(v) Preliminary Specifications
() Final Specifications

Module	21.5 Inch Color TFT-LCD with Touch Function
Model Name	PV215006D046G

Customer	**Date**	**Approved by**	**Date**
		Dennis Zhu	2024/05/20
Checked & Approved by	**Date**	**Prepared by**	**Date**
Neil Xue	2024/05/20	Benjamin Peng	2024/05/20
		Kingtech Group Co.,Ltd.	

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Record of Revision

Version and Date	Page	Old description	New Description
0.1 2024/05/20	All	First draft specification	-

1. Operating Precautions

1) Since front cover glass 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) To avoid ESD (Electro Static Discharde) damage, be sure to ground yourself before handling Touch Display.
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 light bar edge. Instead, press at the far ends of the LED light bar 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 Touch Display.
11) Touch Display 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 having no flammability grade is used in the touch display. The touch display should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
14) Continuous operating touch display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when touch display is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It’s recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.
17) In order not to damage the touch panel, please remove the protected film as slow as possible in an environment with a humidity range from 60% to 80%.
18) PCBA shielding does not allow force.

2. General Description

PV215006D046G is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, P-cap touch panel ，AD Board and LED backlight system. The screen format is intended to support the 16:9 Full HD, 1920(H) x1080(V) screen and 16.7M colors with LED backlight driving circuit. All input signals are HDMI interface compatible.

2.1 Display Characteristics

The following items are characteristics summary under 25 °C condition:

Items	Unit	Specifications
Screen Diagonal	[inch]	21.5”
Active Area	[mm]	476.064(H) x 267.786(V)
Pixels H x V		1920 x 3(RGB) x 1080
Pixel Pitch	[um]	247.95 (per one triad) X 247.95
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		AHVA Mode, Normally Black
Nominal Input Voltage	[Volt]	DC 12V (Typical)
Power Consumption	[Watt]	26.26W（Typ.） LCD Module：PDD（Typ.)=2.3W@ White Pattern，Fv=60Hz Backlight Unit：P_{BLU}(TYP.)=12.96W TP：1W Speaker：2 x 5W@8R
Weight	[Kg]	3.1
Physical Size	[mm]	524.55(H) x 311.4(V) x12.6(T)（W/O PCB side）， 23.15(PCB Side)
I/O		Speaker，Key Board，HDMI，USB（Type-C）， DC12V 3A（DC Jack 5.5/2.1）
Surface Treatment		NON , AG&AF Optional
Support Color		16.7M colors
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 ~ +60 -20 ~ +60
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

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

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m2]	I_{LED}= 90mA (5p average)	250	300	-	With TP
Uniformity	%	9 points	75	80	-	
Contrast Ratio			600	1000	-	
Response Time	[msec]	Rising Time (T_{rR})	-	12	22	
		Falling Time (T_{rF})	-	10	20	
		Raising + Falling	-	22	42	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	- -	89 89	- -	
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	- -	89 89	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.593	0.643	0.693	
		Red y	0.284	0.334	0.384	
		Green x	0.266	0.316	0.366	
		Green y	0.579	0.629	0.679	
		Blue x	0.107	0.157	0.207	
		Blue y	0.002	0.052	0.102	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%		-	72	-	

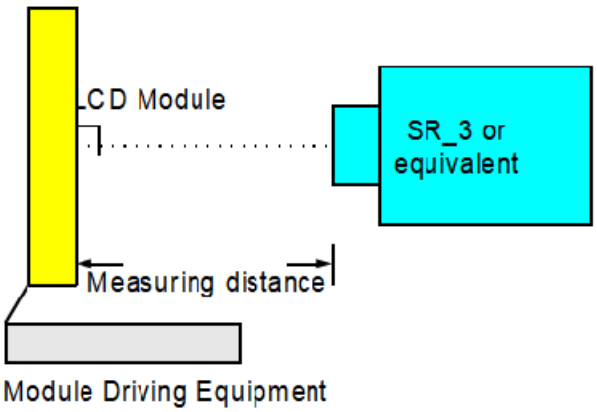
Note 1: Measurement method

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

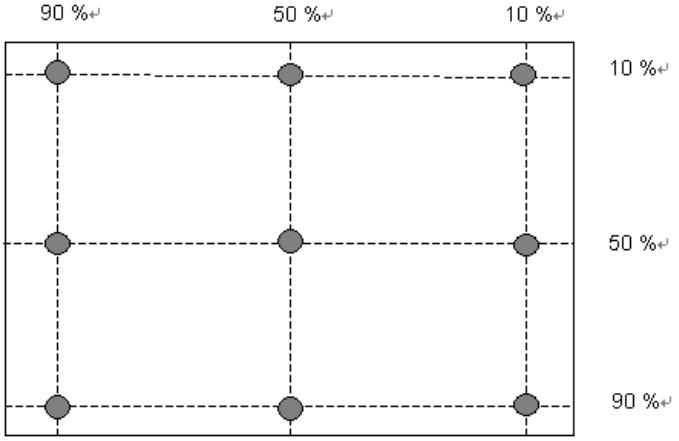
Aperture Field angle 2◦ with 50cm measuring distance

Test Point Follow Note 2 position

Environment *< 1 lux*



Note 2: Definition of 9 points position



Note 3: The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

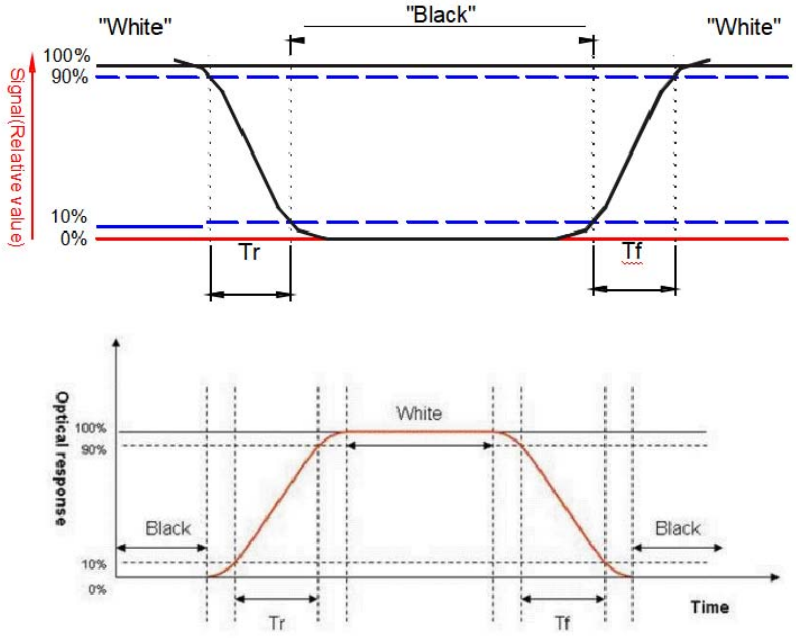
$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

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

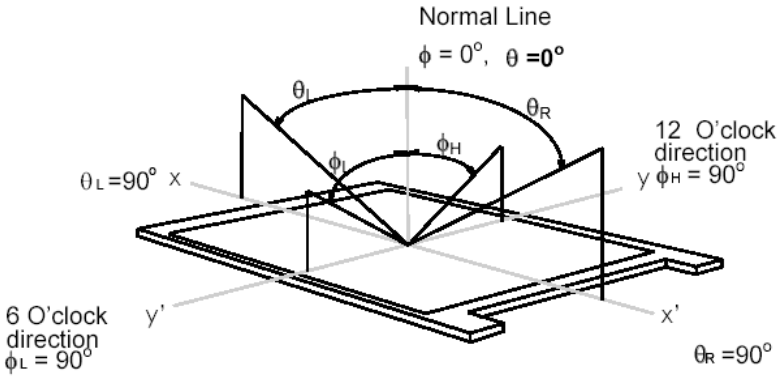
Note 5: Definition of response time:

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.



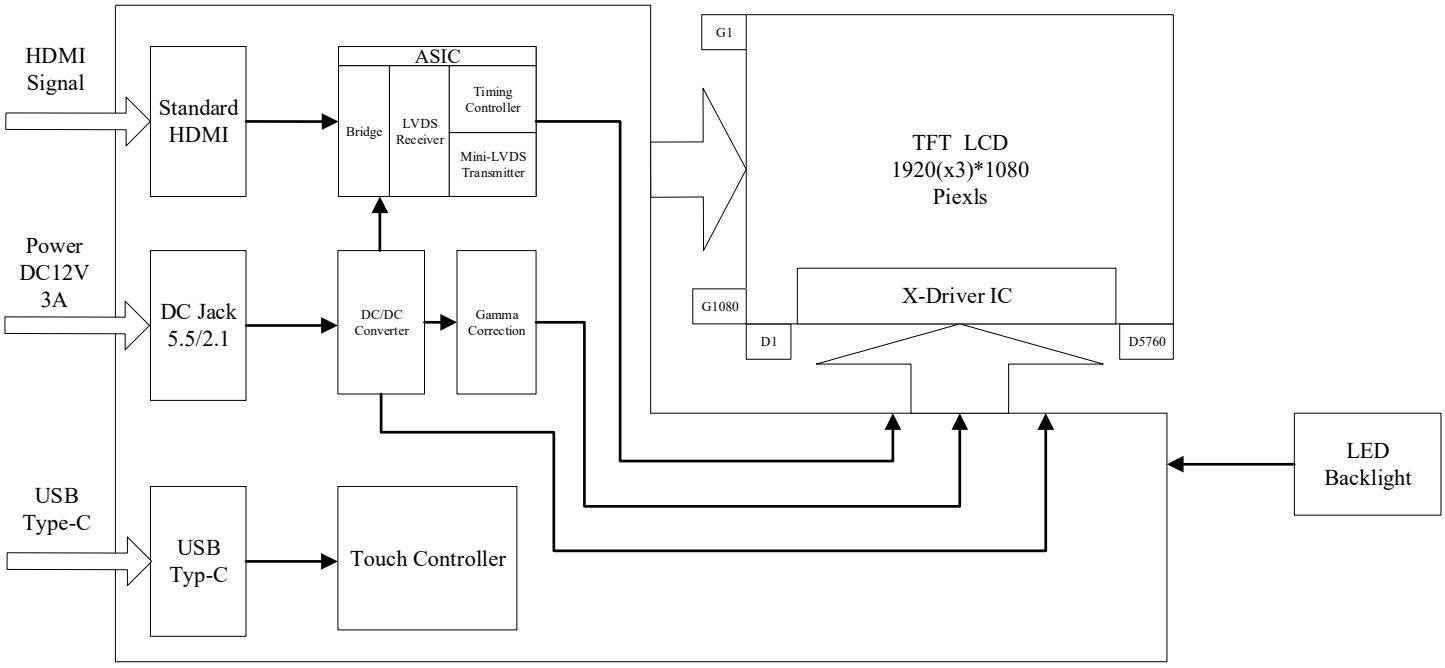
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧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 21.5 inch color TFT/LCD module:



4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Typ.	Max	Unit
Logic/LCD drive Voltage	VDD	+5	+5.5	[Volt]

4.2 Absolute Ratings of Touch Sensor

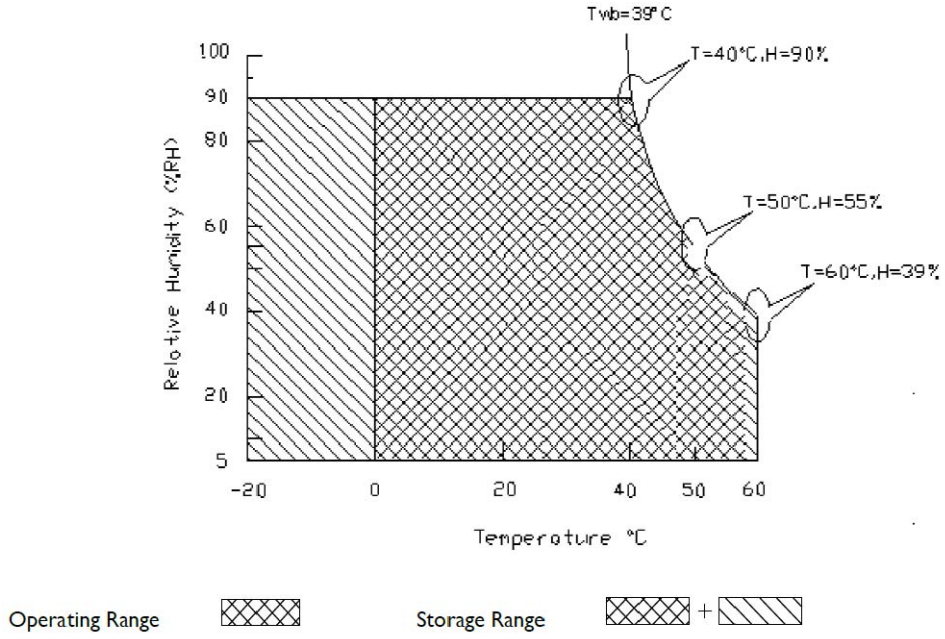
Item	Symbol	Rating	Unit	Conditions
USB Voltage	VBUS	+5	[Volt]	-

4.3 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	0	+60	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-20	+60	[°C]
Storage Humidity	HST	5	90	[%RH]

Note 1: Permanent damage to the device may occur if exceed maximum values

Note 2: Maximum wet-bulb temperature is less than 39°C and no condensation



5. Electrical Characteristics

5.1 Backlight Unit

5.1.1 Parameter guideline for LED

Following characteristics are measured under a stable condition using an inverter at 25℃ (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VLED	Input Voltage	32.4	36	39.6	[Volt]	
I_F	LED Forward Current	-	360	-	[mA]	Ta = 25°C
Operation Life		30,000	-	-	Hrs	(Ta=25℃), Note 2 I_F=90mA

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

Note 2: $V_{Light\text{-}bar}$, $I_{Light\text{-}bar}$, P_{VLED} are defined for LED backlight.(100% duty of PWM dimming)

Note 3: If module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 4: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 5:Each LED light bar consists of 48 pcs LED package(4strings x 12pcs/string)

5.2 Touch

5.2.1 Electrical Characteristics

Item		Min.	Typ.	Max.	Unit	Remark
Power Supply		4.5	5	5.5	Voltage	
Power Supply Current	Normal Operation Mode	---	---	200	mA	

5.2.2 Touch Driver Information

Item	Driver information
Manufacturer	ILITEK
Type / Part Number	ILI2510

5.2.3 Touch Characteristics

Item	Specifications
Cover Glass Thickness	2 ± 0.2 mm
TP OD	524.55(H) x 311.4(V) (typ.)
Substrate Material	SDL Glass
Single / Multi-touch Accuracy	Center: +/- 1.5mm Edge: +/- 2mm
Linearity	Center: +/- 1.5mm Edge: +/- 2mm
The smallest distance between 2 points	8 mm
Channel (X * Y)	35 x 61
Report Rate (points /sec)	>100Hz

5.2.4 Touch Connector

Connector Name / Designation	TP Connector
Type / Part Number	USB Type-C 2.0

5.3 Speaker

5.3.1 Speaker Specification

Item	Specification
Speaker Output Power	2 x 5W@8R Max

5.3.2 Speaker Connector

Connector Name / Designation	TP Connector
Manufacturer	Kingtech Group Co.,Ltd.
Type / Part Number	PH-04AWB

5.3.3 Pin Assignment

PIN	SYMBOL	DESCRIPTION	REMARK
1	R-	Right Speaker -	
2	R+	Right Speaker +	
3	L-	Left Speaker -	
4	L+	Left Speaker +	

5.4 Key Board

5.4.1 Key Connector

Connector Name / Designation	TP Connector
Manufacturer	Kingtech Group Co.,Ltd.
Type / Part Number	PH-06AWB

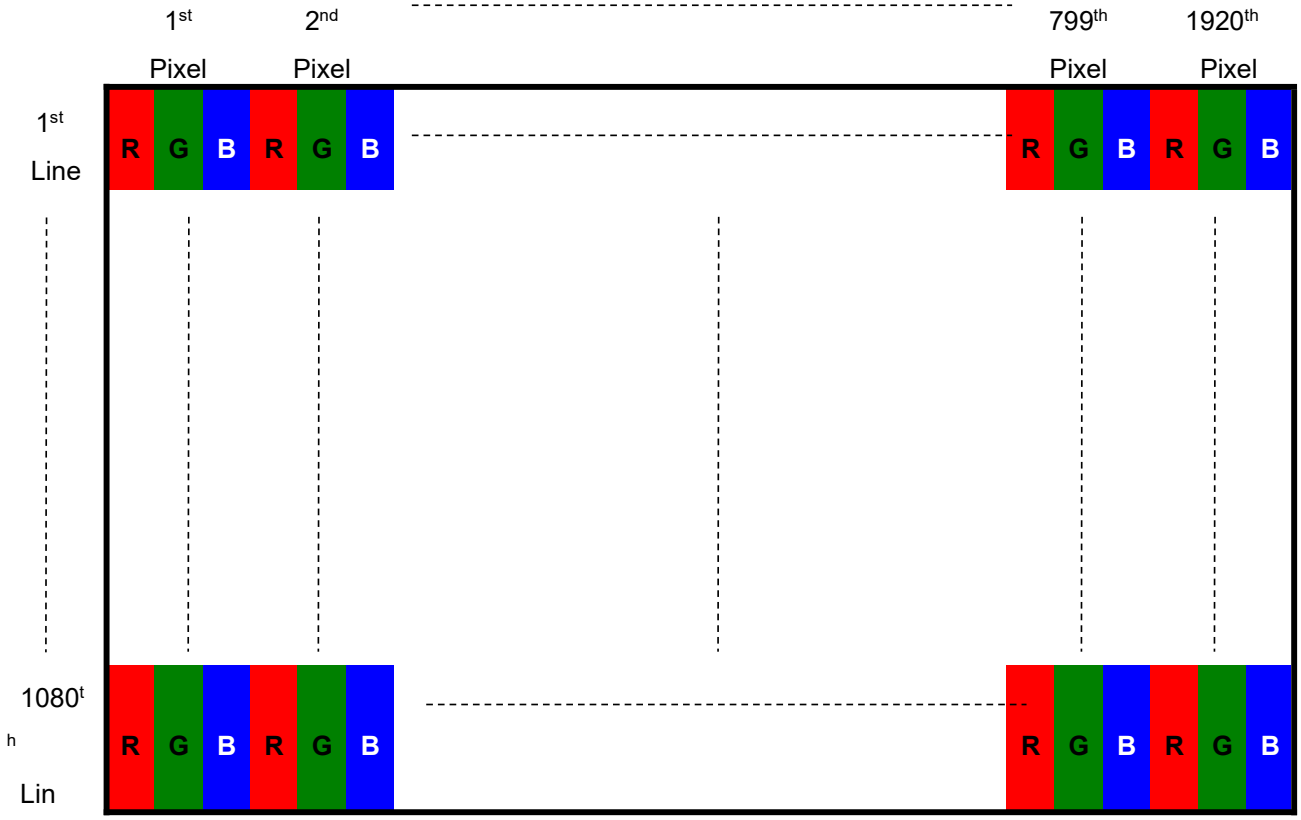
5.4.2 Pin Assignment

PIN	SYMBOL	DESCRIPTION	REMARK
1	GND	Ground	
2	VCC	Supply Voltage 3.3V	
3	BL-	Backlight brightness down	
4	BL+	Backlight brightness up	
5	ON/OFF	Power on & off	
6	STATE	State	

6. Signal Characteristic

6.1 Pixel Format Image

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



6.2 Signal Description

The module uses a HDMI receiver on PCBA. The HDMI signal convert to LVDS by chip on PCBA.

6.2.1 HDMI Connector Description

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
Type / Part Number	Standard HDMI Connector
Mating Housing/Part Number	Standard HDMI Cable

7. Reliability Test Criteria

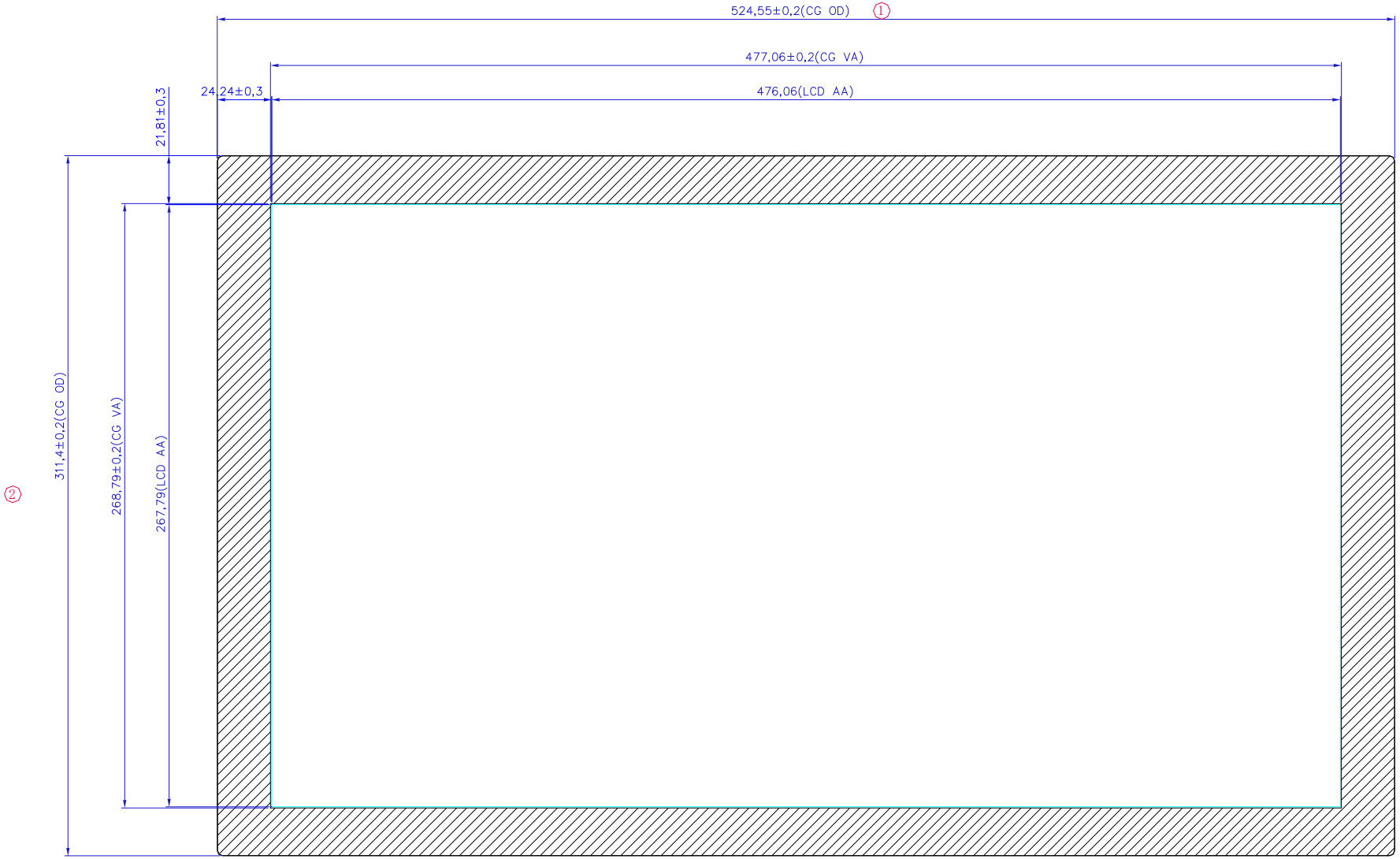
Items	Required Condition	Note

Temperature Humidity Bias (THB)	Ta= 50ºC, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 60ºC, 300hours	
Low Temperature Operation (LTO)	Ta= 0ºC, 300hours	
High Temperature Storage (HTS)	Ta= 60ºC, 300hours	
Low Temperature Storage (LTS)	Ta= -20ºC, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Thermal Shock Test (TST)	-20ºC /30min, 60ºC /30min, 100 cycles	***1***
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	***2***
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	

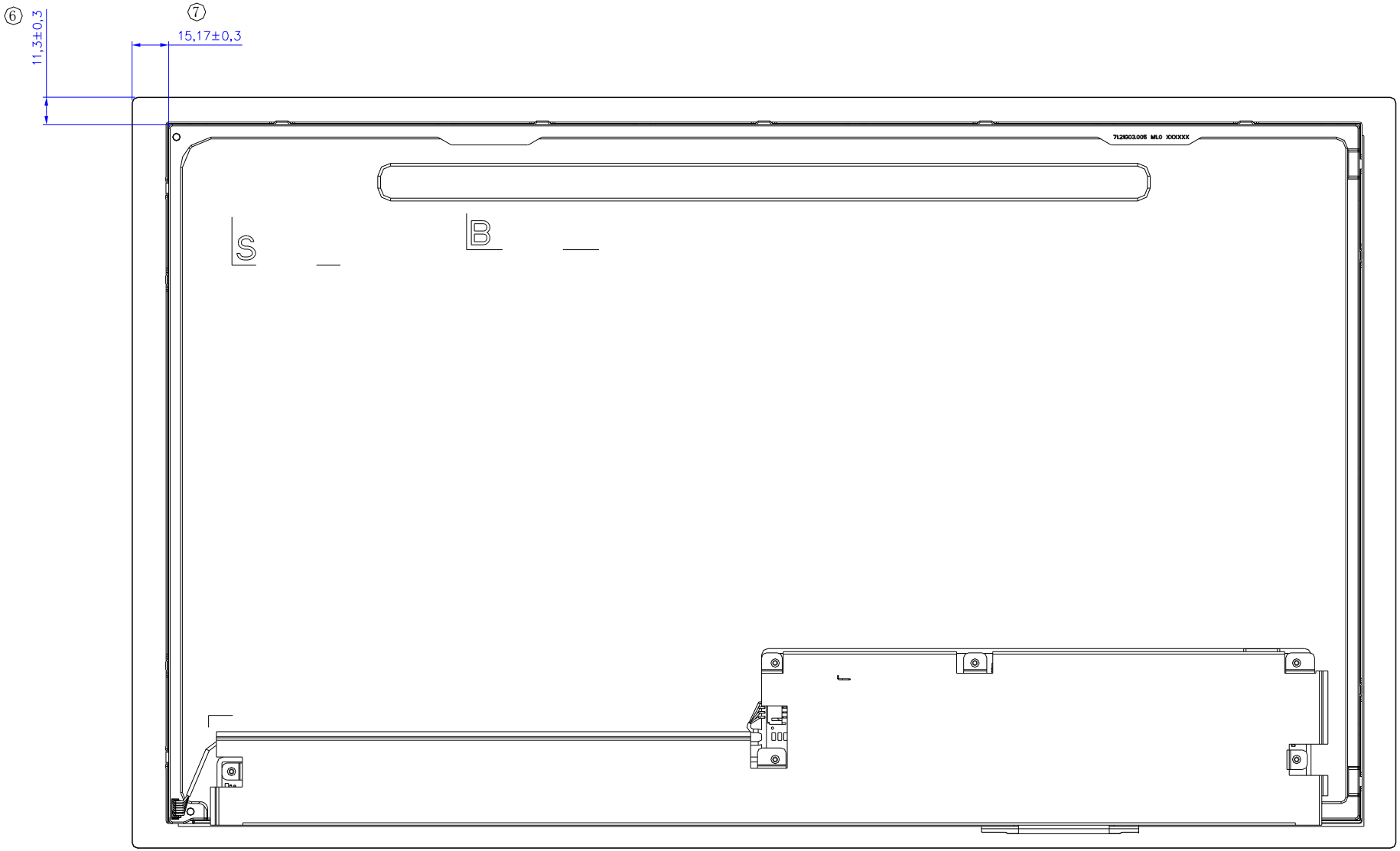
Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20oC to 60oC, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.
Note 3 : Mura shall be ignored after high temperature reliability test.

8. Mechanical Characteristics

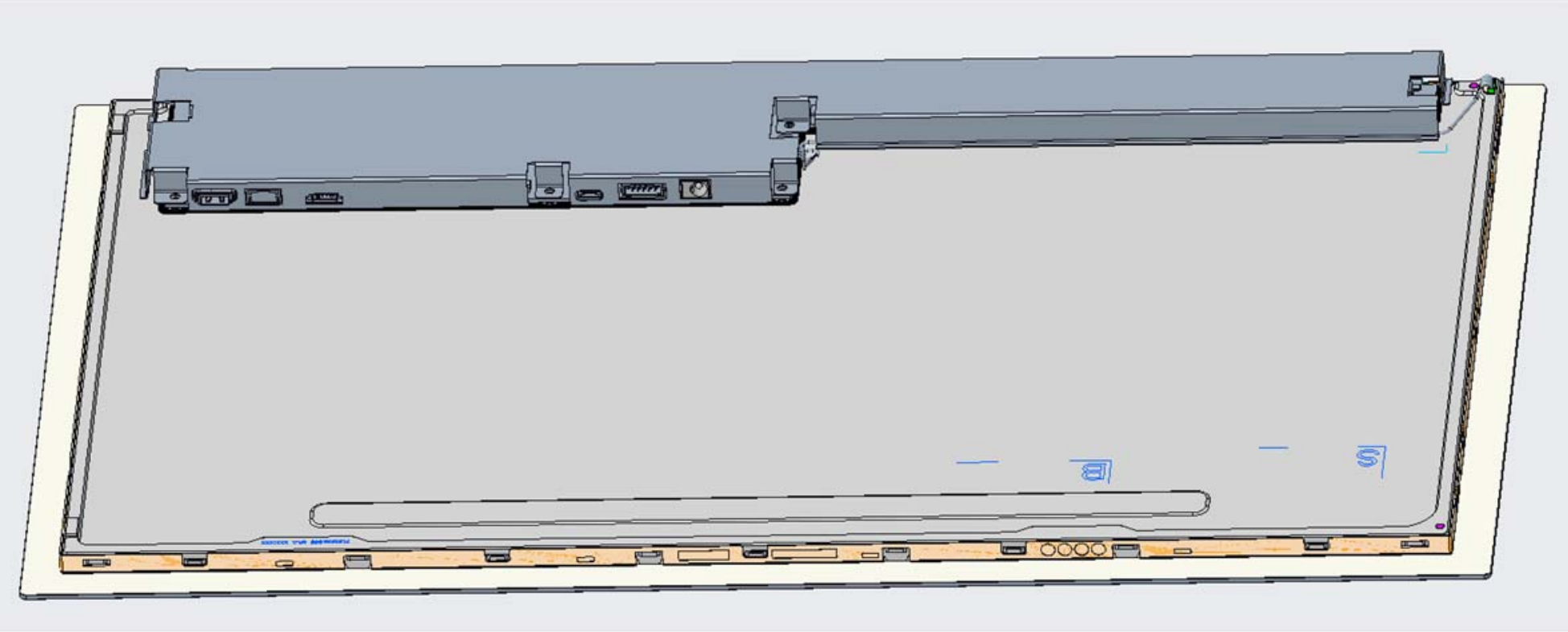
8.1 Outline Dimension (Front View)



8.2 Outline Dimension (Rear View)



8.3 Outline Dimension (I/O Description)



9. Label and Packaging

9.1 Shipping Label (Touch Monitor Open Frame)

TBD

9.2 Carton/Pallet Package

TBD

10 Safety

10.1 Sharp Edge Requirements

There will be no sharp edges or comers 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 display module. If toxic materials are used, they will be reviewed and approved by the responsible Kingtech.

10.2.2 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.

10.3 Capacitors

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