

Instructions for Power Supply Maintenance

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File Category: Maintenance Guide

Content of this Volume: It mainly describes the troubleshooting of various faults of the power supply APW7, and how to use the test tool for accurate positioning.

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I. Requirements on the Maintenance Platform

1. The constant temperature soldering iron above 80W (soldering temperature: 300-350°C). The tip soldering iron head is used for soldering chip resistors and capacitors. The blade type soldering iron head is used for soldering and replacement of plug-in components (soldering temperature: 380-420°C)
2. The thermal chimney is used for chip disassembly and soldering, be careful not to heat for a long time to avoid PCB foaming (soldering temperature: 260°C ±2 °C).
3. The AC controllable power supply voltage regulator (output 200-250V, can limit 0-20A current) is used for APW8 power-on inspection. If there is no such condition, a 100W ordinary light bulb can also be strung on the AC fire line with mains. Be careful. Power analyzer; used for PF value and power calculation test after power supply repair.
4. For electronic load (power 2KW, meet the voltage 0-50V), if there is no such condition, a resistive load that matches the APW7 can also be made.
5. The multimeter, suction gun, tweezers, test station surface has electrostatic protection (if there is condition, an oscilloscope can be configured).
6. Flux, lead-free tin wire, water for cleaning panel with anhydrous alcohol; water for cleaning panel is used to clean flux residue and appearance after maintenance.
7. Thermally conductive silicone grease (2500) is used to repair the thermal conduction between the MOS and the cooling fin, thermal conductive silicone (704 silica gel) is used for fixing and covering the glue damage at the original after the repair of the PCBA components

II. Requirements on Maintenance Operations

1. The maintenance personnel must have certain electronic knowledge, more than one year of maintenance experience, and a certain understanding of the working principle of switching power supply, and well master the soldering technology.
2. Before the product is opened and the PCBA panel is repaired, the large capacitor must be discharged, and the voltage must be measured with a multimeter (less than 5V discharge), and then the soldering operation can be performed! Be sure to confirm to avoid electric shock.
3. Pay attention to the working method when judging the circuit components. After replacing any device, the PCB panel has no obvious deformation, the soldering of bonding pad is reliable, and the replacement parts and the surrounding area have no problem such as insufficient parts, open circuit or short circuit.
4. After replacing the key components, the main circuit shall have no short circuit and other obvious abnormalities before the AC voltage test, otherwise there is a hidden danger of explosion.
5. It needs AC220V voltage to judge the circuit signal; pay attention to operational protection.

The following: Notes, key slogans

- Maintenance personnel qualifications must meet the specified requirements;
- Instruments and equipment used for maintenance must meet the specified requirements;
- The instruments and equipment for maintenance must be effectively grounded, and the maintenance environment must comply with anti-static requirements;
- Materials used for maintenance must meet the specified requirements; in order to guarantee the accuracy and traceability of the materials used for maintenance, the materials used for maintenance must be the production materials for the corresponding models, and the material replacement must be confirmed;

1. In order to prevent possible electric shock hazard, non-professionals should not disassemble the enclosure;
2. The maintenance personnel shall use a special enclosure opener to open the enclosure of power adapter and repair, to avoid damage to the internal components of the product;
3. After the product is opened, it is required to discharge the high voltage capacitor;
4. E-waste waste generated during product maintenance cannot be arbitrarily dropped;
5. Bad products must have a repair process card and indicate the cause of the failure, and placed separately;
6. The repaired products must be well marked to distinguish.
7. The repaired products must be placed in the repaired area and shall be systematically tested before they can be stored.

1. Principle overview

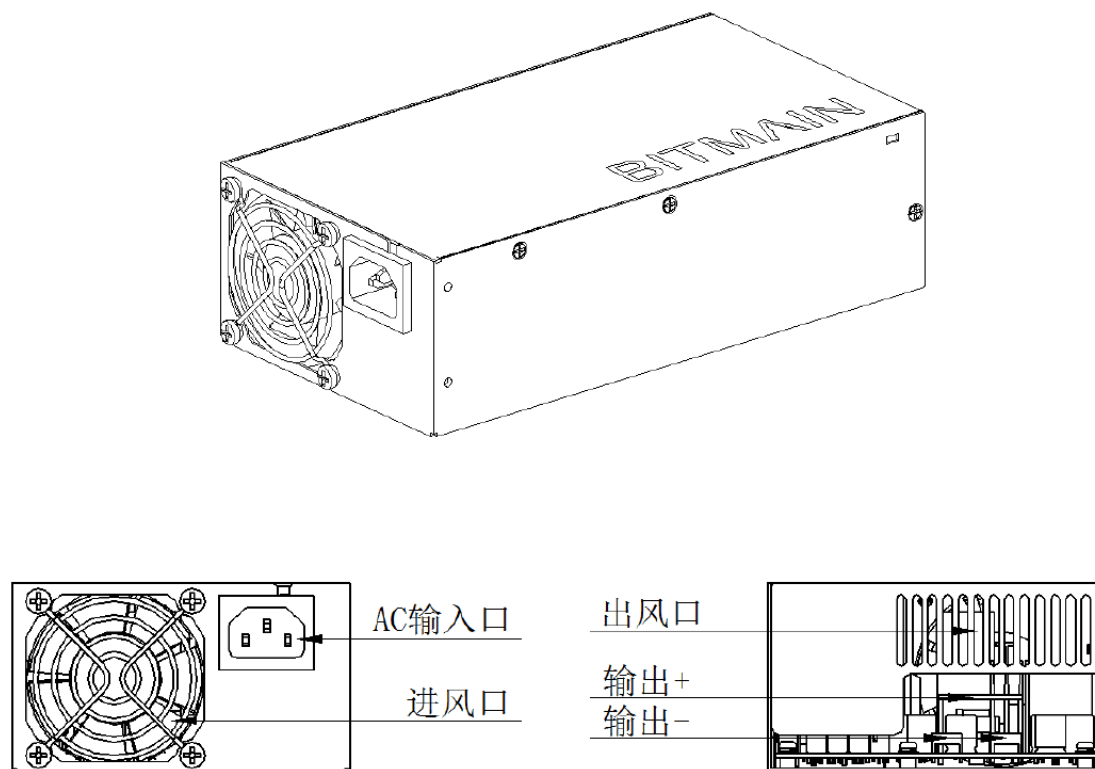
APW7 performance characteristics and scope of use

APW7 -12-1800 series power supply is a high-efficiency DC power supply designed and produced by our company, with single-phase AC input, single DC 12V output, and can meet the common DC load of 12V 1800W, especially suitable for circumstances with strict requirements for power supply of servers and mining machines; it has the following characteristics:

- ◆ 200-264V voltage input, power factor greater than 0.99 (full load)
- ◆ Maximum conversion efficiency up to 95% (without output line loss)
- ◆ Output ripple less than 1%
- ◆ Undervoltage, short circuit, overload, over temperature protection, automatic recovery after fault removal
- ◆ The use of high-quality devices ensures stable and reliable products through reasonable design, and can work at full load for a long time in a high temperature environment at 60°C or lower.
- ◆ Small size and high power and density

1.2 Appearance of APW7 Power Supply

APW7 电源外观介绍



APW7 电源外观介绍: Appearance of APW7 power supply

AC 输入口: AC input port

出风口: Air outlet

进风口: Air inlet

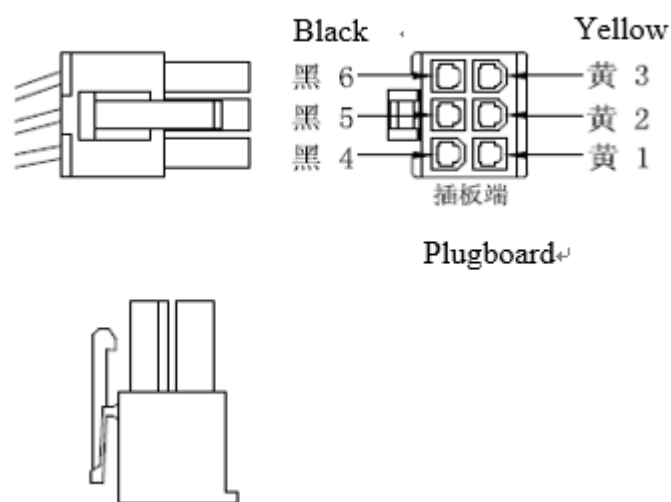
输出+: Output +

输出-: Output -



The model of the AC input terminal on the power supply front panel is C14, and the AC input cable of the C13 interface is required.
The power supply is equipped with an output line. The standard model output line contains a total of 10 PCIe output terminals with a line length of 380mm. Other output lines can be customized according to the actual needs of the customer.
The PCIe output terminal diagram is as follows:

The PCIe output terminal diagram is shown below :



The output line consists of two color lines, the 12V positive line is yellow, and the negative s line is black.

Definition of 6PIN PCIE terminal positive and negative poles:

Positive pole: yellow 1, yellow 2, yellow 3

Negative pole: black 4, black 5, black 6

1.21 The are following characteristics:

- ♦ 200-240V voltage input
- ♦ There is protection for undervoltage, short circuit, overload, over temperature, with automatic recovery after fault removal
- ♦ The use of high-quality devices ensures stable and reliable products through reasonable design, and can work at full load for a long time in a high temperature environment at 60°C or lower.
- ♦ Small size, high power density

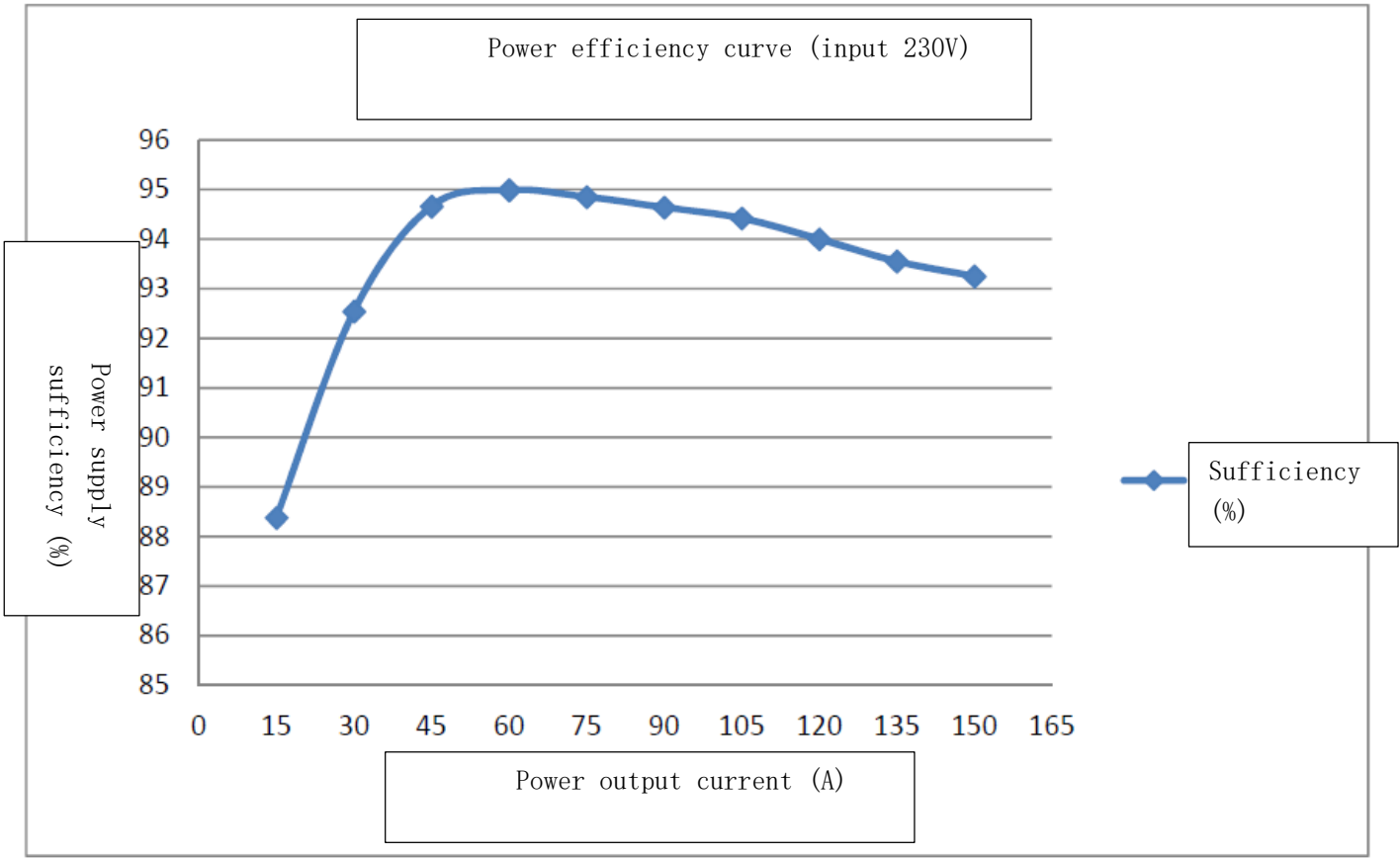
1.3 Parameters of APW8 Power Supply:

Output	DC voltage	12.0V
	Rated current (at 220V input)	150A
	Rated power (at 220V input)	1800W
	Rated current (at 110V input)	83.3A
	Rated power (at 110V input)	1000W
	Ripple and noise	<1%
	Voltage accuracy	12.0V---12.5V
	Source regulation rate	<1%
	Load regulation rate	<1%
	Startup, rise time	<2S
	Power down holding time	>10mS

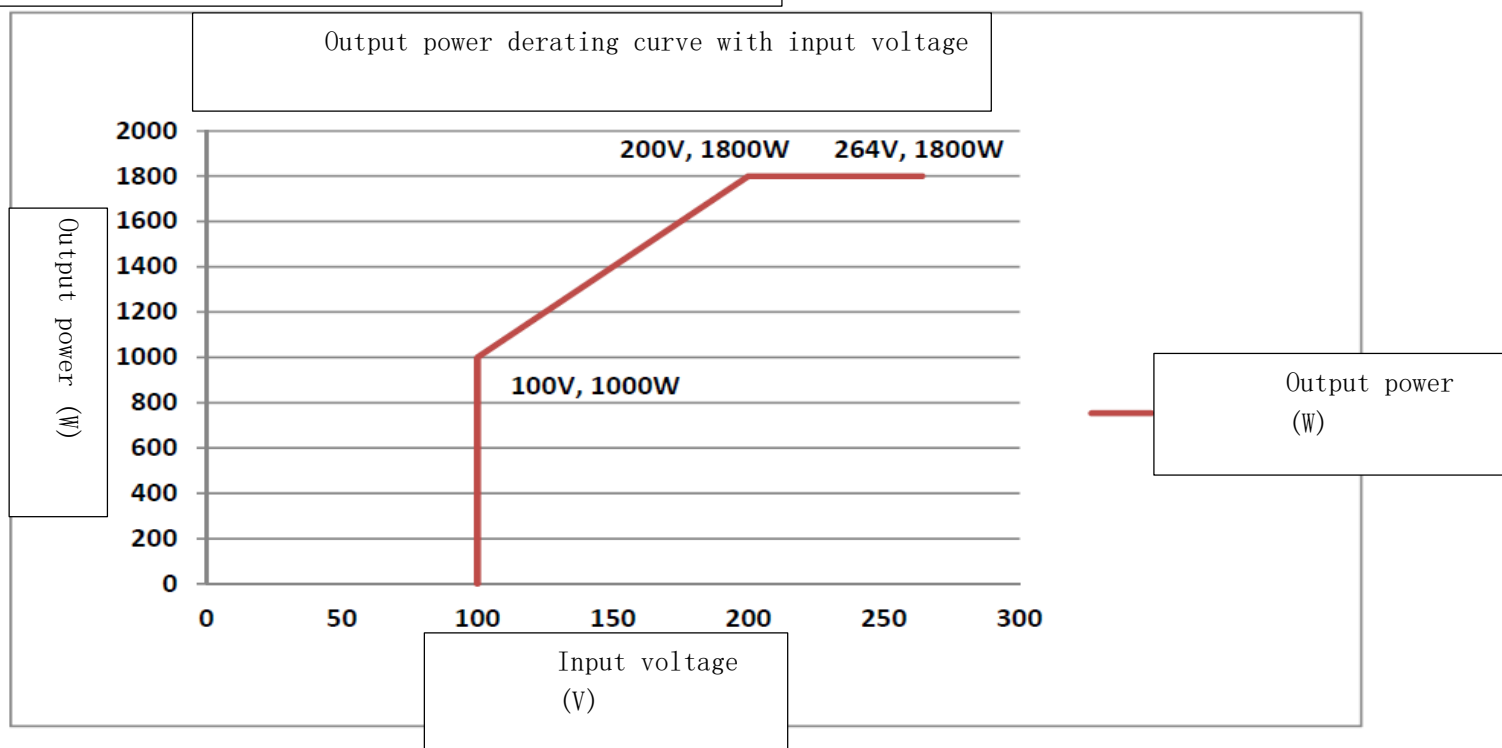
Input	Voltage range - for mining machine	200-264V AC
	Frequency range	47-63Hz
	Power factor	>0.99(full load)
	Leakage current	<1.5mA（220V 50Hz）
Protection	Input undervoltage protection value	80-89V AC
	Output short circuit	Yes
	Output overcurrent protection value	150-200A
	Over temperature protection	Yes
Environment	Operating temperature	-20-60℃
	Working humidity	20%-90%RH (no condensation)
	Altitude	Lower than 2000m
Structure	Size	206*110*62mm
	Net weight	2.0kg
	Cooling method	Forced air cooling
	Noise	43dBA

1.4 Voltage efficiency ratio

APW7 efficiency curve (excluding output line loss)



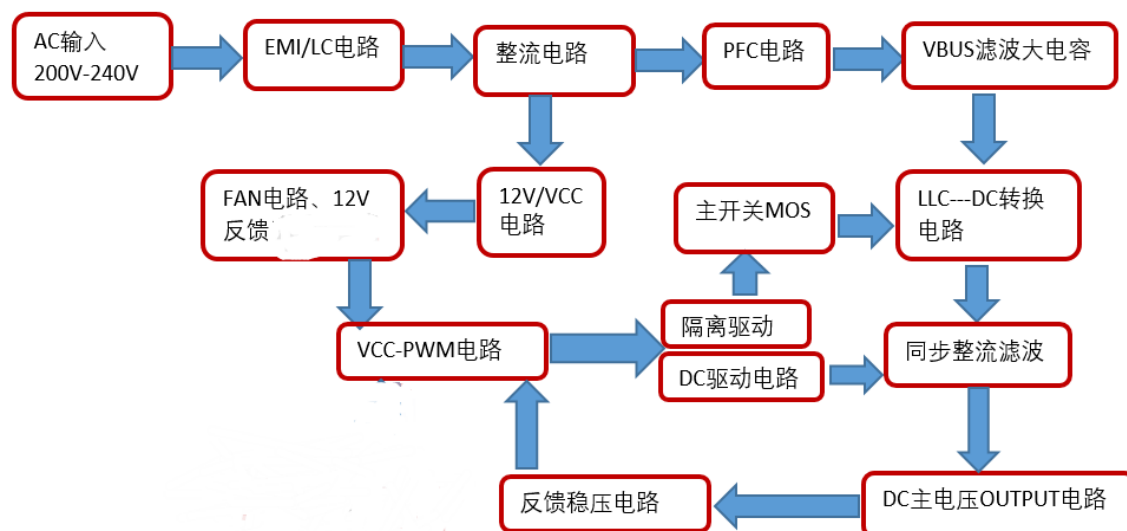
APW7 output power with input voltage derating curve



2. Maintenance ideas and cases of common faults

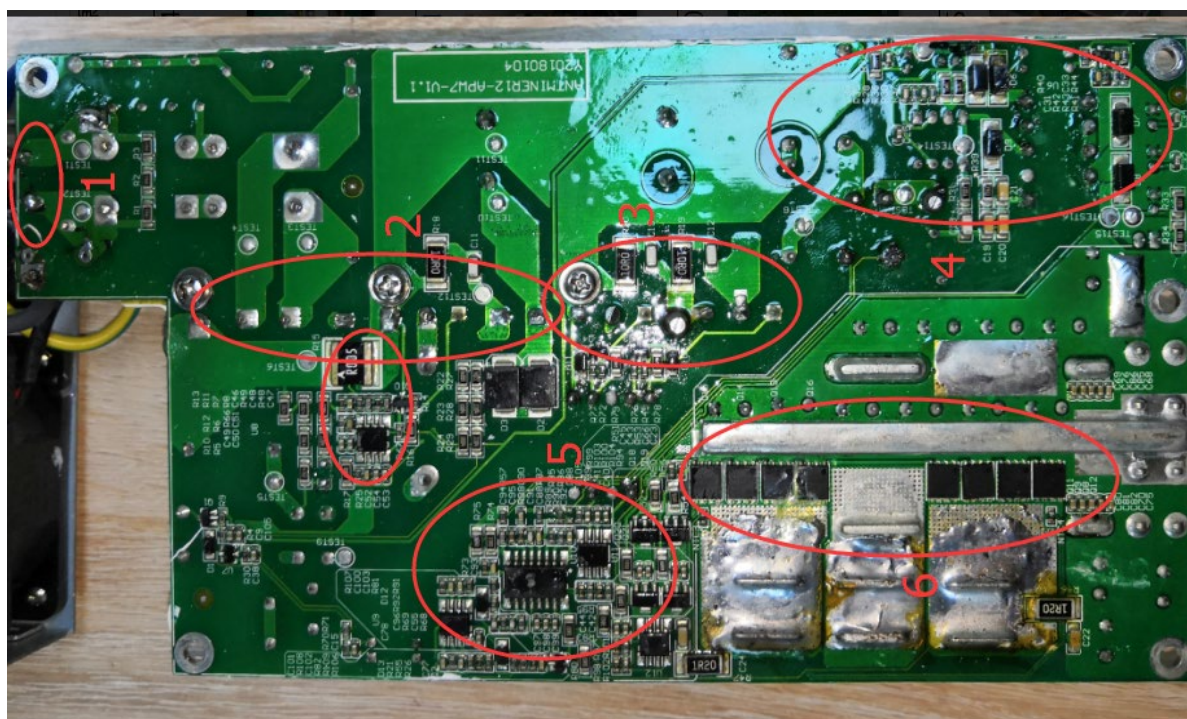
2.1 Block diagram for power basic principle

基本原理工作流程图

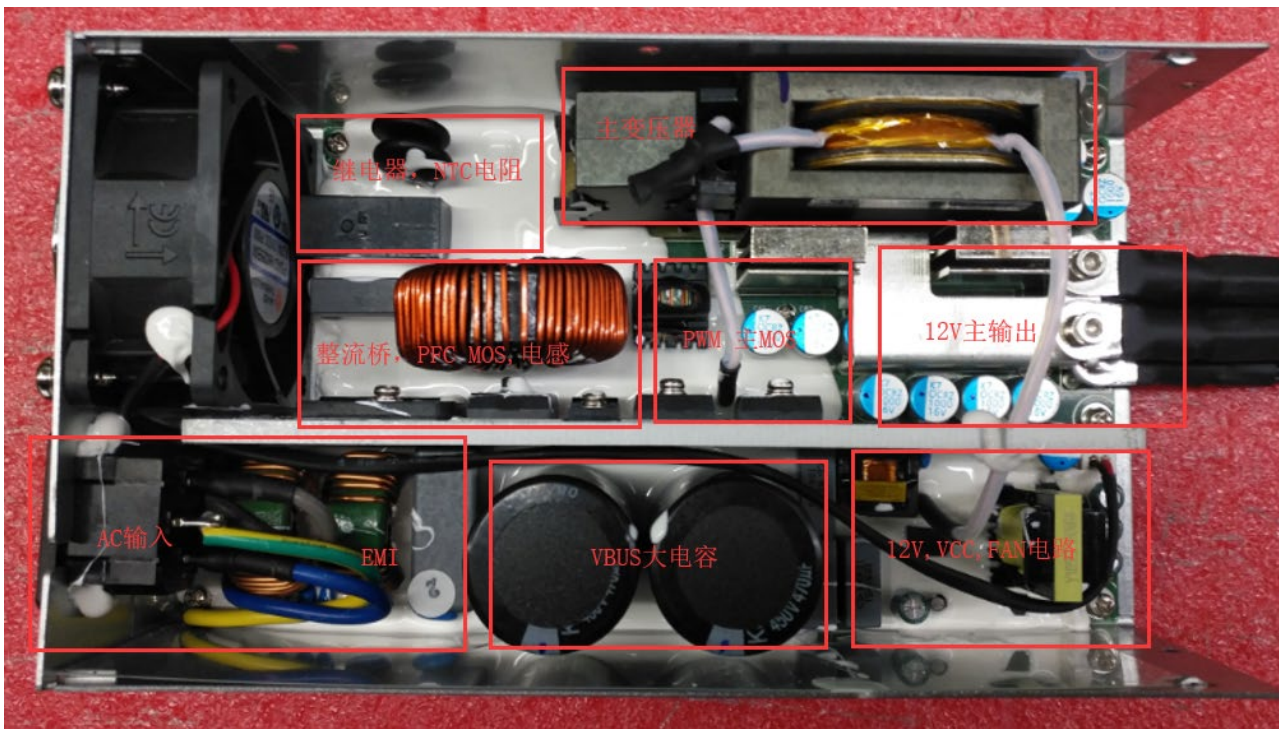


2.2 Power PCBA board layout

1. Input F1 fuse
2. Rectifier bridge PFC drive and main Q circuit
3. LLC main switch circuit
4. Auxiliary power circuit provides VCC power supply
5. PWM drive and detection feedback protection circuit
6. The main output circuit rectifier MOS



Physical picture of DIP plug-in(there will be small differences in product versions, but the structure is the same)



继电器、NTC 电阻: Relay, NTC resistor

主变压器: Main transformer

整流桥、PFC、MOS、电感: Rectifier bridge, PFC, MOS, inductance

PWM 主 MOS: PWM main MOS

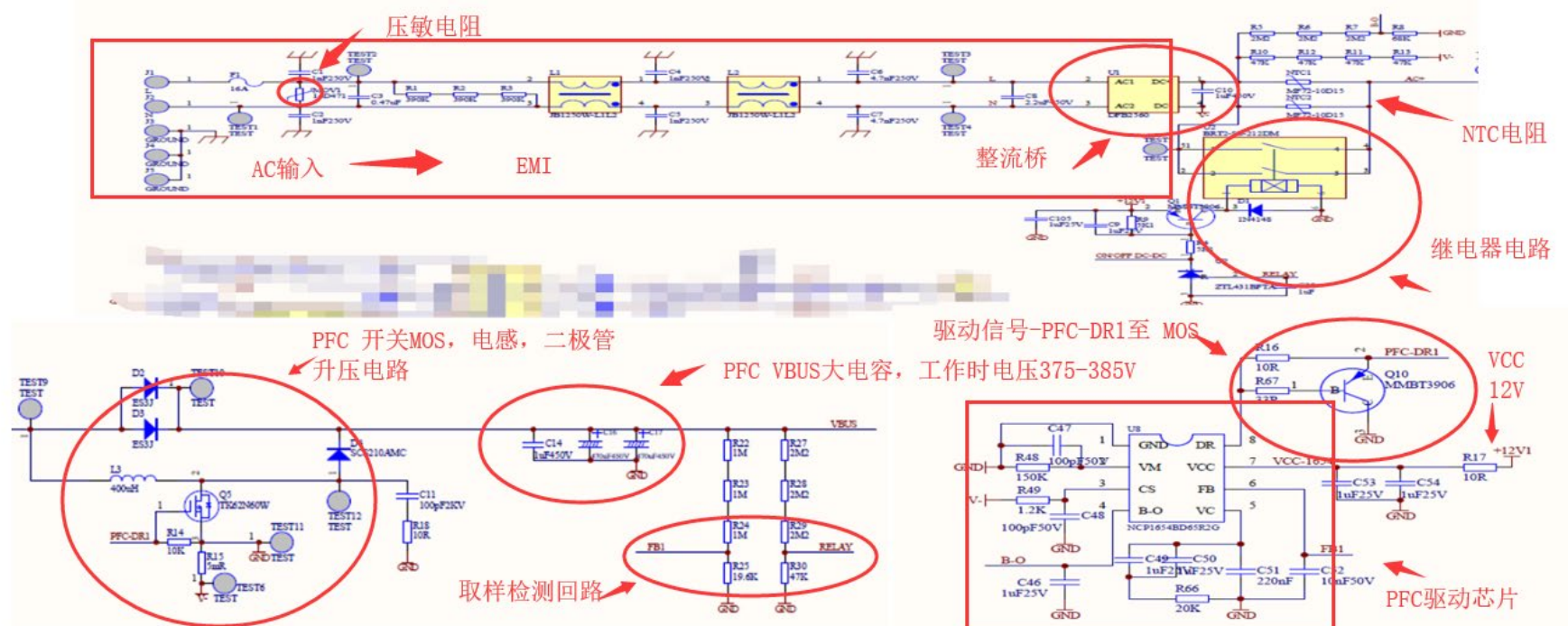
12V 主输出: 12V main output

AC 输入: AC input

VBUS 大电容: VBUS large capacitor

12V, VCC, FAN 电器: 12V, VCC, FAN appliances

2.21 AC inputs EMI to PFC circuit schematic, focus on measuring whether F1 insurance, U2 rectifier bridge, Q4, D7, D5, D6 are damaged.



压敏电阻: Varistor

AC 输入: AC input

整流桥: Rectifier bridge

NTC 电阻: NTC resistor

继电器电路: Relay circuit

PFC 开关 MOS, 电感、二极管升压电路: PFC switch MOS, inductance, diode boost circuit

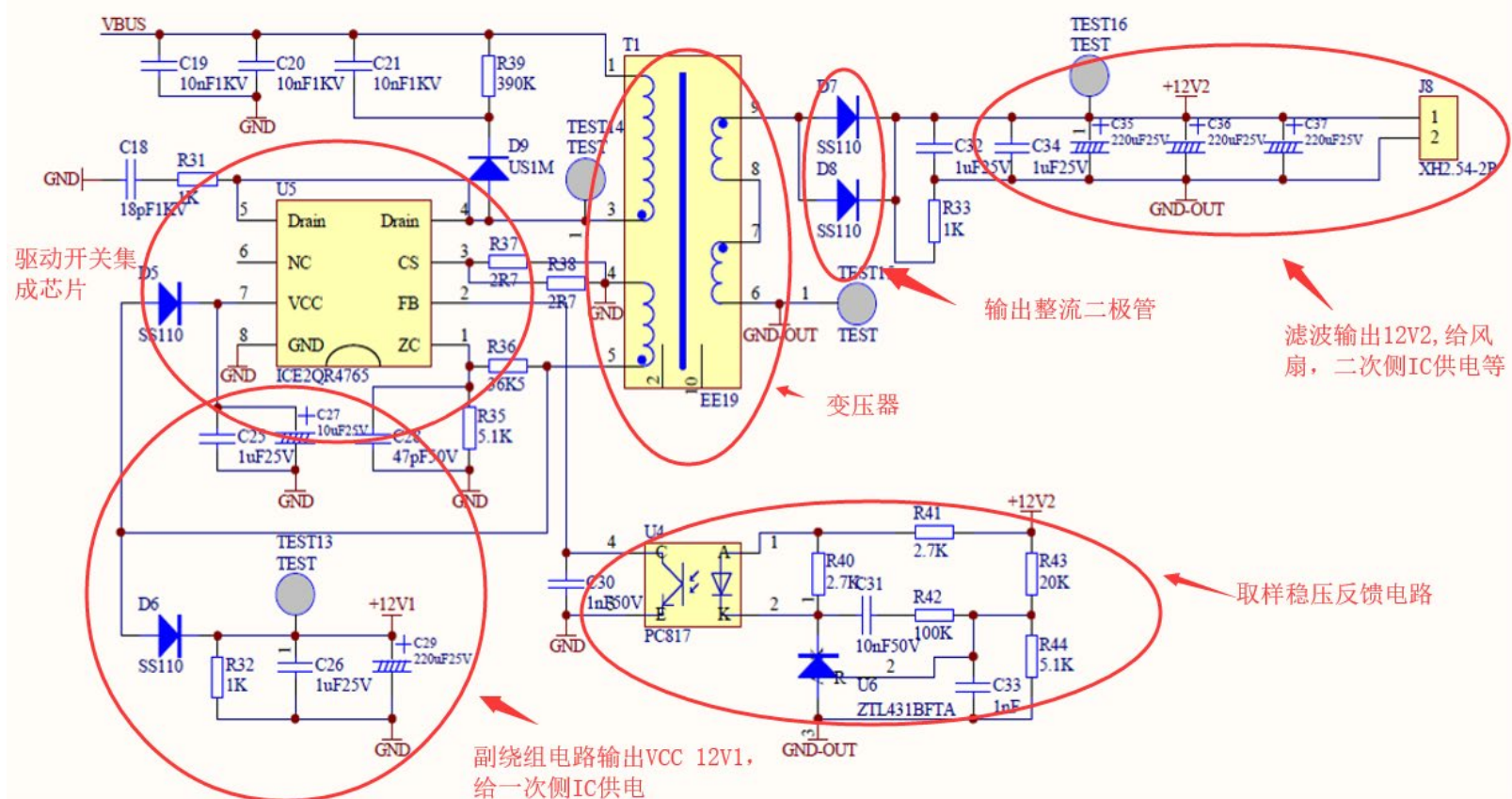
PFC VBUS 大电容, 工作时电压 375-385V: PFC VBUS large capacitor, working voltage 375-385V

取样检测回路: Sampling detection circuit

驱动信号-PFC-DRI 至 MOS: Drive signal - PFC-DRI to MOS

PFC 驱动芯片: PFC driver chip

2.22 12V auxiliary circuit principle, if there is no 12V2 voltage and the fan does not rotate, focus on measuring whether voltage detection start chip U5 Pin 4 and 3 have short circuit, and whether resistor R37 and R38 change value and have open circuit, whether T1 (winding has open circuit), and whether fan Q5, D6, D9, D7, D8 are damaged. Voltage feedback check, etc.



驱动开关集成芯片: Drive switch integrated chip

变压器: Transformer

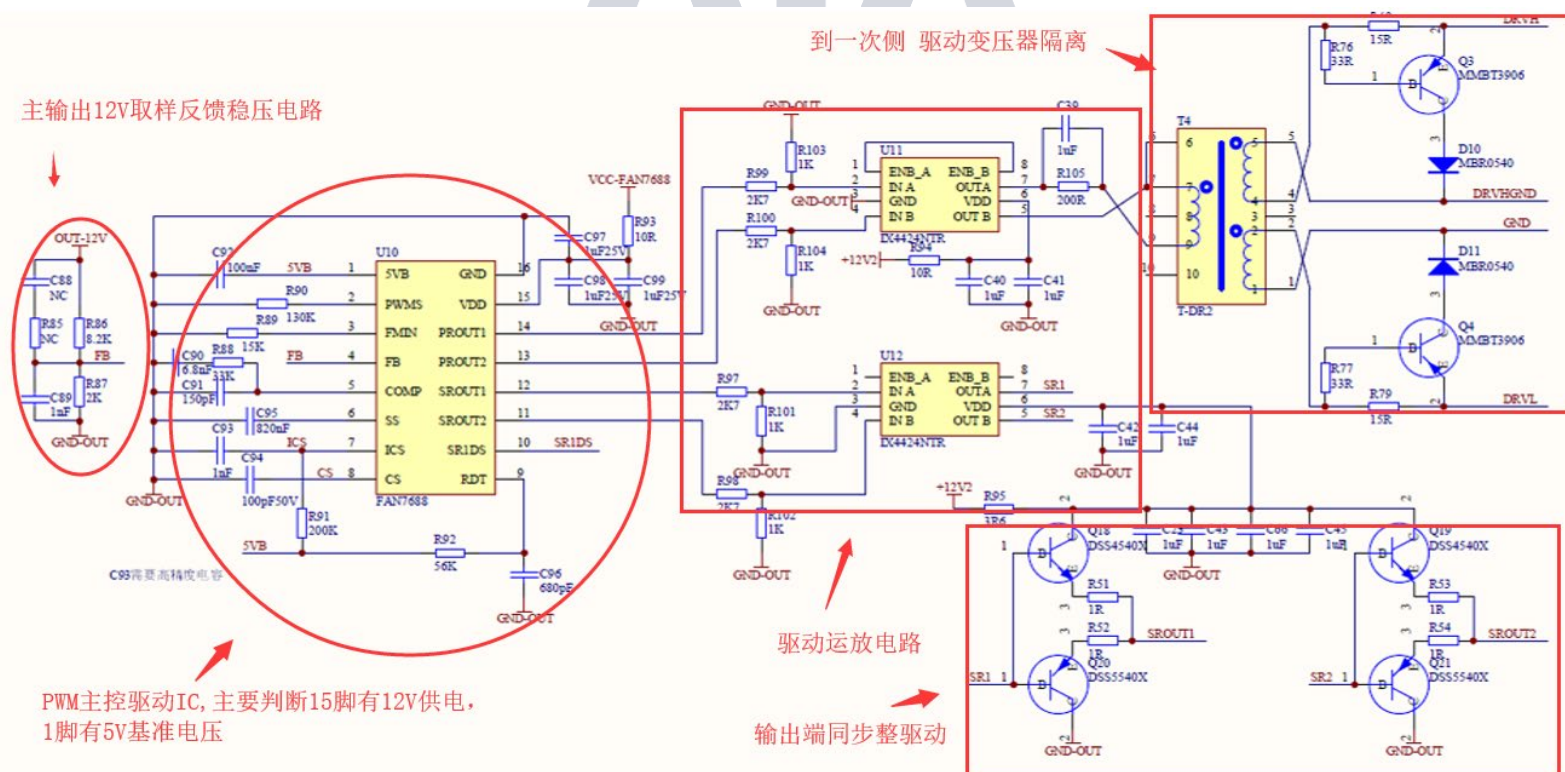
输出整流二极管: Output rectifier diode

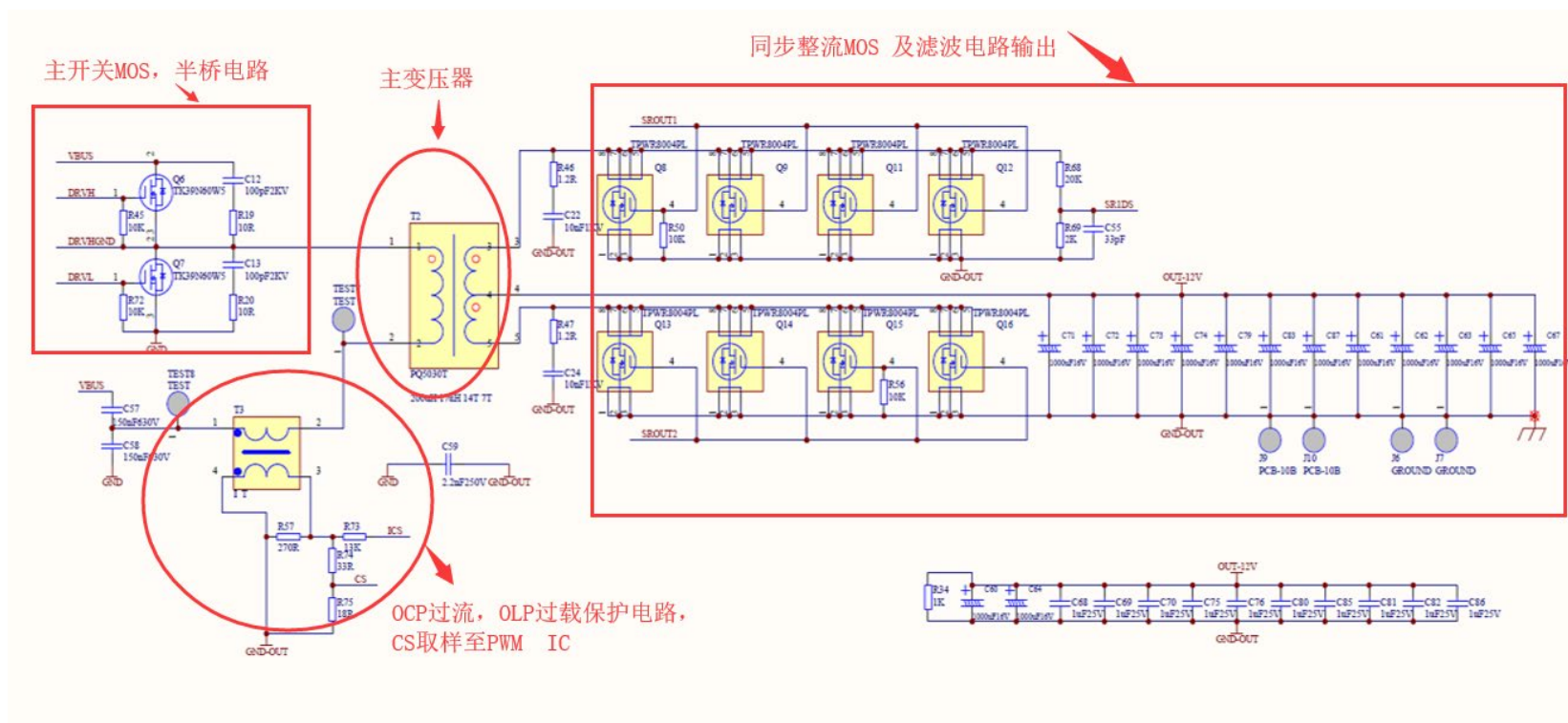
副绕组电路输出 VCC 12V1, 给一次侧 IC 供电: The secondary winding circuit outputs VCC 12V1 to supply power to the primary side IC.

取样稳压反馈电路: Sampling voltage feedback circuit

滤波输出 12V2, 给风扇, 二次侧 IC 供电等: Filter outputs 12V2, power supply for fan and secondary side IC, etc.

2.23 The schematic diagram of the main control PWM drive circuit, Focus on measuring whether the main IC U10, VCC 12V power supply is normal, and U11, U12 and drive transformer T4 are damaged.





主开关 MOS,半桥电路: Main switch MOS, half-bridge circuit

主变压器: Main transformer

同步整流 MOS 及滤波电路输出: Synchronous rectification MOS and filter circuit output

OCP 过流, OLP 过载保护电路, CS 取样至 PWM IC: OCP overcurrent, OLP overload protection circuit, CS sampling to PWM IC

2.25 Location of A side of SMD patch and B side of plug-in

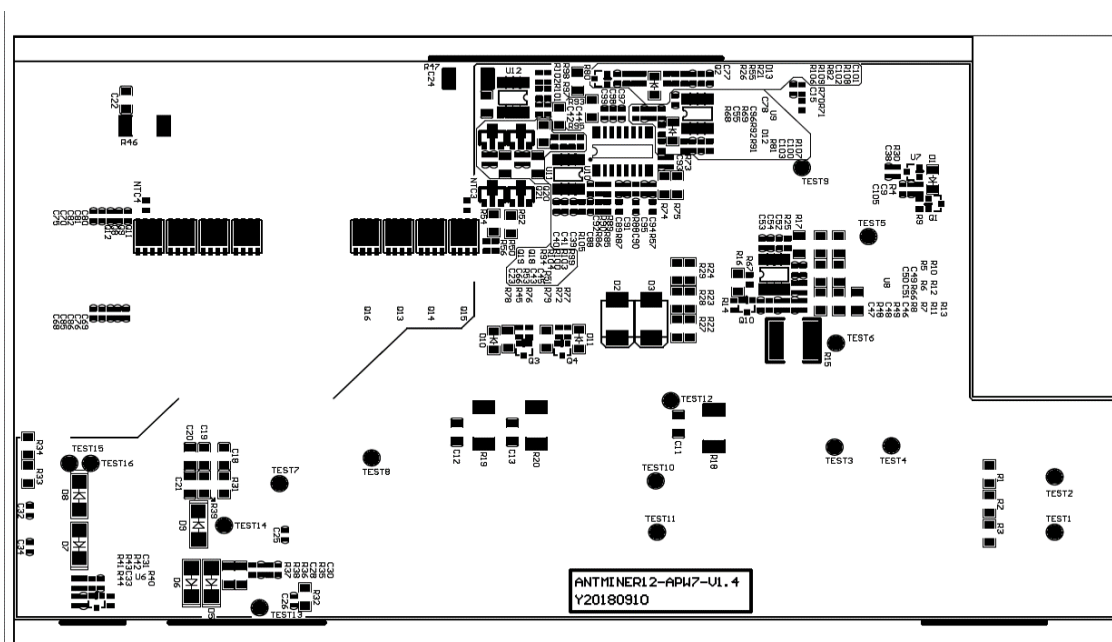


Figure 1 Side A of SMD patch

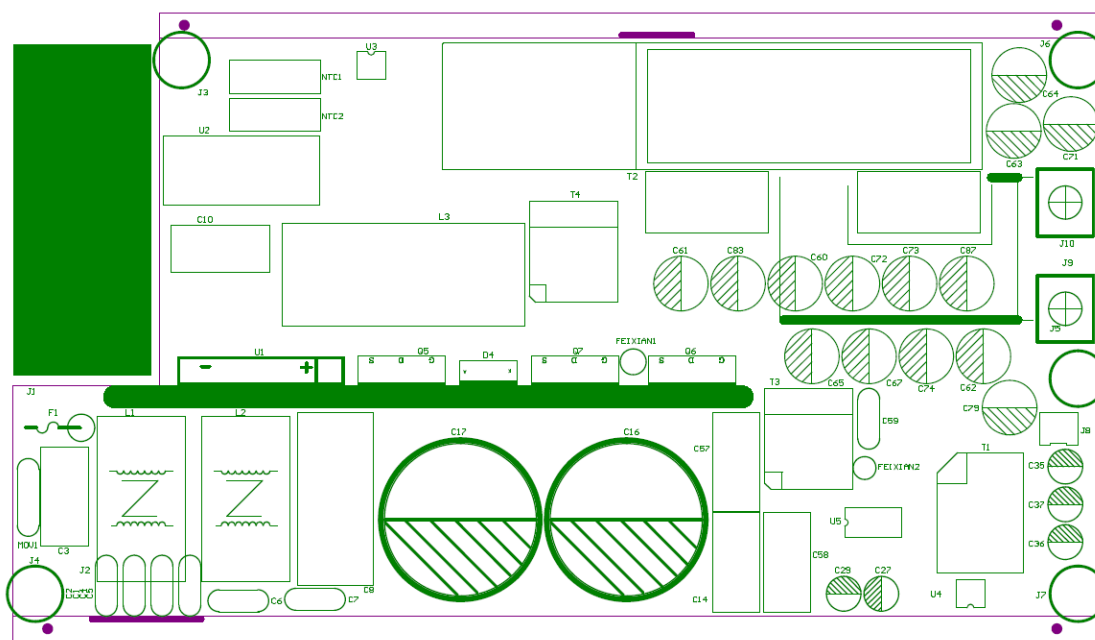


Figure 2 Side B of plug-in

2.3 Maintenance steps

2.31. Check whether the appearance of the power supply is seriously damaged or deformed, and whether the DC fan and the AC socket are damaged.

2.32. Power on AC220V, check whether the fan is rotating normally, and use the multimeter to measure whether the output J6 terminal's voltage is 12V (12.1V-12.50) to eliminate measuring error

2.33. Open the enclosure to check whether the components and solder surface have sparking phenomenon (focus on whether the R33 resistor is damaged), use a multimeter to detect whether the AC input terminal's F1 fuse has open circuit, whether the U2 rectifier bridge; PFC MOS Q1; D7; D5; D6 have short circuit, whether the PWM circuit's main switches MOS Q6; Q14; Q15; Q16 and output patches MOS Q17; Q18; Q19; Q20 have short circuit; if there is a short

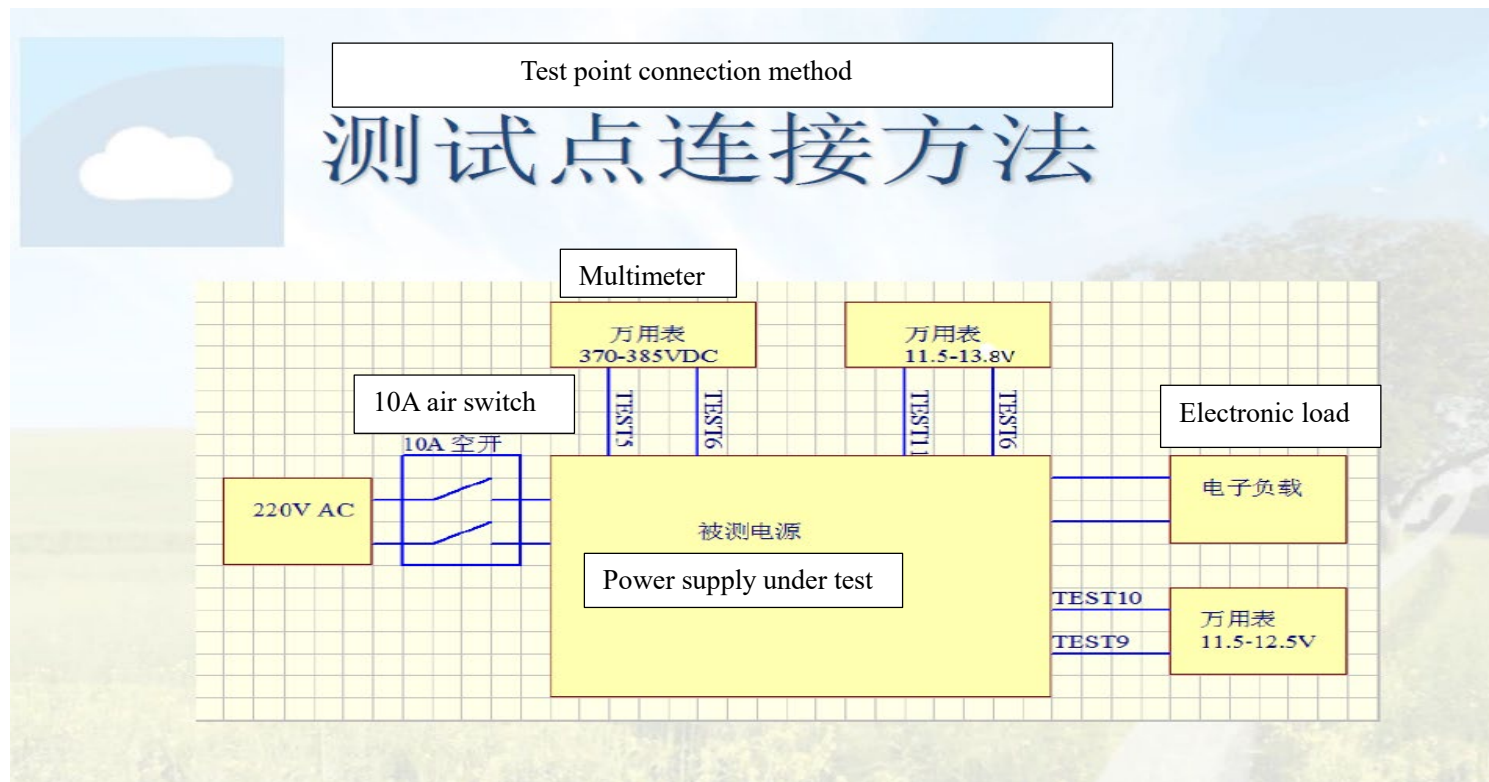
circuit, the component position should be checked and replaced, pay attention to the circuit resistance around bad bit MOS tube; the transistor may be damaged and needs to be replaced.

2.34. Detect whether the auxiliary 12V circuits U5; T1; Q5; D11 have short circuit or open circuit, and whether the surrounding components are burned, etc., replace if necessary.

2.35. If there is no abnormality in the above locations, the F1 fuse path is normal. After the AC is powered on, the DC fan rotates (if there is no rotation, check whether the fan socket has voltage of 12V, if the voltage is normal, replace the fan); the output terminal J6 has 12V voltage, measure whether there is DC370V-380V at both ends of PFC large capacitor C16 or C17, otherwise check whether U1, pin 7V VCC power supply has 12V or judge material damage and replace, if there is no abnormality, it needs to detect PWM circuit U9; U10; U11; whether supply VCC has 12V voltage or judge material damage and replace, and whether the T4 drive transformer is damaged.

2.36 Other bad needs to be further analyzed and judged according to the skills of maintenance personnel,

2.4 Diagram for electrical function test connection, PCBA main voltage measurement point.



Test steps:

(1) Visually inspect the board. Make sure that the board has no pseudo soldering, continuous soldering, electrolytic capacitor polarity, plug-in components are installed in place, MOS tube insulation gaskets are normal, and then connect the board input line L/N and the output line's positive and negative poles.

(2) Turn on the AC input's air switch. After all the multimeters are correctly read (the judgment condition is in the above figure), set the electronic load current to 1A, and record the electronic load voltage at this time as the load voltage, the voltage value is qualified between 12.10-12.50V.

(3) Input 220V, set the electronic load current to 150A, record the voltage, power and power factor of the AC side power meter. If the power factor is greater than 0.99, the output voltage is normal, and the power is not less than 1800W, it is qualified.

Rotate the electronic load knob to increase the current by 2A/div. If the current protection point is directly protected at 160-200A, it is qualified, and the protection value is recorded.

Set the short circuit protection. After the power is turned back on, the power supply can operate normally.

(4) Input 110V, set the electronic load current to 83.3A, record the voltage, power and power factor of the AC side power meter. If the power factor is greater than 0.99, the output voltage is normal, and the power is not less than 1000W, it is qualified.

(5) Turn off the AC switch and electronic load in turn, and remove the AC input line and DC output line. Note: The large electrolytic capacitor is charged before the fan stops. You need to wait until the fan stops completely before you can touch the board.

Judging criteria (this test requires electronic load, power meter, voltage regulator)

Test item	Test condition	Judging criteria	Measured value	Qualified	Product code
Input start voltage	Output no load	100V start is judged qualified			
Output voltage	Load 1A (230V)	12.10-12.50V			
Efficiency	Full load (230V) 150A	>92.5%			
	83.3A (110V)	>91.5%			
Power factor	Full load (110V/230V)	>0.99			
Overcurrent protection	Input 230V	160-200A			
Short circuit	Input 230V	After the short circuit, the power supply has no output, the short circuit is removed, and the power supply is not required to be restarted, and the normal output is restored within 3-5 seconds.			

Ripple	Full load (110V/230V)	<120mV			
TEST10/TEST11	Output no load (230V)	375-385V			
TEST13/TEST11	Output no load (230V)	11.5V-13.8V			
TEST16/TEST15	Output no load (230V)	11.5V-12.5V			

Remarks: After the maintenance of the power supply, if the above items have no equipment conditions, it only needs to test the input AC220V, output 12V plus load 150A (1800W), it they can work normally, it is also considered qualified.

2.5 Simple judgment and maintenance of common faults of mine power supply

No.	Fault symptom	Cause	Solution
1	The fan does not run, there is no 12V output	The power supply on the AC side is abnormal	1. Check if the AC input line of the power supply is normal and the plugs at both ends are not loose. 2. Check if the grid is powered and the voltage is normal.
2	The fan runs normally, there is no 12V output	1. Low grid voltage 2. Power protection	1. Use a multimeter to confirm that the current voltage is above 205V, so that the power can be turned on. 2. Detect whether the power supply has an output short circuit or overload. This situation will cause the power supply to enter the lock protection state. It needs to be re-powered after the fault is removed to recover.
3	After the power supply stops output for a few seconds, it resumes normal operation. After a few minutes of continuous operation, it stops outputting again.	The power supply has entered the over temperature protection	1. Check if the fan is running normally 2. Check if the cooling air duct of the power supply is blocked. 3. Check if the power supply has accumulated excessive dust inside for a long time. 4. Check if the power used by the power supply or the ambient temperature exceeds the value of the power supply limit curve.
4	Output is normal, the fan does not work	The fan is faulty	1. Check if the fan is blocked by debris 2. The fan is faulty
5	The normally working power supply suddenly has no output and will not start again	Overcurrent protection of the power supply	Check whether the current of the load exceeds the upper limit of the overcurrent protection of the power supply. The power supply sets the overcurrent protection to the locked state, to prevent the power supply from continuing to output when the load is abnormal, causing a dangerous situation such as a fire.

2.6 After the power supply maintenance test is normal, it is required to operate normally for 2 hours with the rated load of 80% (130A) or more before it can be used by the client.