Specification

Model	JOINTLY-3S1512-01

Version 1.1　　2021.02.01

Customer Approval

深圳市麒墅科技有限公司

批准 Approved	营业**确**认 Checked by Sales Dept.	标**准化**审**核** Standard Checked	**技**术**确**认 Checked by Technical Dept.	**制作** Prepared
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变**更履**历
Revision History

版本 Rev.	日期 Date	变更前 Previous	改进 Revised	备注 Remark
1.0	2019-03-01	(初版) Original Release	--	
1.0.1	2019-05-11		1.0	Add constant frequency voltage regulation
1.1.0	2020-03-8		1.0.1	
1.1.1	2020-07-8		1.1.0	Upgrade the resonant capacitor, 50V to 100V, improve the sensing distance
1.2	2021-02-01		1.1.1	Increased voltage detection

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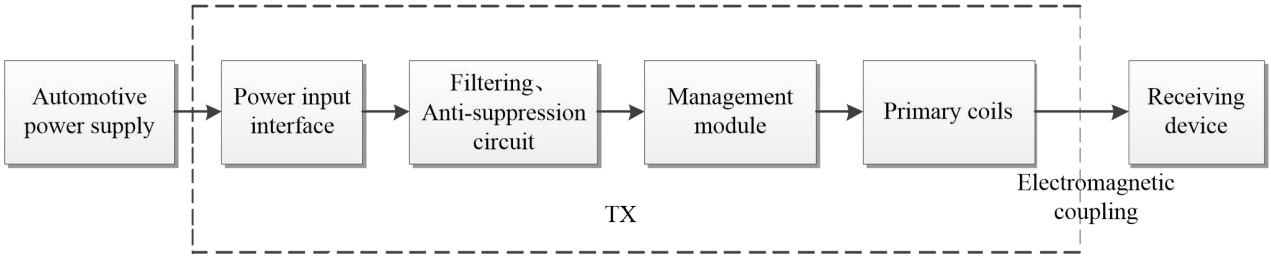
1. 无线充电模块简述 Wireless charging module brief

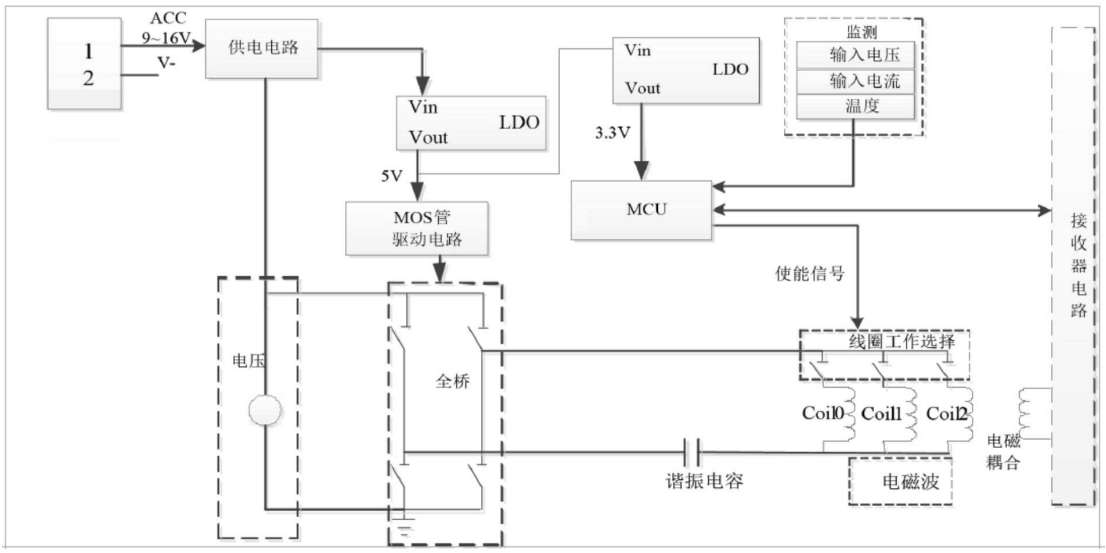
此手机无线充电发射模块，适用于 12V 电源系统。此模块采用 ST 公司的芯片,WPC Qi 标准，MP-A6 三线圈。 芯片内置了 FOD 保护功能，即发射功率减去接收端 RX 回传的有效功率数据，就近似得到寄生金属发热损耗功率的大小。通过设定 FOD 的保护门限，间接限 制了手机寄生金属损耗的温升值。

The phone wireless charging transmitter module applies to 12V power system. This module uses ST's chip, WPC Qi standard, MP-A6 three coils. chip built-in FOD protection function, transmit power minus the effective power data of receiving end RX return, approximated get parasitic heat loss power. By setting the FOD protection threshold, indirectly limit the phone parasitic loss temperature rise.



wireless charging system block diagram

2. 电路原理框图 Circuit block diagram



此产品能在 9V～16V 的电压范围内工作。同时供电电路需要增加滤波、抗抑制、过压、过流保护、防反接功能。

This product can work in the voltage range of 9V- 16V. At the same time power supply circuit needs to increase filtering, anti-suppression, overvoltage, overcurrent protection, anti-reverse function.

3. 电气连接 Electrical connection

引脚序号定义 Pin number definition

引脚定义表

脚位 PIN	功能 Function	说明 Description	规格 Specification
1	V+	电源正 VCC	耐压（Voltage resistance）：-25V～+25V
2	V-	电源负 GND	

4. 基本参数 Basic parameters

符号 Symbol	描述 Description	条件 Conditions	Min	Typ	Max	单位 Unit
输入特性 Input characteristics						
V_{in}	工作电压 Working Voltage	CHARGING	9	12	16	V
I_{in}	工作电流 Working current	CHARGING	0.12	0.7	2.5	A
I_{pc}	待机电流 Standby current	PING	10	20	40	mA
I_{sc}	静态电流 Quiescent Current	ACC 关断 ACC turns off		0	0.1	mA
输出特性 Output characteristics						
P_{out}	输出功率 Output Power			5	15	W
系统特性 System characteristics						
η_{peak}	最大转换效率 Maximum conversion efficiency	负载≥3W Load≥3W	60	68	80	%

Fs	工作频率 working frequency	CHARGING	110		205	KHz
温度特性 Temperature characteristics						
T_o	工作温度 Working temperature		-40	25	85	℃
T_s	储存温度 Storage temperature		-55	25	105	℃
T_r	充电温升 Chargingtemperature rise	环境温度 25℃ Environment temperature 25℃		10	15	℃

5. 关键特性 Wireless charging module characteristics

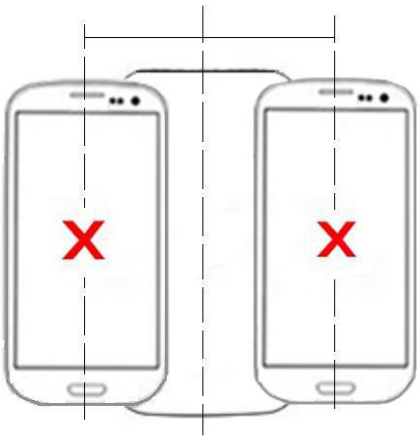
9V～16V 供电	9V ~ 16V power supply
WPC Qi1.2 标准	WPC Qi1.2.4 standard
MP-A6 三线圈	MP-A6 type three coils
过电压保护(OVP)	Over voltage protection
过电流保护(OCP)	Over current protection
过温度保护(OTP)	Over temperature protection
FOD 保护	Foreign Object Detection (FOD) protection
LED 灯显示充电状态	LED display charging status
电源转换效率最高80%	Energy Convert Efficiency 80%

6. 系统性能参数 System performance parameters

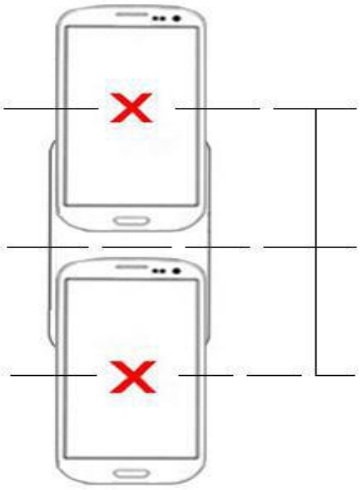
输入电压范围 Input voltage range	DC 9V～ 16V
输入电流 Input current	45mA ～ 2500mA（MAX） （VIN = 12 V）
待机电流 Standby current	＜50mA。（VIN = 12 V， typical values around35 mA）
输出功率 Output power	15W（MAX）
最大转换效率 The maximum conversion efficiency	80%（常温 25℃环境下测试，用稳压源读取输出电压、电流，用电子负载读取负载功率值，然后进行计算。25℃ environment temperature test. We use the regulator to read the output voltage and current, and the electronic load to read the load power value, then calculated）
无线充电标准 Wireless charging standard	WPC Qi1.2.4
发射频率 Transmission frequency	110kHz～ 205kHz
无线充电 Z 轴距离 Wireless charging Z-axis distance	外壳表面 0mm～ 6mm (max)（过 Qi 认证，不建议增厚。As the product

线圈类型 Coil Type	MP-A6 三线圈 MP－A6 type three coils
FOD 寄生金属损耗设定 FOD parasitic losses set	按Qi1.2.4 标准设定寄生金属损耗，大于此额外损耗就关闭充电。 Setting parasitic losses according to Qi1.2.4 standards, off the charge when greater than the additional losses.
保存温度 Storage temperature	-55°C～ 105°C
工作温度 Working temperature	-40°C～85°C（无线充电器端可以满足此温度范围，但是手机是消费类产品，不支持高温工作，手机锂电池不能高于 60°C。 Wireless charger ends meet this temperature range, but the phone is a consumer product, do not support high temperatures operation, cellphone lithium
自由充电面积 Free charging area	70mm × 30mm
PCB 尺寸 PCB size	97mm×55mm
外形尺寸 Dimensions	132.1 mm×73 mm×21mm
保护功能 Protection	有过流保护、过压保护、短路保护、过热保护。Over current protection, Over voltage protection, Short circuit protection, Over temperature protection.
充电状态指示 Charging status prompt	白、兰 LED 灯指示充电状态。white and bule LED lights indicate charging status.
环保方面 Environmental protection	满足 RoHS 要求。 Meet the RoHS requirements.

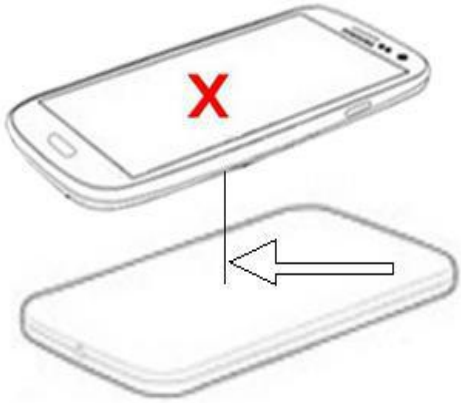
7. 有效工作区域Effective working area



X 轴可移动区域:-15mm~15mm， X-axis chargeable area：-15mm~15mm



Y 轴可移动区域：-35mm~35mm， Y-axis chargeable area：-35mm~35mm



Z 轴可移动区域：外壳表面 0mm~8mm， Z-axis chargeable area：Shell surface 0mm~8mm

8. 控制逻辑Control logic

LED 灯指示逻辑状态：

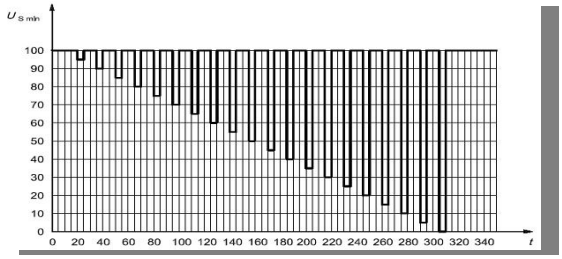
LED lights indicate logical status：

LED 颜色 LED color	LED 运行状态 LED operating status					
	待机 Standby	充电 Charging	充电完成 Charging completed	FOD 故障 FOD fault	TX 端故障 TX fault	RX 端故障 RX fault
White light	open	close.	close.	Slow flicker	Slow flicker	Slow flicker
Orchid lantern	close.	open	Slow flicker	close.	close.	close.

9. 可靠性试验 Reliability Test

9.1 电子硬件可靠性 Electronic Reliability

9.1.1 工作电压测试 Working Voltage Variation Test	(1)调好直流电源的输出电压9V或16V后（用万用表确认电压），再给样品通电（允许在工作过程中直接调节直流电源）； Set 9V and 16V of voltage before test; (2)试验中开关机10次并检查各功能状态。 Testing check each function status.
9.1.2 供电电压的缓慢升降测试 Voltage Slow- Up And Down Test	(1)样机电源正、负两端接上DC电源正、负两端； Connect to DC power of positive and negative; (2)以(0.5±0.1)V/分钟的速度调整样品所有与电源相连的接口的供电电压从0V到16V,然后以相同的电压变化速率(0.5±0.1)V/分钟，从16V逐步降低样品的供电电压到0V，在这一过程中对样品的功能进行检查； Adjust the voltage from 0V to 16V at (0.5±0.1)V/min, then at same rate from 16V to 0V, and check all functions during the process;
9.1.3 过压测试 Overvoltage Test	将DC电压调到18±0.2V，达到持续时间60min后，将样品的供电电压调整回14V，并对样品的功能进行检查；然后将电压调到24±0.2V，持续60s后，将样机电压调到14V，并对样品的功能进行检查。 Adjust DC voltage to 18±0.2V, after 60min, adjust to 14V, then test the sample function;Adjust DC voltage to 24±0.2V, after 60s, adjust to 14V, then test the

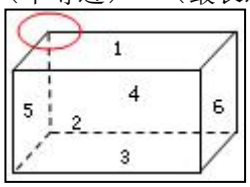
	sample function.
9.1.4 电源反接测试 Reverse Connection Test	将DC电压调到14±0.1V，达到持续时间60s后,将样品的供电电压调回正相14V，并对样品的功能进行检查。 Adjust DC voltage to 14±0.1V, after 60s, adjust to 14V, then test the sample function.
9.1.5 端子短路测试 Port Short Circuit Test	(1)样机电源两端连接到DC=14V的直流电源上，并开机; Connect to power DC=14V, then turn on; (2)其他所有输入、输出端子分别到电源正极和电源地上，试验过程中可以通过操作启动或关闭样品正在短接的输入或输出,持续60S, 并对样品的功能进行检查。 Connect all output/input terminals; Test time:60±6s , then test the sample function.
9.1.6 开路测试 Open Circuit Tes	(1)样机电源两端连接到DC=14V的直流电源上，并开机； Connect to power DC=14V, then turn on; (2)每次分别单独中断样品的每一个输入输出端子/插头10± 1s; Break off each input/output plug every time for 10±1s; (3)记录试验过程中样品所有的功能状态。 Record the sample function status during the testing.
9.1.7 电压下降测试 Voltage Reduction Test	按下图对样品电源施加规定的电压波形，并在规定的点上对样品的功能进行简单的检查。 Make specified voltage waveform as below diagram, and do test the function on specified point; 
9.1.8 绝缘电阻测试 Insulation Resistance Test	(1)样机在通电工作；The sample at work status; (2)测试电压：100V/500V DC；Test voltage: 100V/500V DC; (3)测试点：样品表面任意距离小于3.8mm的两点； The test orders: The sample surface is arbitrarily apart from more than 3.8 mm two positions; (4)记录测试点的位置和绝缘电阻值。 Record the position of test point and insulate electric resistance resistivity.
9.1.9 耐电压测试 Withstand Voltage Test	在完成湿热循环后对DUT的端子与端子间，端子与外壳间分别施加交流500Vrms(50 ～60 Hz)，持续60s。 After the damp heat cyclic test, apply a test voltage of AC 500Vrms(50 ～60 Hz) to DUT, between terminals ,terminal and housing for a duration of 60s.

9.2 结构件可靠性 Structure Reliability

9.2.1 拔插力测试 Plug & extract Test	(1)插头拔出力：对于卡扣的连接插座必须能承受住拔除和插入方向分别至少80N，持续时间5分钟的拔除力和插入力而不能出现损伤； Cinch sockets shall be able to withstand a force of 100N during 5 minute; (2)插接器配合力：用50mm/min±10mm/min的速度插头完全插入插座，要求最大 的配合力≤75N Connector mating force: with 50mm / min ± 10mm / min speed plug is fully

	inserted into the socket, with the requirements of the largest force ≤75N

9.3 包装结构可靠性 Packing Structure Reliability

9.3.1 包装跌落测试 Package Drop Test	(1)产品在包装出货状态下进行试验,面跌落高度80cm;角、棱跌落高度60cm; In the package goods state for the test, face drop height 80cm; corner & edge drop height 60cm; (2)跌落顺序为六面三棱一角,跌落面按3-2-5-4-6-1的顺序进行;棱跌落顺序按〔最短边〕→〔中等边〕→〔最长边; 跌落角为样品固定部位的角;一面一次。  Drop sequence: Six faces three edges one corner ,face drop sequence:3-2-5-4-6-1;edge drop sequence: the shortest edge→the next longest edge→the longest edge; Corner for the sample fixed position angle; one side at a time.
9.3.2 裸机振动测试 Bare Unit Vibration Test	(1)按照规定的能量曲线进行振动试验；有效加速度为：31.5m/s^2，振动频率：10Hz至1000Hz。PSD参照司内规范。 Carry on a vibration to experiment according to the stipulated energy curve. (2)试验过程中通电开机，振动方向：X，Y，Z轴，每个轴向各8小时； In the process of test power on, the vibration direction: X, Y, Z axis, each axial every 8 hours; (3)试验后进行静态测试。After the test of static test.
9.3.3 包装振动测试 Package Vibration Test	(1)将整箱出货状态的样机安装于振动台面上施加正弦振动，加速度2.5G，扫描频率10～200Hz，扫描周期T=15Min，X\Y\Z方向各振动2H。然后进行静态测试；Acceleration:2.5G; Frequency range:10～200Hz; Cycle sweep: T=15Min; X\Y\Z aspect vibration 2H; (2)在包装状态下，三个垂直方向各振动两个频率范围，扫频次数为5次； Samples should vibrate from 3 directions in turn which are vertical as it transport status; (3)振动方向\X、Y、Z：表示已包装好产品的上下、前后、左右三个方向。 Vibration direction X、Y、Z : The carton up and down, front and back, left and right three direct.
9.3.4 机械冲击试验 Mechanical Shock Test	(1)样品按要求安装在试验台上； Samples were installed in the test table according to the requirements; (2)脉冲波形: 半正弦;加速度: 350m/s^2;冲击持续时间11MS，冲击6个方向，每个方向冲击10次； Pulse shape: half-sinusoidal; acceleration: 350m/s^2; duration:11MS; the impact of 6 direction, the impact of the 10 time in each direction; (3)观察试验中和试验后样机外观及功能是否正常。 The appearance and function of test and test prototype is normal.

9.4 环境适应性 Climatic Test

9.4.1 高温运行试验 High	(1)将放入试验炉并通电，待温箱温度升到+80℃再开机工作试验96小时； On temperature+80 ℃ continuous working for 96 hours; (2)检查外观 Appearance inspection：面壳应无不良；

Temperature Operation Test	Appearance inspection: Before the test, check appearance and sure it is normally; (3)试验完成后在常温下放置1小时后再做一般功能检查。 After test, place the sample in room temperature for 1 hours then normally function test.
9.4.2 低温运行试验 Low Temperature Operation Test	(1)额定电压状态，将产品以未包装状态放在试验箱内（电源OFF状态下）先冷藏2小时后，再通电进行低温启动检查；之后将产品放在试验箱内（电源ON状态下）连续负荷工作24小时在低温-40℃条件下； Power off and store for 2 hours + power on and on temperature -40℃ continuous working for 24 hours; (2)检查 外观：面壳应无不良； Appearance inspection: Before the test, check appearance and sure it is normally; (3)试验完成后在常温下放置1小时后再做一般功能检查。 After test, place the sample in room temperature for 1 hour then normally function test.
9.4.3 高温保存试验 High Temperature Storage Test	试验前检查外观、功能正常，在裸机状态下置于环境箱内，温度设置+85℃，连续放置48小时。试验完成后在常温下放置2小时后再做一般功能检查。 Storage for 48 hours at 85℃, then check functions after 2 hours recovery.
9.4.4 低温保存试验 Low Temperature Storage Test	试验前检查外观、功能正常，在裸机状态下置于环境箱内，温度设置-40℃，连续放置24小时。试验完成后在常温下放置2小时后再做一般功能检查。 Storage for 72 hours at -40℃, then check functions after 2 hours recovery.
9.4.5 高温高湿工作试验 Steady Temperature Damp Test	试验前检查外观、功能正常，将产品处于通电开机状态置于45℃/90%恒温恒湿箱内48小时；试验完成后在常温下放置2小时后再一般功能检查。Temperature and damp pay respects to the test condition(45℃/90%) continuous working for 48 hours. Then check the appearance, structure and function after 2 hours' recovery.
9.4.6 高低温冲击试验 High And Low Temperature Shock Test	试验前检查产品外观、功能正常，将产品处于关机状态置于温度冲击箱内，温度85℃冲击1小时； -40℃冲击1小时为一个循环，转换时间5min，一个循环为2小时，共作20个循环。试验完成后在常温下放置2小时后再做一般功能检查。 Power off and store in 85℃ for 1 hour + store in -40℃ for 1 hour + air exhaust for 5min,repeat 20 cycles，then check the appearance, structure and function after 2 hours' recovery.

10. 散热可靠性 Thermal reliability

10.1 温度分布试验 Temperature distribution test	(1)将待测样机放入密闭试验箱，满负荷工作2小时； Put the DUT into the test box, operate at full capacity for 2 hours; (2)检查、对比样机发射线圈表面工作前、后的温度分布情况。 Check and compare the temperature distribution of transmitter coil surface before and after working.

11. 寿命测试实验 Aging test

11.1 寿命测试试验（连续工作 1000 小 时） Aging test	(1)将待测样机放在试验台上，满负荷工作1000小时； Put the DUT into the test bench, operate at full capacity for 1000 hours; (2)使用工控机监测样机工作情况； Use industrial computer to monitor the working condition of the DUT； (3)老化测试结束后，检测样机功能。 Check the function of the DUT,after the aging test.

12. 线圈规格Coil specifications

12.1 线圈参数 Coil parameter

测 试 条 件 Test Condition

项 目 Item	规 格 Specification
温 度 Temperature	25℃
湿 度 Humidity	65±20%
频 率 Frequency	110KHz~205KHz

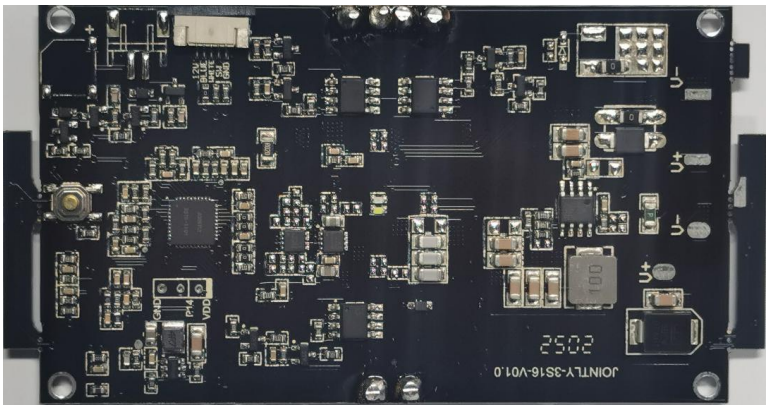
测 试 项 目 Test Project

项 目 Item	规 格 Specification
电 感 L	12.5uH±10%； 11.5uH±10%
电 阻 Resistance	DCR 65mΩ±20%

说 明 Description： (1) 测 试 仪 器 为 ： LCR 测 试 仪 。 Test equipment: LCR tester.

(2) 测 试 用 磁 芯 以 我 司 的 为 准 。 Magnetic core is based on our company.

14.2 线 圈 尺 寸 Coil Size



线圈实物图 Physical coil diagram

（单 位 unit： mm）

项 目 Item	A	B	C	D	E
规 格 specification	97 MAX	53.0±3.0	6.0 MAX	20.0±3.0	5.0±1.0

电 气 特 性 ：

GOTREND PN	Inductance (1 , 2) (uH)	Inductance (3) (uH)	DCR (1 , 2 , 3) (m Ohm)	Isat (A)	Irms (A)
GW975306PT - 12C12RTS	11.5 ±10%	10.5 ±10%	60.0 ± 20%	35.0 typ.	5.2 Max.