SHENZHEN APTUS TECHNOLOGY CO., LIMITED

PRODUCT SPECIFICATION

21.5inch TFT-LCD 2560*1024 MODULE

MODEL NAME: AS215XDHP01

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FOR CUSTOMER	
CUSTOMER APPROVED	

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REVISION HISTORY

REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
1.0	-	Initial Release		

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1 基本规格 Specifications

特性		规格 Specification	备注
显示规格.	尺寸 Size	21.5 寸	
	分辨率 Resolution	2560 (RGB) ×1024	
	系统接口 System Interface	2 Port LVDS	
	色深 Color Depth	16.7M (24Bit)	
	技术类型 Technology	a-Si	
	像素尺寸 (mm) Pixel Size (mm)	0.1983×0.1983	
	像素配置 Pixel Arrangement	R.G.B.	
	显示模式 Display Mode	Normally Black	
	表面处理方式 Surface Treatment	防眩晕光 Anti-Glare	
	视角方向 Viewing Direction	全视角 All	
机械特性	模组尺寸 Module Dimensions (W×H×T, mm)	545.00×240.00×29.1	
	有效显示区域 Active Area (mm)	507.648×203.059	
	是否带触摸屏 Touch Screen	不带 Not Included	
	重量 (g) Weight (g)	TBD	备注 2

备注 1：环保要求：Q/S0002

备注 2：液晶显示模组重量公差：±5%

2 输入/输出端口

2.1 液晶显示屏连接器端口定义

LCD Connector Pin Definitions

Connector Model: QTH-020-01-F-D-DP-A

No.	Symbol	I/O	Description	No.	Symbol	I/O	Description
1	NC	N	No Connect	2	DA0-	I	Odd pixel data 0
3	NC	N	No Connect	4	DA0+	I	Odd pixel data 0
5	GND	P	Ground	6	DA1-	I	Odd pixel data 1
7	GND	P	Ground	8	DA1+	I	Odd pixel data 1
9	GND	P	Ground	10	DA2-	I	Odd pixel data 2
11	GND	P	Ground	12	DA2+	I	Odd pixel data 2
13	BIT	O	Power Status Indicator 备注 2	14	CLKA-	I	Odd pixel clock
15	T-BIST	I	Internal Test 备注 3	16	CLKA+	I	Odd pixel clock
17	GND	P	Ground	18	DA3-	I	Odd pixel data 3
19	GND	P	Ground	20	DA3+	I	Odd pixel data 3
21	VDD	P	3.3V Power Supply	22	DB0-	I	Even pixel data 0
23	VDD	P	3.3V Power Supply	24	DB0+	I	Even pixel data 0
25	GND	P	Ground	26	DB1-	I	Even pixel data 1
27	GND	P	Ground	28	DB1+	I	Even pixel data 1
29	GND	P	Ground	30	DB2-	I	Even pixel data 2
31	GND	P	Ground	32	DB2+	I	Even pixel data 2
33	VCC	P	5V Power Supply	34	CLKB-	I	Even pixel clock
35	VCC	P	5V Power Supply	36	CLKB+	I	Even pixel clock
37	VCC	P	5V Power Supply	38	DB3-	I	Even pixel data 3
39	VCC	P	5V Power Supply	40	DB3+	I	Even pixel data 3

备注 1：I:Input； O:Output； P:Power； N:No Connect;；

备注 2：BIT: Power State Feedback, Open Drain Output, BIT=”L”：Abnormal;

备注 3：T-BIST: Internal Test, Please Pull Low or Floating;

2.2 背光连接器端口定义

Backlight Connector Pin Definitions

Connector Model: DF3EA-14P-2H(21)

No.	Symbol	I/O	Description	Remark
1~5	VBL	P	BL Power Supply	
6	GND	P	Ground	
7	GND	P		
8	GND	P		
9	SDA	I	IIC Serial Data for Brightness Control	备注 2
10	SCL	I	IIC Clock Input for Brightness Control	备注 3
11	TSV	O	Temperature Feedback Voltage	备注 4
12	EN	I	Enable Control Pin(EN=H : Active)	
13	PWM	I	PWM Input for Brightness Control	备注 2
14	PWM	I		备注 3

备注 1：I:Input； O:Output； P:Power；

备注 2：IIC and PWM Mode Selection Description:

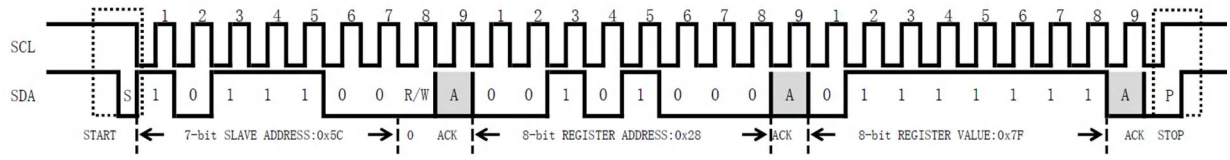
1) IIC Mode: SDA&SCL PIN must have 4.7K~10K Pull-up Resistance, and PWM PIN need to Pull “H” or Floating;

2) PWM Mode: SDA,SCL PIN need to Pull “L” or Floating;

备注 3：Backlight Brightness Adjustment Description：

1) IIC Mode: IIC Device Address:0x5C; Brightness Register: 0x28; Brightness Parameter Range: 0x00~0xFF;

Example：Adjust 127(0x7F) Level Backlight Brightness，IIC Write Register Timing is as follows：



2) PWM Mode: Recommended PWM Dimming Frequency: 500Hz~1000Hz

备注 4：Temperature Feedback Voltage Reference Table:

温度(℃)	电压(V)	温度(℃)	电压(V)	温度(℃)	电压(V)
–40	3.14	20	1.81	80	0.47
–30	3.03	30	1.50	90	0.37
–20	2.88	40	1.22		
–10	2.67	50	0.97		
0	2.41	60	0.76		
10	2.12	70	0.60		

3 绝对最大额定值输入
Absolute Maximum Ratings

GND=0V, Temperature=25°C

Parameter	Symbol	Min	Max	Unit	Remarks
Digital Supply Voltage	V_{DD}	-0.3	4	V	
Analog Supply Voltage	V_{CC}	-0.5	6	V	
BL Supply Voltage	V_{BL}	-0.3	28	V	
Logic Input Voltage Range	V_I	-0.3	V_{DD}+0.3	V	
Logic Output Voltage Range	V_O	-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OPR}	-30	70	℃	
Storage Temperature	T_{STG}	-40	80	℃	

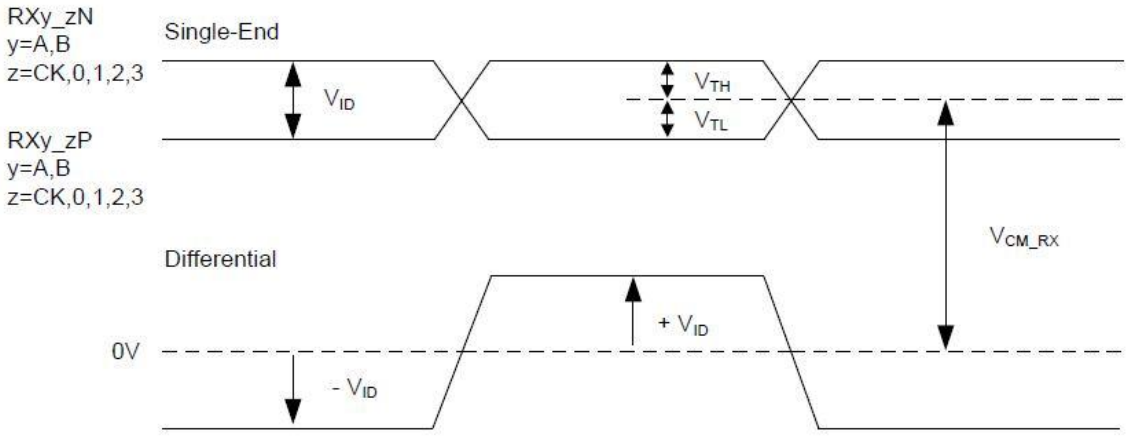
4 电气特性 Electrical Characteristics

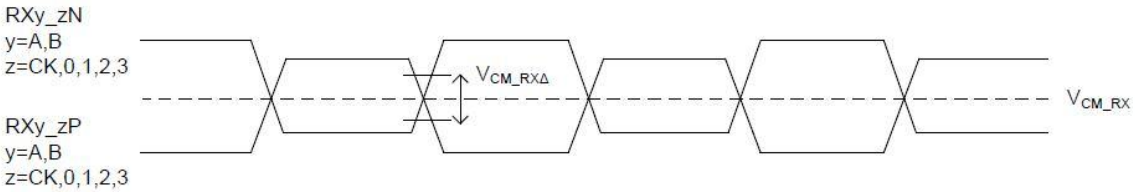
4.1 TFT 液晶显示模组电压驱动
TFT LCD Module Voltage Drive

GND= AGND =0V, Ta = 25℃

Parameter		Symbol	Min	Typ.	Max	Unit	Remarks
Digital Supply Voltage		V_{DD}	3.0	3.3	3.6	V	
Analog Supply Voltage		V_{CC}	4.7	5.0	5.3	V	
Differential Input Voltage		$\|V_{ID}\|$	100	-	600	mV	备注 1
Differential Input “H” Threshold		V_{TH}	-	-	50	mV	备注 1
Differential Input “L” Threshold		V_{TL}	-50	-	-	mV	备注 1
Differential Input Common Mode Voltage		V_{CM_RX}	$\|V_{ID}\|/2$	1.2	$2.4-\|V_{ID}\|/2$	V	备注 1
Differential Input Common Mode Voltage Difference		$V_{CM_RX\Delta}$	-50	-	+50	mV	备注 1 备注 2
Input Signal	Low	V_{IL}	0	-	$0.3*V_{DD}$	V	备注 3
	High	V_{IH}	$0.7*V_{DD}$	-	V_{DD}	V	
Output Signal	Low	V_{OL}	-	-	GND+0.4	V	备注 3
	High	V_{OH}	V_{DD}-0.4	-	-	V	
LCD Power Consumption		P_{VDD}	-	1.3	2	W	备注 4
		P_{VCC}	-	6.5	10	W	

备注 1：LVDS 差分输入。LVDS differential input.





备注 2：VCM_RXΔ: Voltage Difference of “Differential Input Common Mode Voltage”；

备注 3：Input Signal: T-BIST; Output Signal: BIT;

备注 4：Power Typ. Consumption specified is for Frame rate=60Hz, Test Pattern: White Screen;

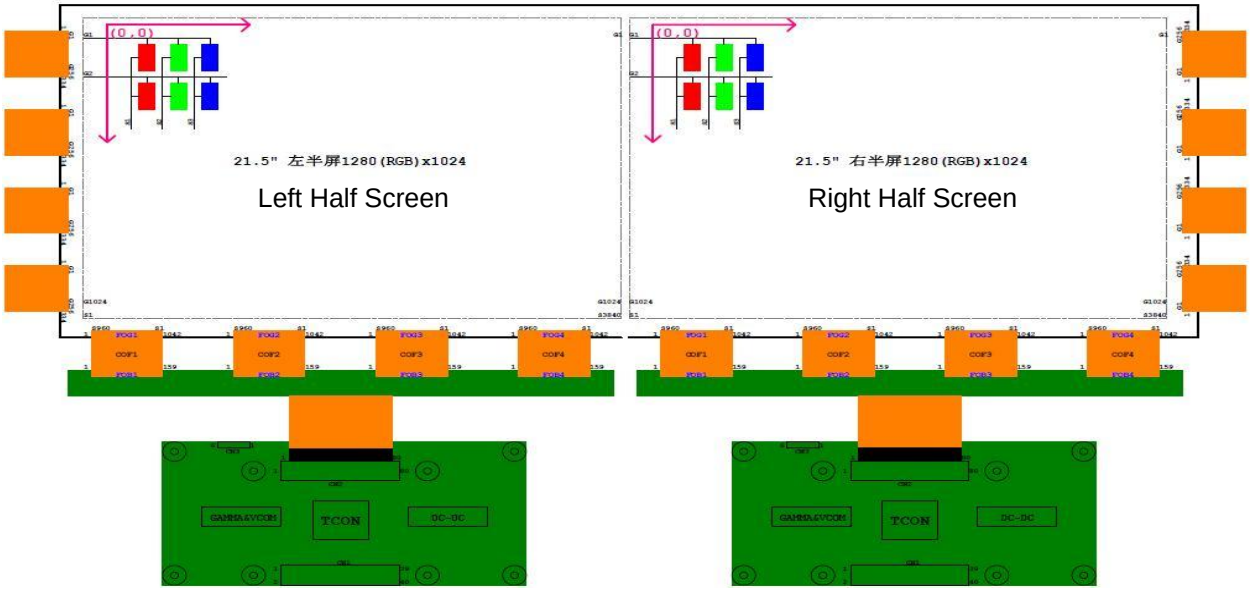
4.2 背光推荐驱动

Backlight Recommended Drive

VDD=3.3V,GND=AGND= 0V, TA= 25°C

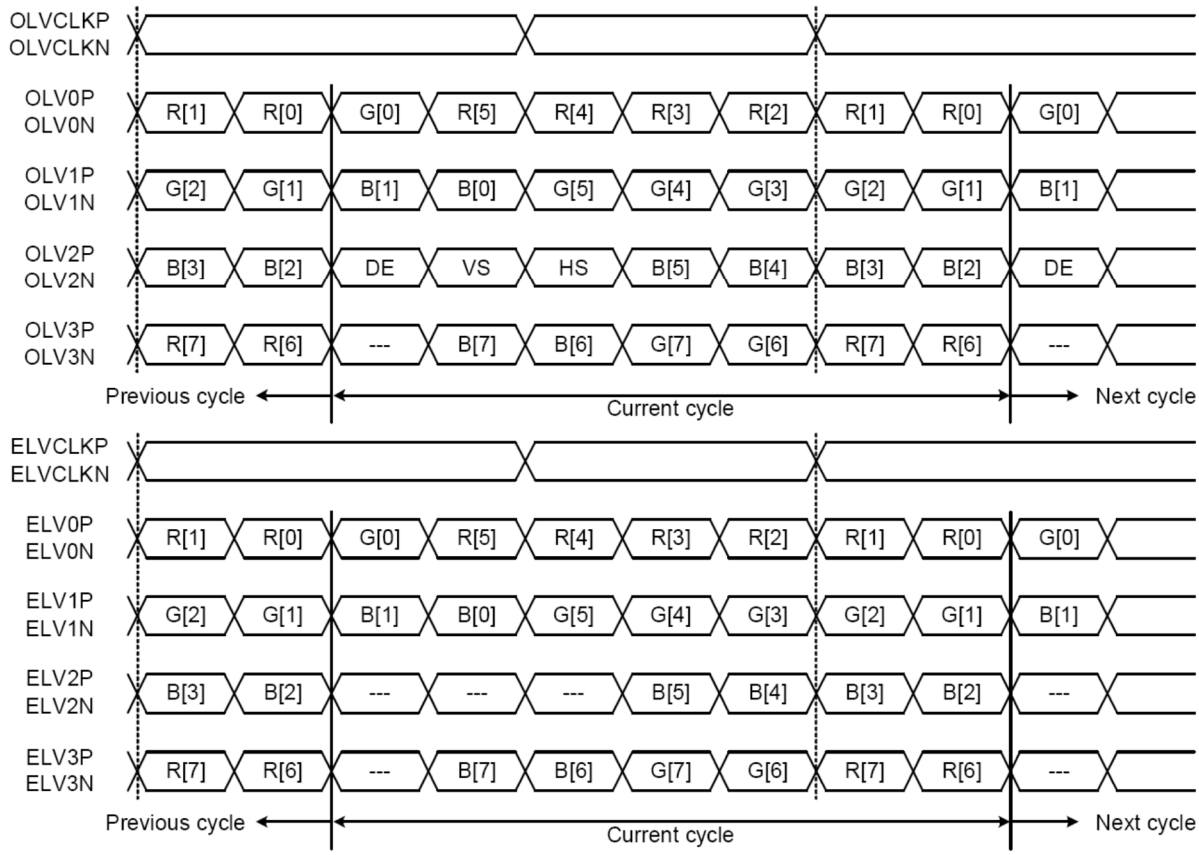
Parameter		Symbol	Min	Typ.	Max	Unit	Remarks
BL Supply Voltage		V_{BL}	11	12	26	V	Input Voltage for LED Driving Board
EN Threshold Voltage	Low	V_{ENL}	-	-	0.4	V	
	High	V_{ENH}	1.5	-	-	V	
PWM Threshold Voltage	Low	V_{PWML}	-	-	0.35	V	-
	High	V_{PWMH}	2.7	-	-	V	
Input Signal (SDA/SCL)	Low	V_{IL}	-	-	$0.2*V_{DD}$	V	-
	High	V_{IH}	$0.8*V_{DD}$	-	-	V	
Power Consumption		P_{BL}	-	36	48	W	

4.3 原理框图 Block Diagram



5 时序图 Timing Diagrams

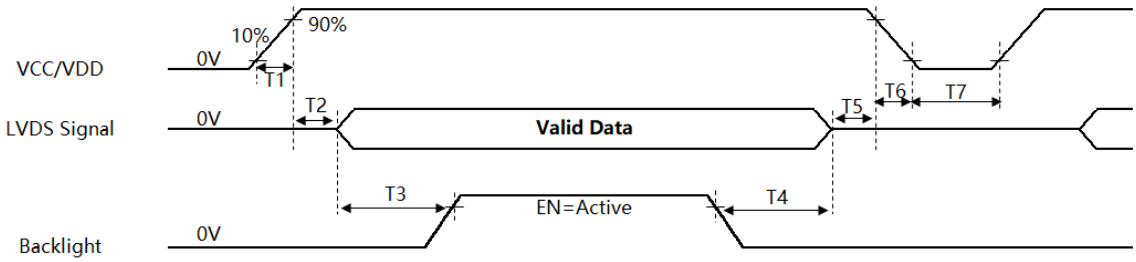
5.1 LVDS 输入模式数据排部图（VESA 模式） LVDS Input Mode Data Layout (VESA Mode)



5.2 液晶显示屏时序参数 LCD Timing Parameters

Parameter		Symbol	Min	Typ.	Max	Unit	Remarks
DCLK Frequency		Fclk	-	108	-	MHz	-
Frame Rate		-	-	60	-	Hz	-
HSYNC	Hsync Total DCLK	H_Total	-	1484	-	DCLK	-
	Hsync Display Area	HACT	1280			DCLK	
	Hsync Front Porch	HFP	-	48	-	DCLK	-
	Hsync Back Porch	HBP	-	228	-	DCLK	-
	Hsync Pulse Width	HPW	-	112	-	DCLK	
VSYNC	Vsync Total Line	V_Total	-	1066	-	H	-
	Vsync Display Area	VACT	1024			H	-
	Vsync Front Porch	VFP	-	1	-	H	-
	Vsync Back Porch	VBP	-	38	-	H	-
	Vsync Pulse Width	VPW	-	3	-	H	-

5.3 电源开关时序 Power On/Off Sequence



Symbol	Min.	Max.	Unit	Symbol	Min.	Max.	Unit
T1	0.5	10	ms	**T5**	0	80	ms
T2	0	80	ms	**T6**	-	10	ms
T3	200	500	ms	**T7**	500	-	ms
T4	200	500	ms				

6 光学参数 Optical Parameters

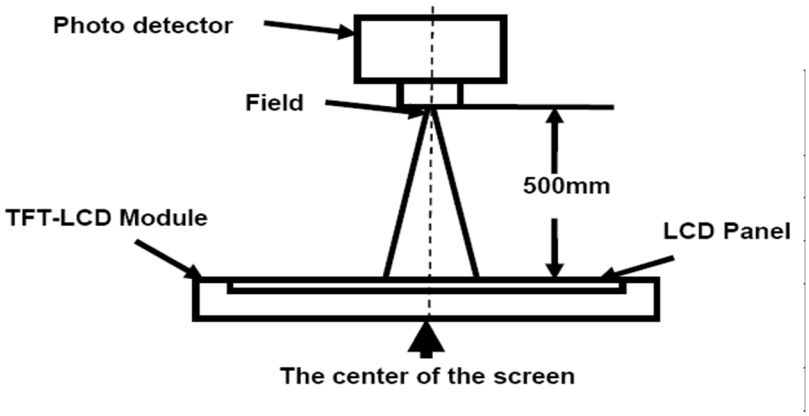
Parameter		Symbol	Condition	Min	Typ.	Max	Unit	Remarks
Viewing Angle		θT	CR≧10	70	80	-	Degree	备注 2
		θB		70	80	-		
		θL		70	80	-		
		θR		70	80	-		
Contrast Ratio		CR	θ=0°	600	1000	-	-	备注 1 备注 3
Response Time		T_{ON}	25℃	-	13	Ton + Toff ≤40ms	ms	备注 1 备注 4
		T_{OFF}		-	12			
Chromaticity	White	x		0.245	0.295	0.345		备注 1 备注 5
		y		0.280	0.330	0.380		
	Red	x		0.565	0.615	0.665		
		y		0.270	0.320	0.370		
	Green	x		0.240	0.290	0.340		
		y		0.575	0.625	0.675		
	Blue	x		0.100	0.150	0.200		
		y		0.020	0.070	0.120		
Luminance Uniformity		U	-	-	75	-	%	备注 1 备注 6
Color Gamut		NTSC	-	60	68	-	%	备注 5
Brightness		L	-	900	-	-	cd/m2	备注 1

测试条件：

1. 测试的液晶显示模组样品应该被放置在室内温度环境下（Ta=25±2℃，湿度=50±5%)。
   Samples must be placed at room temperature (Ta=25±2°C, Humidity=50±5%).
2. 以上光学参数应该在液晶显示模组工作在暗室下(≤1 lux)亮度稳定 20 分钟后再进行测量，稳定的亮度是指白画面亮度。
   Measurements taken in a dark room (ÿ1 lux) after 20 minutes of stable operation (white screen).
3. 以上光学参数应该在被aptus定义的优化过的驱动条件下进行测量。
   Parameters measured under Aptus-optimized driving conditions.

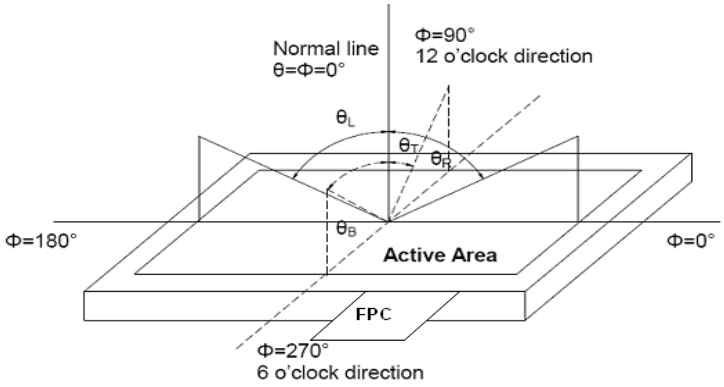
备注 1：光学测量系统的定义. Optical measurement system definitions.

光学参数应该在暗室下，开机 5 分钟以后测量，在液晶显示模组面板的中心点测量光学性能，测量面板中心区域时，所有液晶显示模组面板的输入终端必须与地面平行。如下为光学测量系统的定义。



备注 2：视角范围和测量系统的定义 Viewing angle ranges and measurement definitions.

在液晶显示模组面板的中心点测量视角。如下为视角的定义。



备注 3：对比度的定义 Contrast Ratio = White Screen Brightness / Black Screen Brightness.

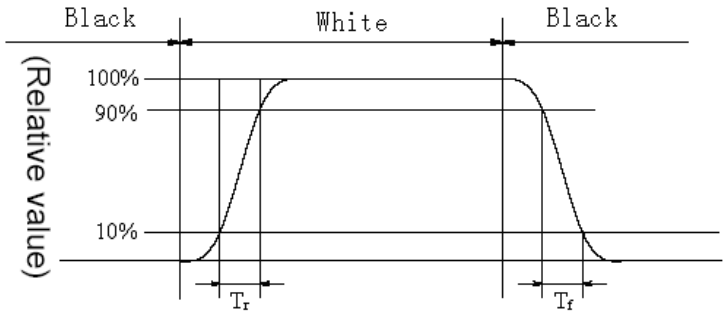
对比度=液晶显示模组在白画面下测试的亮度÷液晶显示模组在黑画面下测试的亮度。

“白画面”：液晶显示模组在白态电压驱动下的状态

“黑画面”：液晶显示模组在黑态电压驱动下的状态

备注 4：响应时间的定义 Response Time (TON + TOFF)

响应时间为液晶显示模组在白画面和黑画面之间切换的区间时间，上升时间(TON)是指画面探测器探测到画面输出强度从 10%改变到 90%的时间。下降时间(TOFF)是指画面探测器探测到画面输出强度从 90%改变到 10%的时间。



备注 5：色度的定义（CIE1931）

色坐标应该测量液晶显示模组的中心点。Chromaticity measured at the center point.

备注 6：亮度均一性的定义 Luminance Uniformity = (Min Brightness / Max Brightness) × 100%.

显示区域被分为 9 个测量区域（参见图 1），测试白画面，每个测量点在每个测量区域的中心。

亮度均匀性（U）=最小亮度/最大亮度

L-显示区域长度，W-显示区域宽度

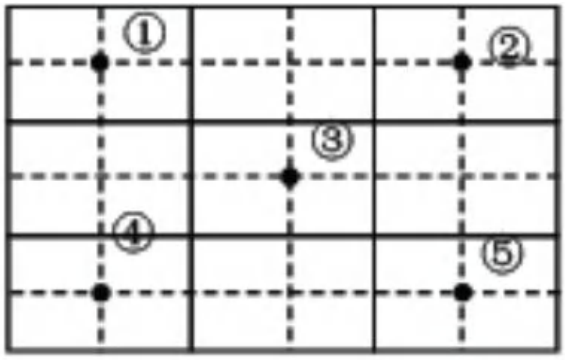


图1 均一性的定义

最大亮度：所有测量位置的最大亮度

最小亮度：所有测量位置的最小亮度

7 环境可靠性实验 Environmental Reliability Tests

1	高低温工作循环	高低温工作循环 10 次。 低温-30℃ 2 小时，高温 70℃ 2 小时，低温开始。	GB2423.4
2	极限高温工作	高温工作 85℃ 10 分钟。	GB2423.2
3	高温存储	高温存储 80℃, 24 小时。	GB2423.2
4	低温存储	低温存储-40℃, 48 小时。	GB2423.1
5	绝缘耐压测试	绝缘试验电压加在（a）互相 短接的对外接线端子和插座(头)芯子对 PE 地；(b) 相互绝缘的各电路之间。 绝缘电阻采用直流 500V 兆欧表进行测试并记录。 耐压试验采用 50Hz 的交流电压。通过逐渐升压， 将试验电压加到装置上，并在 1000V 电压等级 上保持 1min。	绝缘耐压试验应满足 GB/T25119-2010《轨道交通机车车辆电子装置》中 12.2.9 节中试验电压正弦方均根值 1000V 要求。
6	振动测试	振动频率：10~55Hz，振幅：1.5mm 扫频循环：10Hz~55Hz~10Hz，X.Y.Z.每个方向各 2 小时（一共 6 小时）	GB/T2423.10—1995

备注 1： Ts 是指被测试的液晶显示模组正反表面的温度(包括液晶显示模组自发热)。Ta 是指大气温度；

备注 2： 以上所有的可靠性实验项目是一个串行实验，但每一块液晶显示模组只允许做一次串行实验；

备注 3： 在可靠性实验以前，需判定完成所有的视觉检查，应在本规格书中定义的测试条件下测试完成所有的光学参数；

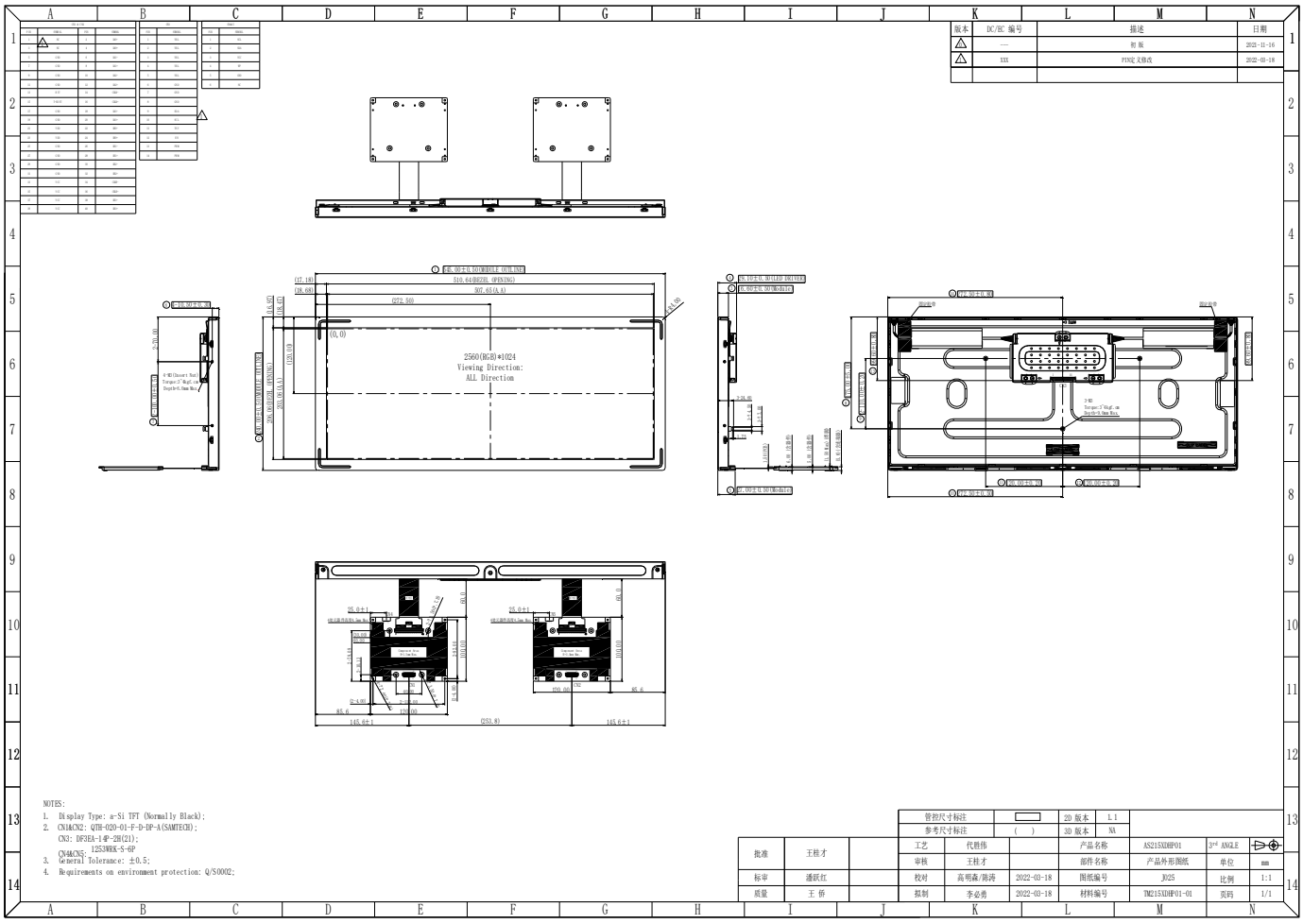
备注 4： 在可靠性测试期间，不允许新的功能性不良，诸如无显，完整点缺，亮线，液晶气泡等，其他问题可忽略；

备注 5： 可靠性实验以后，液晶显示模组样品应该被放置在室温环境中（Ta=23±2℃，Ts≤35℃，湿度=50±5%，大气压=86~106KPa）60 分钟，再进行视觉检查和光学参数测试，不允许新的功能性不良，诸如无显，完整点缺，亮线，液晶气泡等，光学参数允许改变≤20%，MURA 和小碎亮点应该在 IIS (入厂检验规范) 定义的检测环境 (ND filter5%、检验目视距离 50±5cm 等) 下不可见，其他问题可忽略。

No.	Test Item	Conditions	Standard
1	Temperature Cycling	-30°C (2h) → 70°C (2h), 10 cycles	GB2423.4
2	High-Temperature Operation	85°C for 10 minutes	GB2423.2
3	High-Temperature Storage	80°C for 24 hours	GB2423.2
4	Low-Temperature Storage	-40°C for 48 hours	GB2423.1
5	Insulation & Withstand Voltage	- Insulation Resistance: 500V DC Megohmmeter - Withstand Voltage: 1000V AC, 1min	GB/T25119-2010
6	Vibration Test	Frequency: 10~55Hz, Amplitude: 1.5mm X/Y/Z axes, 2 hours per axis (total 6h)	GB/T2423.10—1995

1. Ts: LCD module surface temperature (including self-heating); Ta: Ambient temperature.
2. All tests are sequential; each module undergoes only one full sequence.
3. Pre-test checks: Visual inspection and optical parameter verification required.
4. No functional defects (e.g., dead pixels, bright lines) allowed during testing.
5. Post-test: Modules must stabilize at room temperature (Ta=23±2°C, Tsÿ35°C, Humidity=50±5%) for 60 minutes.

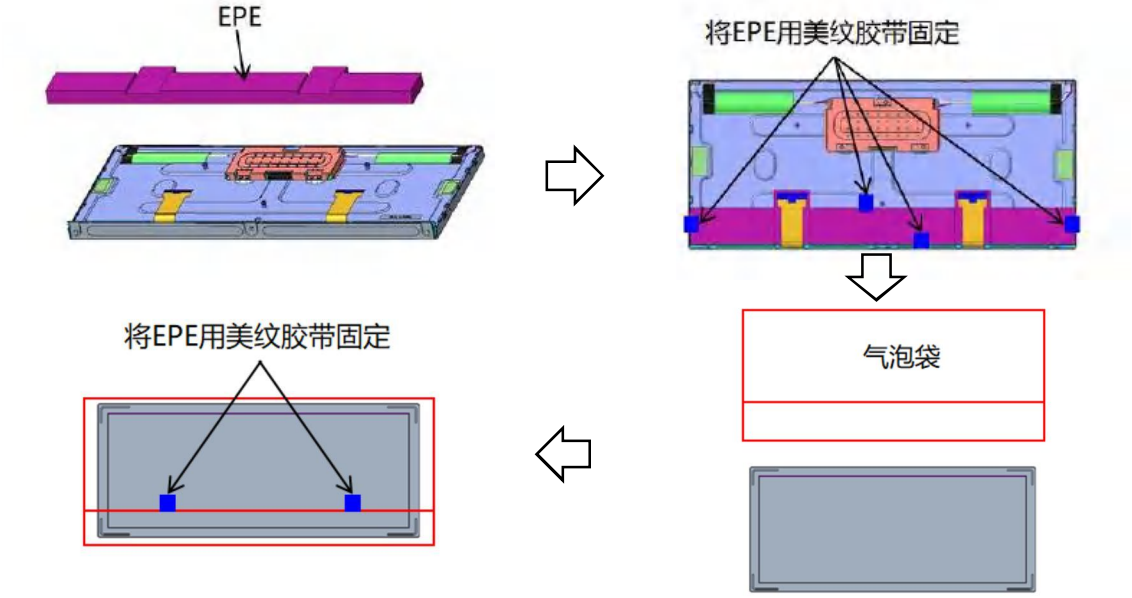
8 机构图 Mechanical Drawings



9 包装图 Packaging Diagram

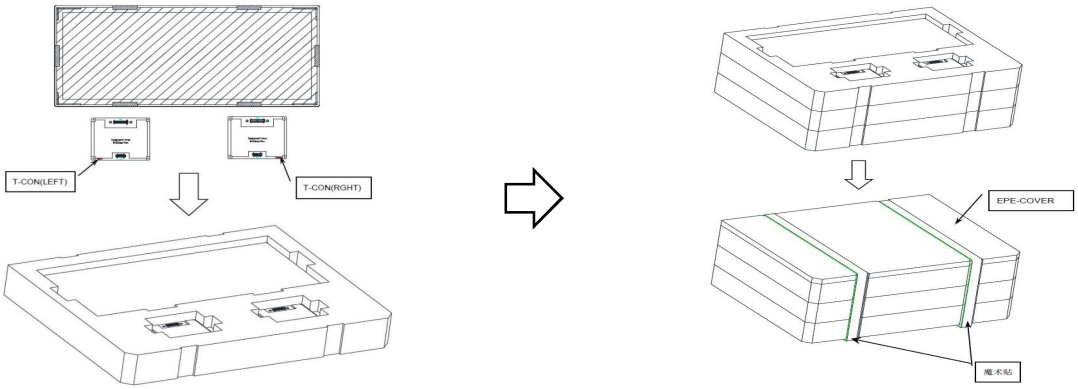
A. 将 EPE 垫片用美文胶带固定在模组背面；Attach EPE pads to the module back using adhesive tape.

B. 按图示将模组装入防静电气泡袋中，并用美纹胶带封口；
Place the module into an anti-static bubble bag and seal with tape



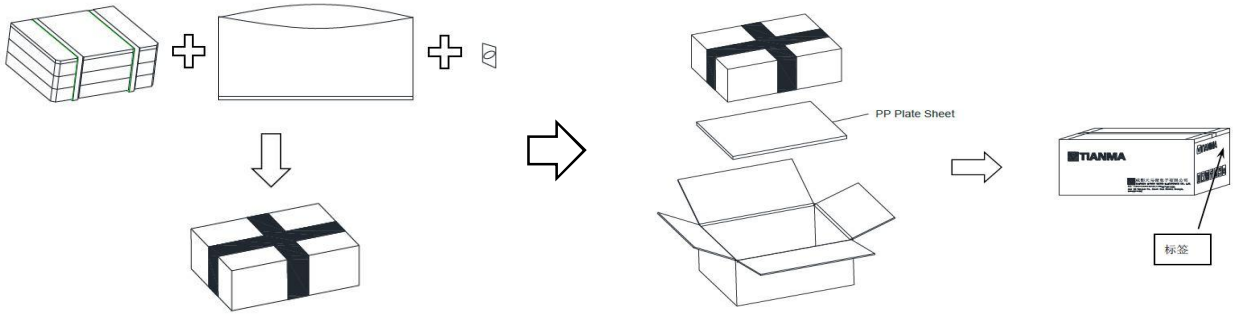
C. 将模组、T-CON 板×2pcs 装入 EPE-BOX 内；Insert the module and 2× T-CON boards into an EPE box.

D. EPE-BOX 堆叠 3 层，盖上 EPE-COVER，并用魔术贴束紧；
Stack 3 layers of EPE boxes, cover with EPE lid, and secure with Velcro straps.



E. 将魔术贴束紧的组件放入防尘袋中，把干燥剂分别放入角落的空格里（2*3=6 包），胶带封口；
Place the packed unit into a dust-proof bag with desiccant (6 packs). Seal the bag.

F. 在纸箱内先放入1pcs PP板，然后将STEP E的半成品放入纸箱内，封箱并贴附纸箱标签；
Place a PP board inside the carton, insert the packed unit, and seal the carton with labels.



10 液晶显示模组使用注意事项 LCD Module Usage Notes

10.1 Handling Precautions

1) The display panel is made of glass. Avoid dropping or mechanical shocks.

2) If liquid crystal leaks, avoid contact with skin or ingestion. Wash immediately with soap and water.

3) Do not press hard on the display surface to prevent discoloration.

4) The polarizer is soft and scratch-prone. Handle with care.

5) Clean the surface with isopropyl alcohol or ethanol. Avoid water, ketones, or aromatic solvents.

6) Do not disassemble the module.

7) Do not apply input signals when power is off.

8) Anti-static measures:

Ground yourself and tools during handling.

Avoid dry environments.

Peel protective film slowly to minimize static.

10.2 Storage Guidelines

1) Avoid direct sunlight or fluorescent light exposure.

2) Storage conditions: Temperature=0°C~40°C, Humidityÿ80%.

3) Store in acid/alkali-free, non-corrosive environments.

10.3 Transportation Precautions

Avoid drops, shocks, moisture, pressure, and direct sunlight during transit.