.o. | Přátelství 275 | 330 02 Dýšina
+49 89 894363-0
info@fortec.cz | www.fortec.cz

FORTEC
UNITED STATES

FORTEC United States, Corp. | 87 Raynor Avenue Unit 1 | Ronkonkoma
NY | 11779 | +1 631 5804360
info@fortec.us | www.fortec.us

FORTEC
SWITZERLAND

FORTEC Switzerland AG | Bahnhofstraße 3 | 5436 Würenlos
+41 44 7446111
info@fortec.ch | www.fortec.ch

FORTEC
UNITED KINGDOM

FORTEC Technology UK Ltd. | Osprey House | 1 Osprey Court
Hinchingbrooke Business Park | Huntingdon | Cambridgeshire | PE29 6FN
+44 1480 411600
info@fortec.uk | www.fortec.uk