



WhatsMiner Air Cooling Miner

Repair Manual

V1.0



Shenzhen MicroBT Electronics Technology Co., Ltd..

Forward

About this Document

This Document introduces repair methods for air cooling miners. All pictures and other information are merely for illustrative purposes.

Symbol instruction

Symbol	Instruction
	Provides additional information to supplement the text.

Revision history

Version	Revision Content	Release Time
V1.0	First release	20250919

Legal information

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1. Tool List

The following tools are necessary for repairing miners, mainly including disassembly and assembly tools, welding and soldering tools, testing and auxiliary tools, safety and auxiliary tools, and others.

Disassembly & Assembly Tools: Philips Screwdriver/Electric Screwdriver, Tweezers

Welding & Soldering Tools: Soldering Iron, Heating Table, Tinol, Solder Paste

Testing & Measurement Tools: 100M Oscilloscope, Multimeter

Safety & Auxiliary Tools: Gloves, Electrostatic Table

Others: 12V DC Power Supply (for Control Board), Adjustable 10A+ DC Power Supply, Customize Control Board for Maintenance, TF Card, M1 Miner Case with a Fan, Power Supply Cable & Network Cable, Cables, Computer

2. Hashboard Testing Software

The following figure shows a setup diagram of a testing and repair environment, and tools involved have been marked in the diagram.

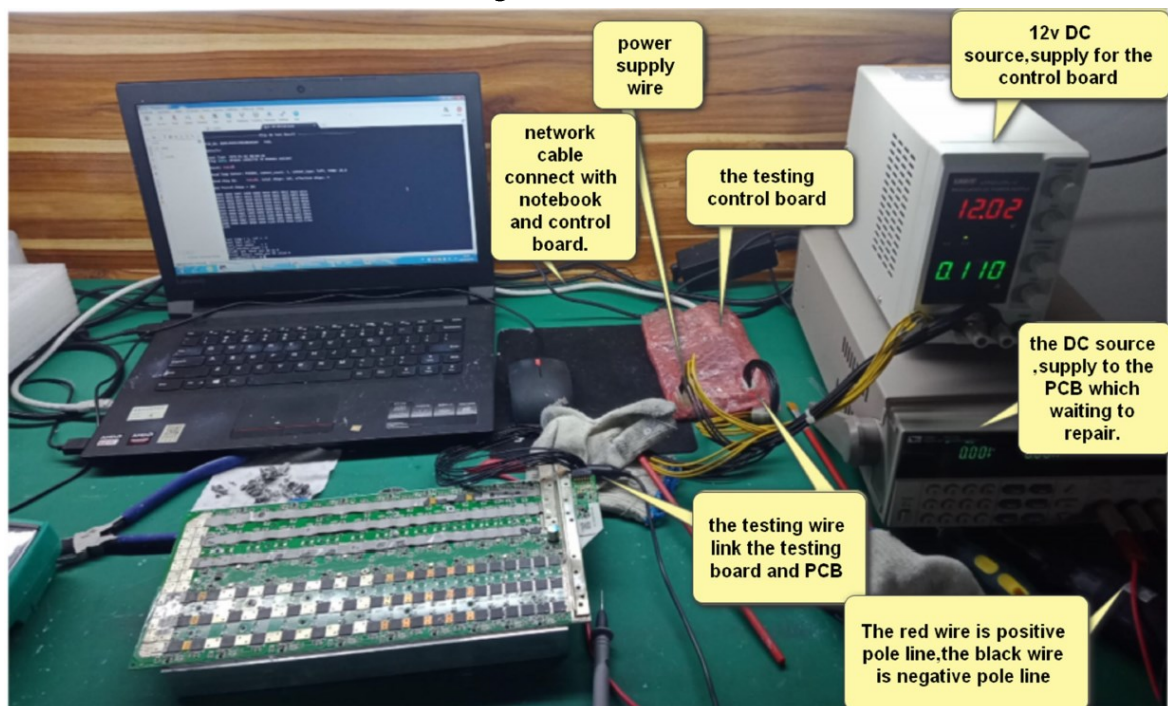


Figure 2-1

After setting up the environment, you could follow the following steps to install the software.

Step 1 Double click , click **Session**, and then click **SSH**.

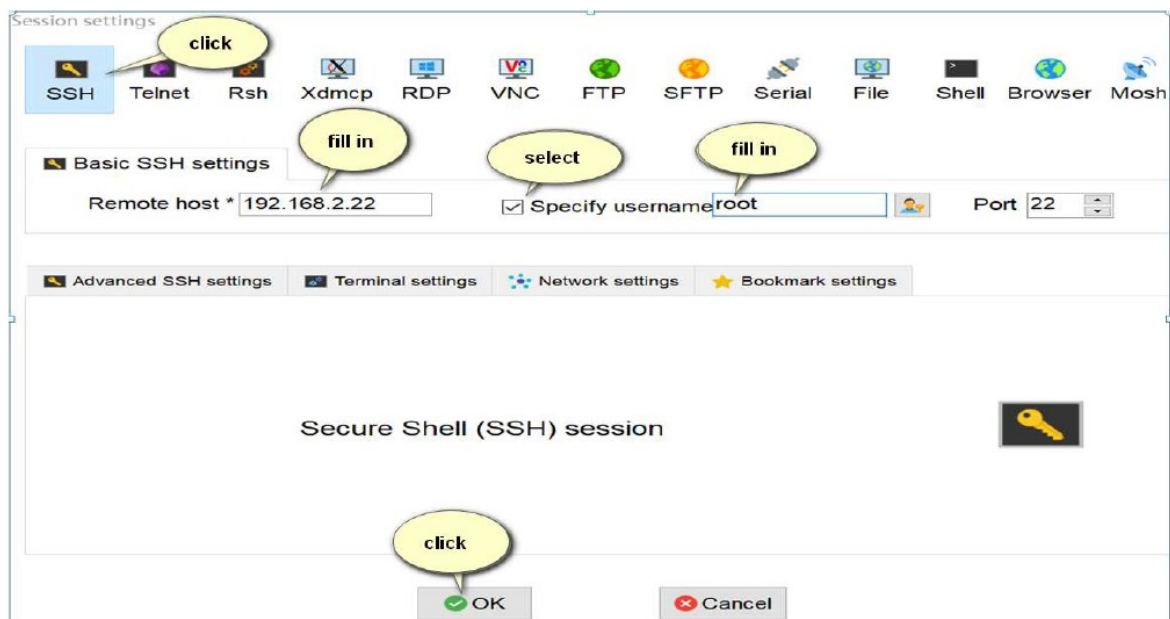


Figure 2-2

Step 2 Fix your computer IP address.

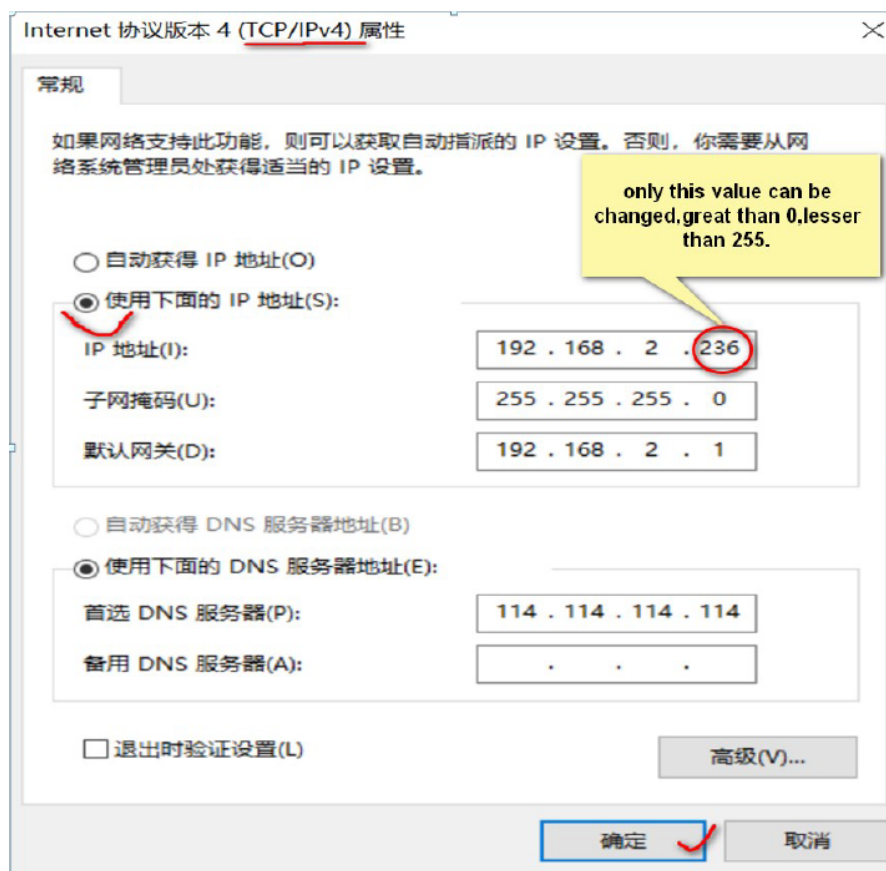


Figure 2-3

Step 3 You can start to test hashboard when the following interface appears.

```
? MobaXterm 10.2 ?  
    (SSH client, X-server and networking tools)  
  
> SSH session to root@192.168.2.22  
? SSH compression : x (disabled or not supported by server)  
? SSH-browser      : ✓  
? X11-forwarding   : ✓ (remote display is forwarded through SSH)  
? DISPLAY          : ✓ (automatically set on remote server)  
  
> For more info, ctrl+click on help or visit our website  
  
sh: /usr/bin/xauth: not found  
  
BusyBox v1.24.2 () built-in shell (ash)  
  
┌───┐ ┌──────────┐ ┌───┐ ┌───┐ ┌───┐ ┌───┐ ┌───┐  
│ - │ │ - │ │ - │ │ - │ │ - │ │ - │ │ - │ │  
└───┘ └───┘ └───┘ └───┘ └───┘ └───┘ └───┘  
W I R E L E S S F R E E D O M  
-----  
DESIGNATED DRIVER (Bleeding Edge, 50045)  
-----  
* 2 oz. Orange Juice           Combine all juices in a  
* 2 oz. Pineapple Juice        tall glass filled with  
* 2 oz. Grapefruit Juice       ice, stir well.  
* 2 oz. Cranberry Juice  
-----  
root@WhatsMiner:~#
```

Figure 2-4



 Note: The main test commands are: test readchipid (read chip id) and reboot (restart control board).

```
echo 0 > /sys/class/gpio/gpio99/value (RST signal set to low level 0 V)
```

```
echo 1 > /sys/class/gpio/gpio99/value (RST signal is set to high level 1.8 V)
```

3. Circuit Principle of M20S Hashboard

3.1 Power Supply Relationship of Chips on M20S Hashboard

On the M20S hashboard, every three chips form a group. Within each group, the positive pins of all three chips are connected together, and their negative pins are also connected. This configuration means the three chips in a group share a parallel power supply arrangement.

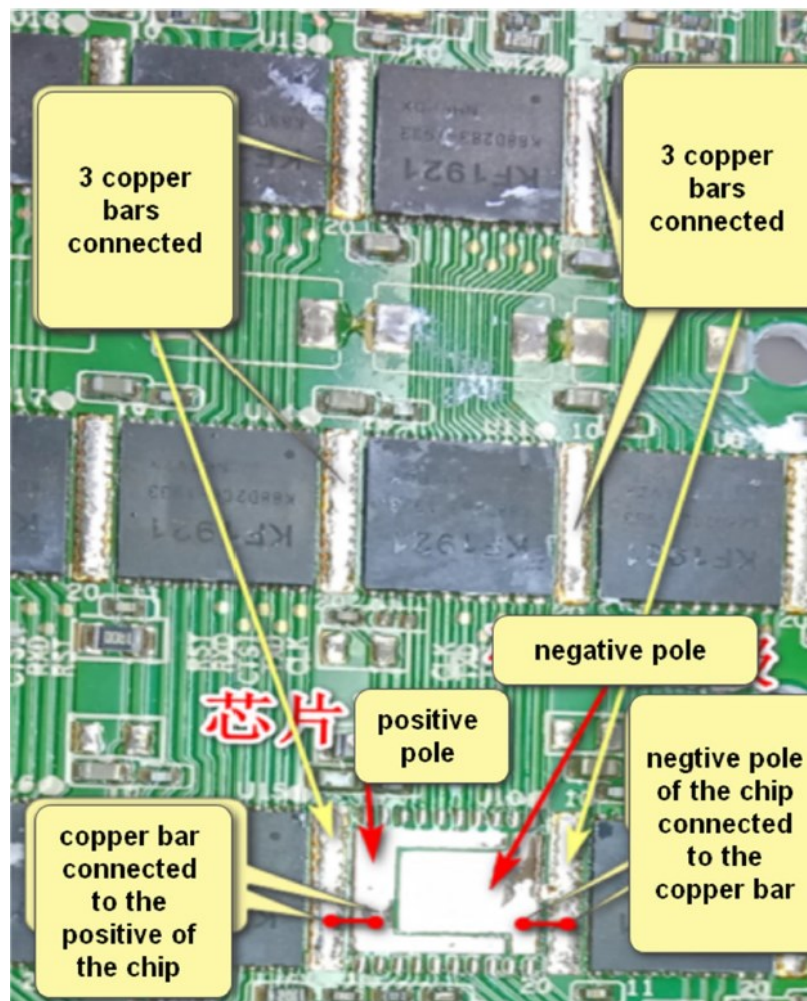


Figure 3-1

The power supply model of each chip in a group is parallel.

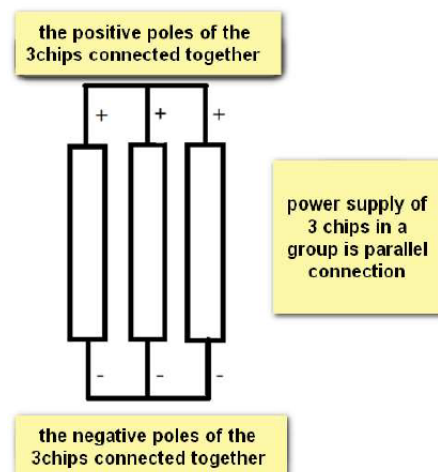


Figure 3-2

The power supply between groups is in series.

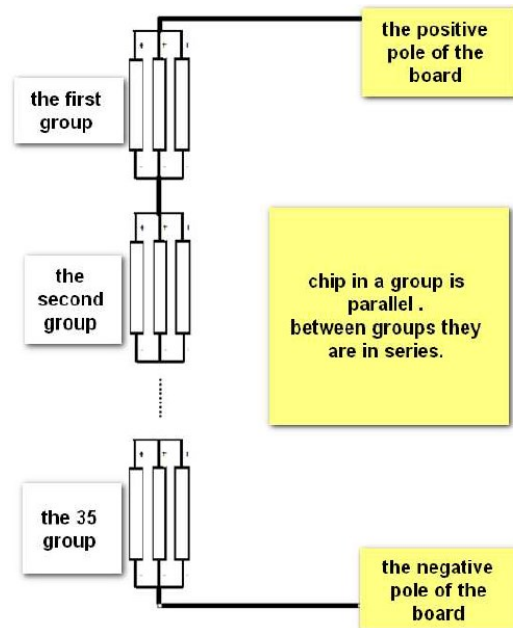


Figure 3-3

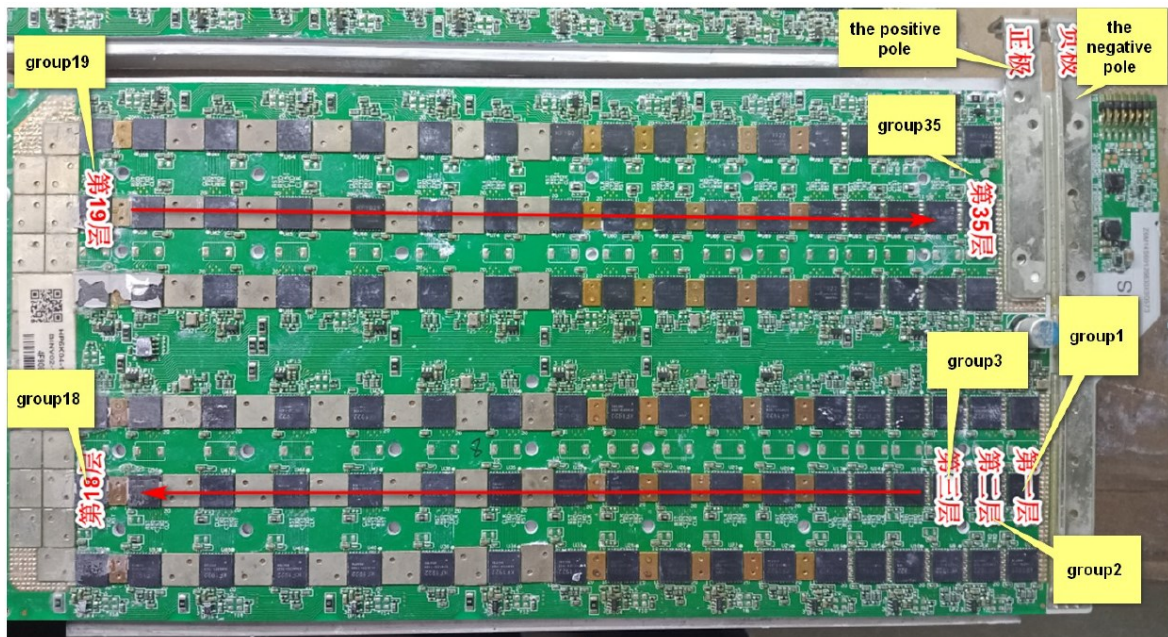


Figure 3-4

3.2 LDO Power Supply Relationship of Chip Groups

LDO supplies power for normal transmission of chip signals. Each group has an LDO. The 5-pin is the output, with a voltage of 1.8V, which is sent directly to the chip.



Note: When measuring, a reference point is ground of current group.

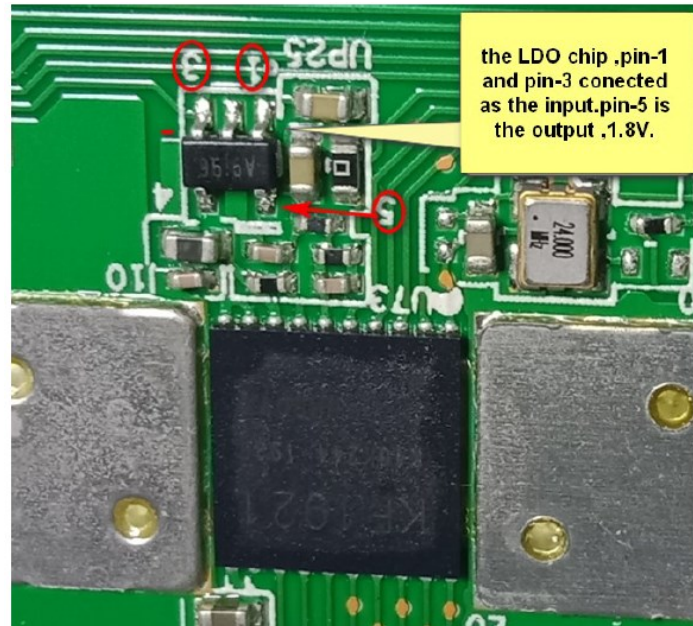


Figure 3-5

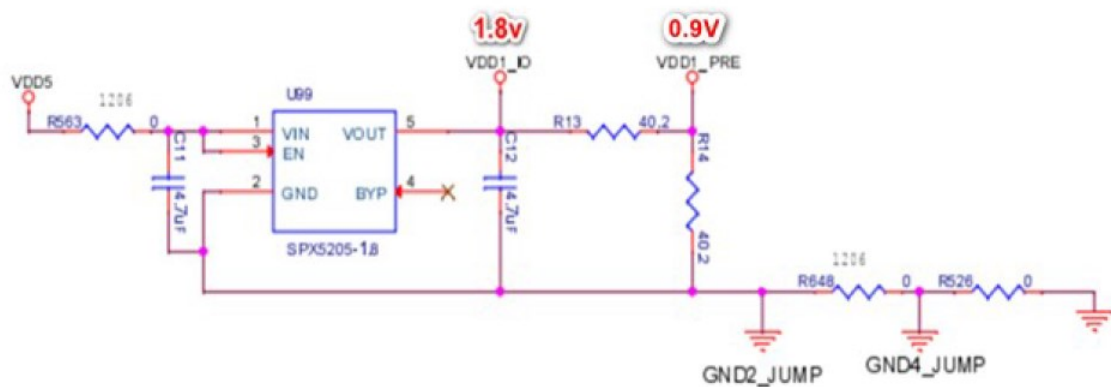


Figure 3-6

The following figure shows a signal transmission direction.

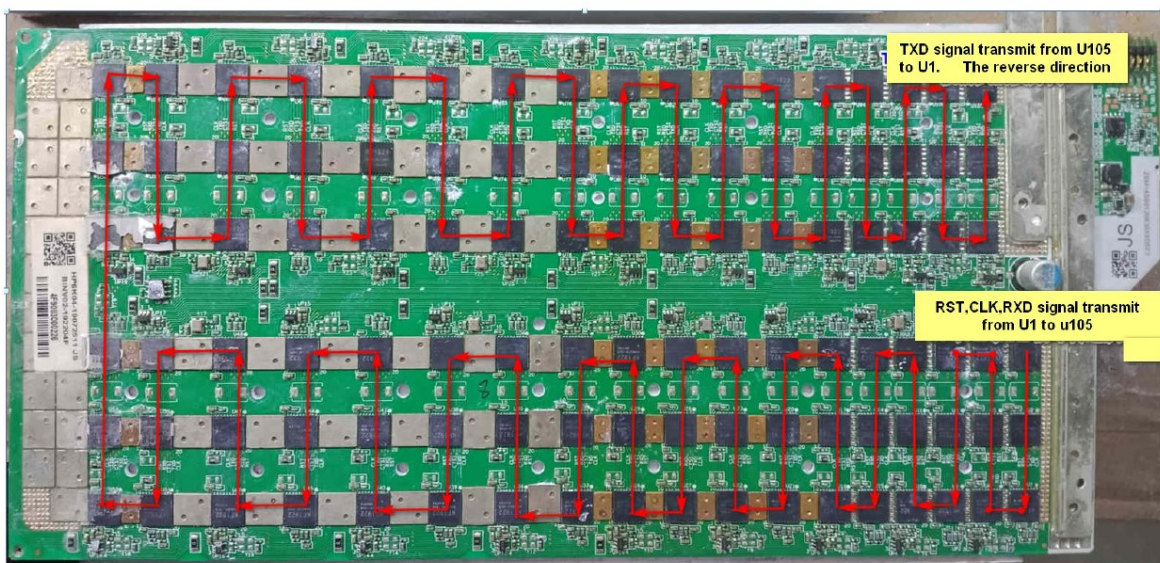


Figure 3-7

There are 5 transmission signals in the hashboard, including RST (reset), CLK (clock), CTSI

(chip selection), RXD (receive), and TXD (transmit), of which RST, CLK, RXD, and TXD are the main measurement signals.

- RST signal comes in from the control board and is transmitted from U1 to U105.
- CLK signal is generated by the crystal oscillator on board.
- RXD signal comes in from the control board and is transmitted from U1 to U105.
- TXD signal is transmitted in reverse from U105 to U1 and returns to the control board.

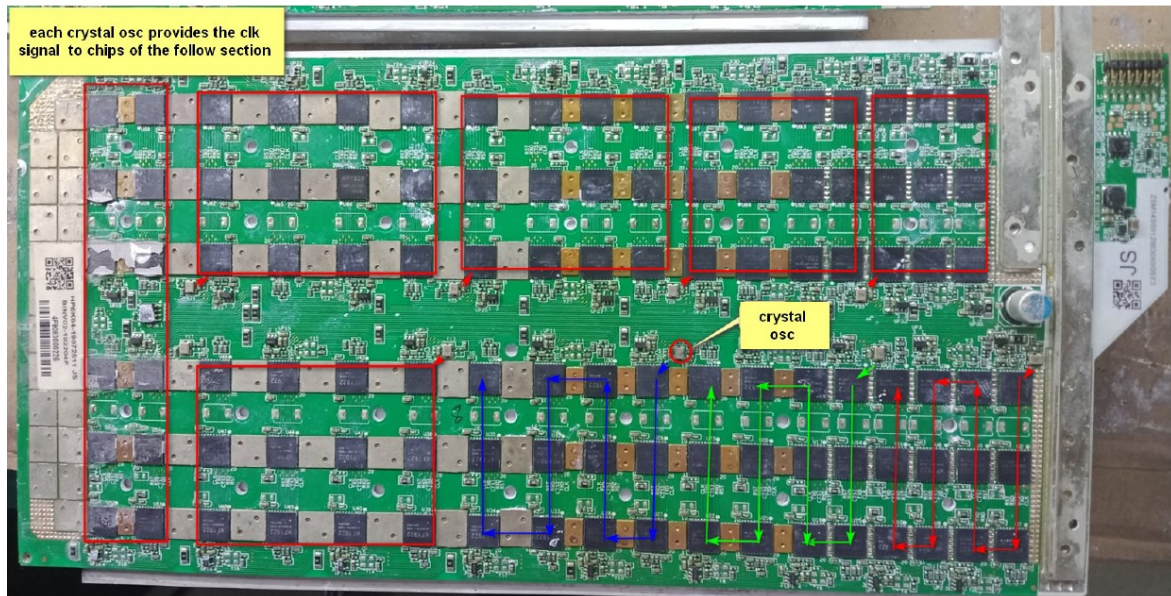


Figure 3-8

Signal	Measured Voltage Value
RST	Use the test command: <code>echo 1 > /sys/class/gpio/gpio99/value</code> . RST signal is set to a high level of 1.8 V, and in normal conditions, it is 0 V.
CLK	About 0.9 V
RXD	1.8 V
TXD	1.8 V
CTSI	0 V

Table 3-1

3.3 Way of Signal Passing Through Chip

The way of signal passing through the chip is direct in and direct out.

For example, when measuring a signal, if the input is normal but the output is abnormal, the chip may be out of work. To measure a chip signal, you can directly test the corresponding test points or the pins of the chip.

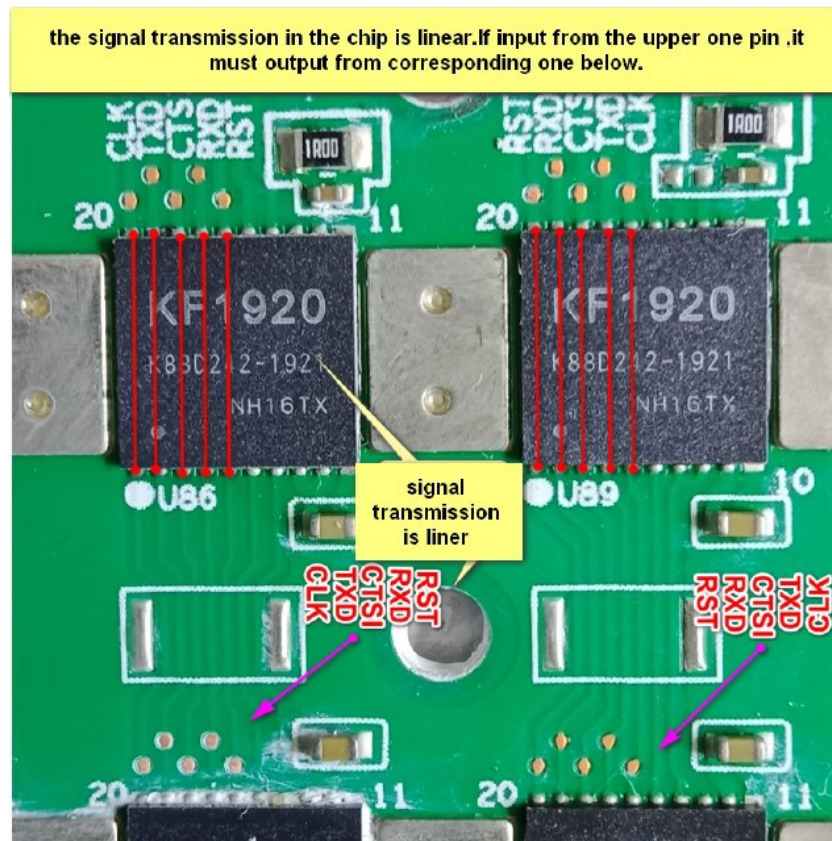


Figure 3-9

Requirements for normal operation of chip include the following:

1. Normal power supply voltage for hip group
2. Normal LDO voltage
3. Normal RST signal
4. Normal CLK signal
5. Normal RXD signal
6. Normal TXD signal

3.4 Memory and Temperature Sensing Chip

The following figures show memory and temperature sensing chips.

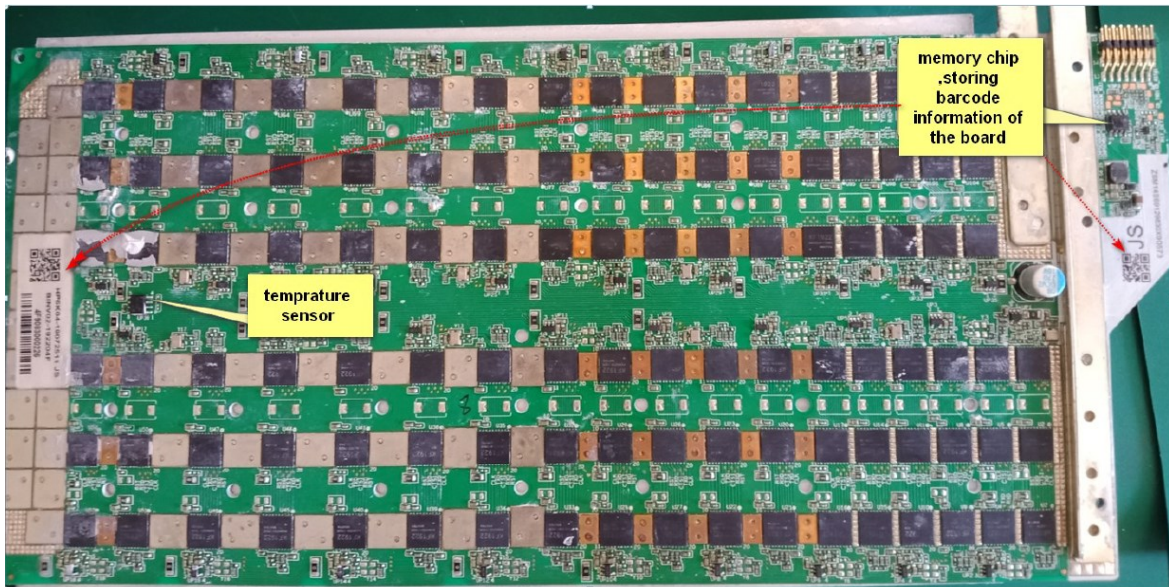


Figure 3-10

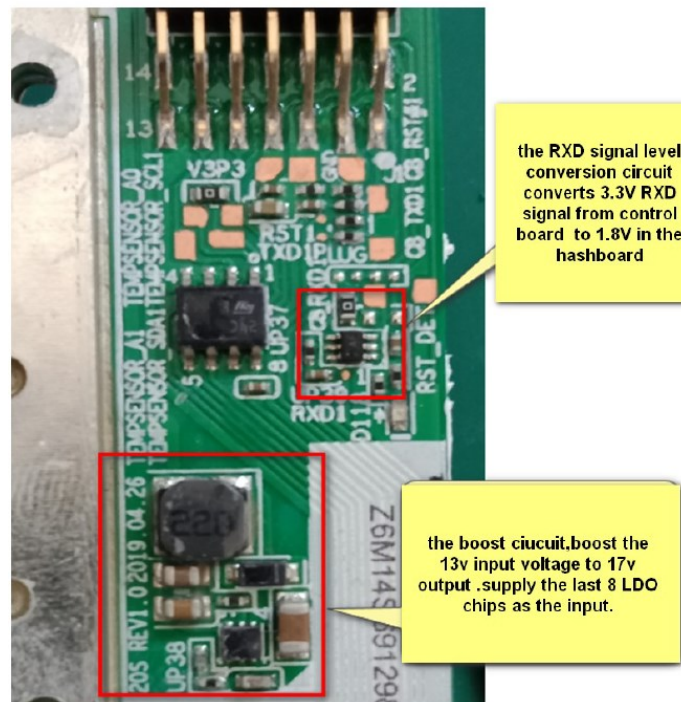


Figure 3-11

3.5 Repairing Method

You can follow the following steps to find a fault.

Step 1: Measure and repair the power supply voltage of each group of chips (Group 1 to Group 35).

Step 2: Measure and repair the LDO output voltage (Group 1 to Group 35).

Step 3: Measure and repair the RST signal (U1 to U105).

Step 4: Measure and repair the CLK signal (U1 to U105).

Step 5: Measure and repair the RXD signal (U1 to U105).

Step 6: Measure and repair the TXD signal (U105 to U1).

4. Brief Introduction to Hashboard Block Diagram

The M30X block diagram is the same as that of M20S.

The circuit consists of a group chipset, a temperature sensor, a boost circuit, a memory, and a voltage level converter. What is different is the hashboard, which has 1 piece of crystal oscillator, and each group's LDO supports 2 groups $\times$ 1.8V and 1 group $\times$ 0.8 V.

General Signal Transmission Direction

The following figure shows a general signal transmission direction of M31S.

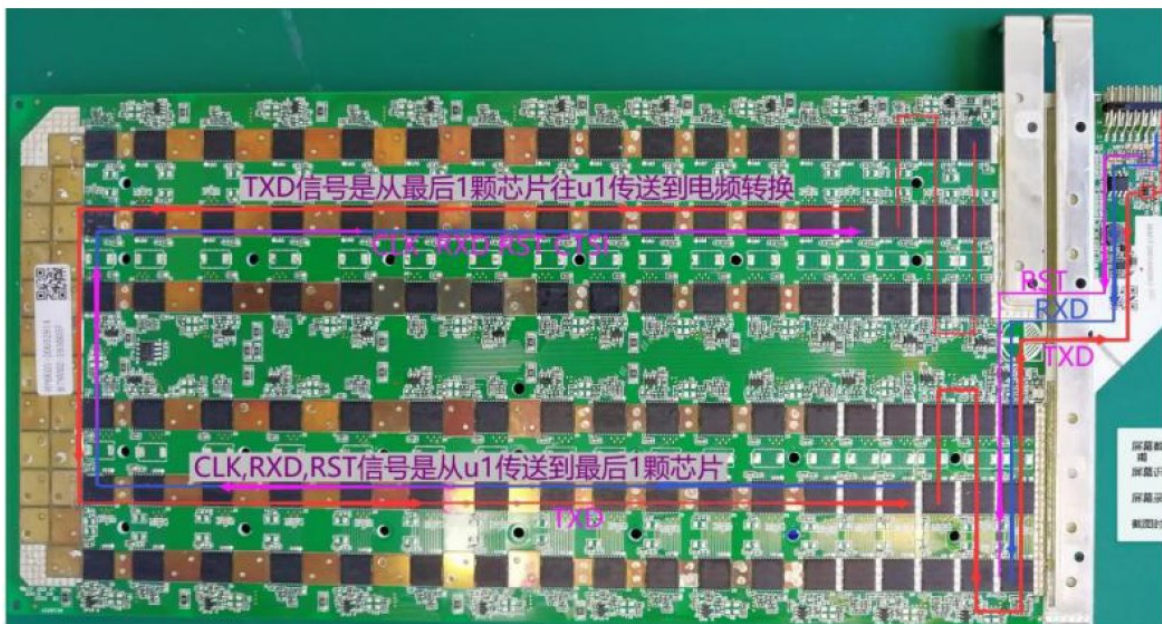


Figure 4-1



Note:

- The TXD signal is transmitted from the last chip to U1 for level conversion.
- The CLK, RXD, and RST signals are transmitted from U1 to the last chip.

The following figure shows a general signal transmission direction of M30S.

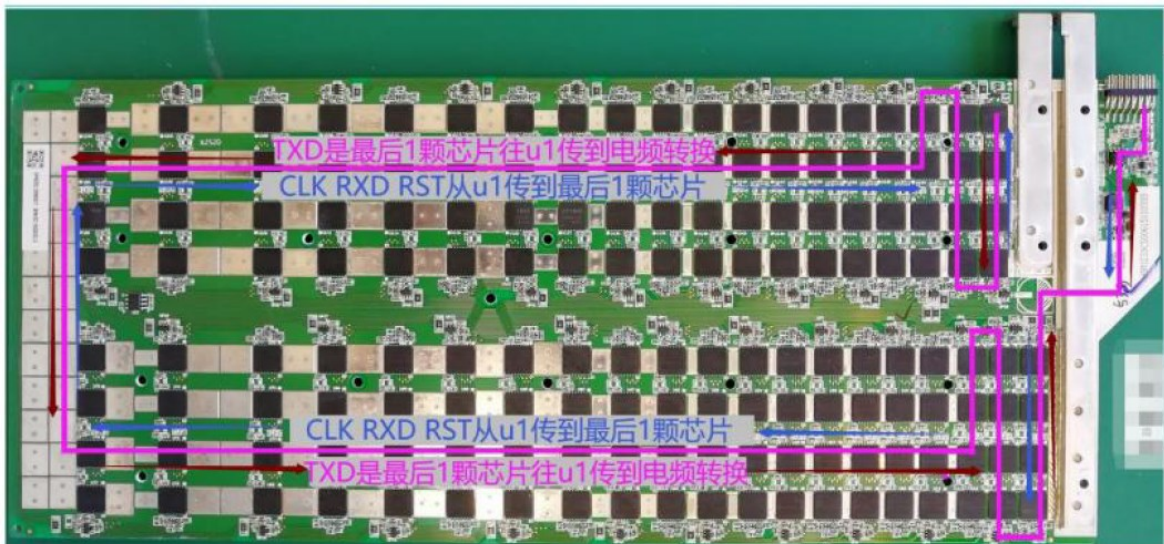


Figure 4-2



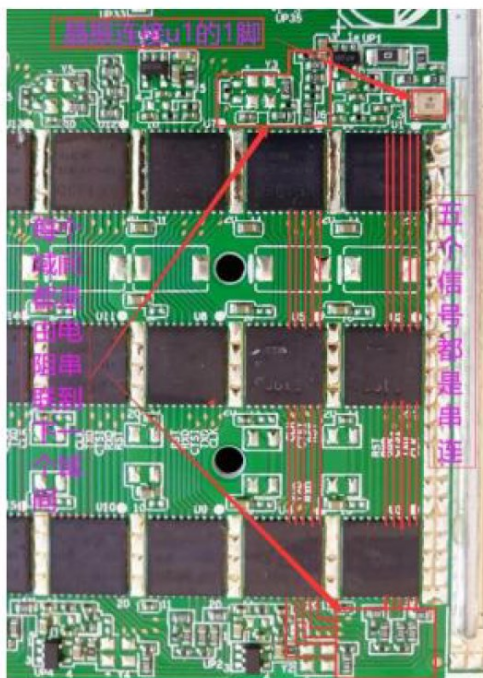
Note:

- The TXD signal is transmitted from the last chip to U1 for level conversion.
- The CLK, RXD, and RST signals are transmitted from U1 to the last chip.

Other diagrams

The M30x hashboard has 1 piece of crystal oscillator, and the signals between the two groups are connected by resistors. Details are shown in the following figures.

31s



30s

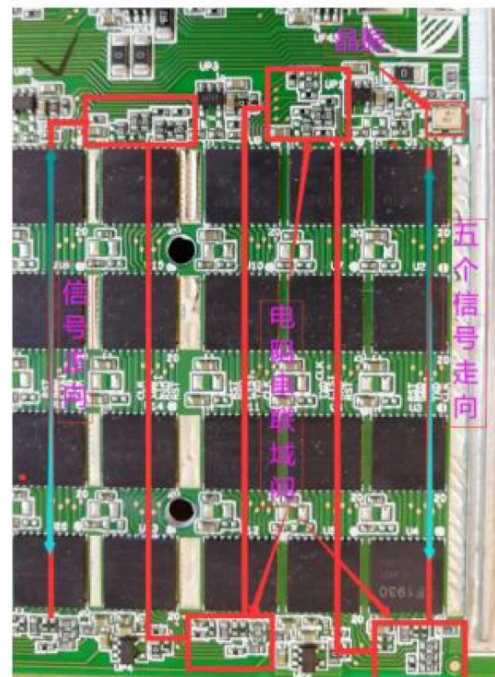


Figure 4-3

Each group's LDO 1.8V supports voltage input for Pins 7, 8, 13, and 14, and 0.9V supports voltage input for Pins 6 and 15.

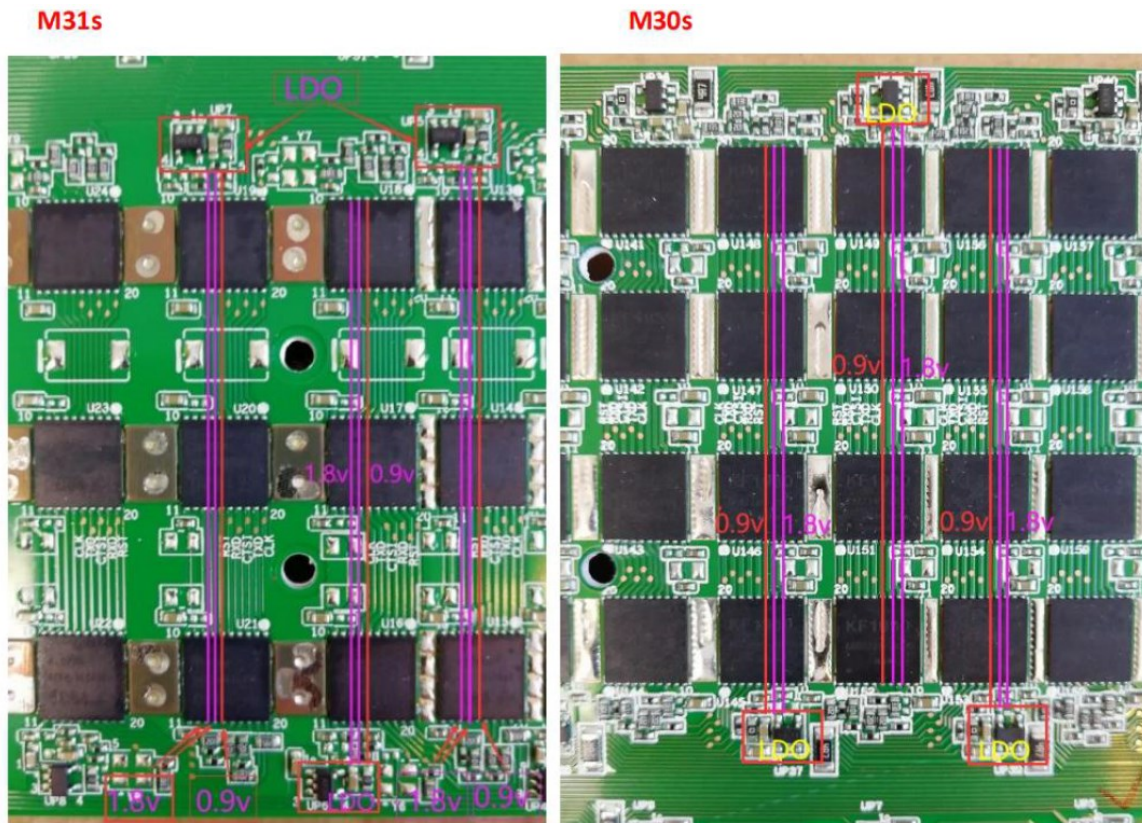


Figure 4-4

The 17V boost circuit is shown as the following figure. As highlighted in green, 17V is for the last 8 groups.

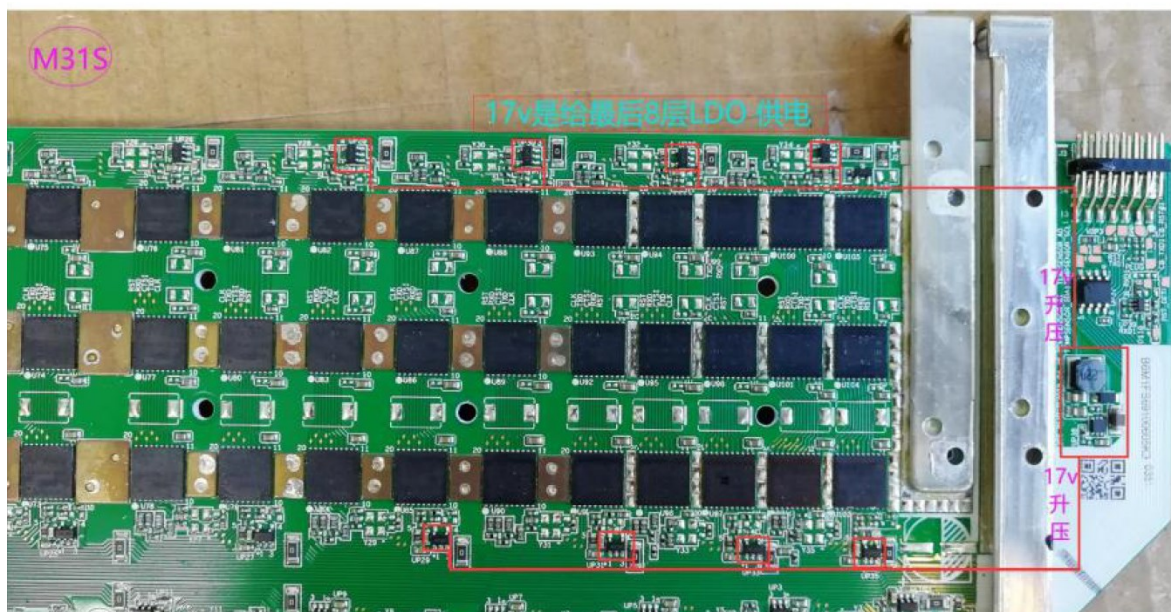


Figure 4-5

This 17V is for last 9 groups, which is based on the hashboard version.

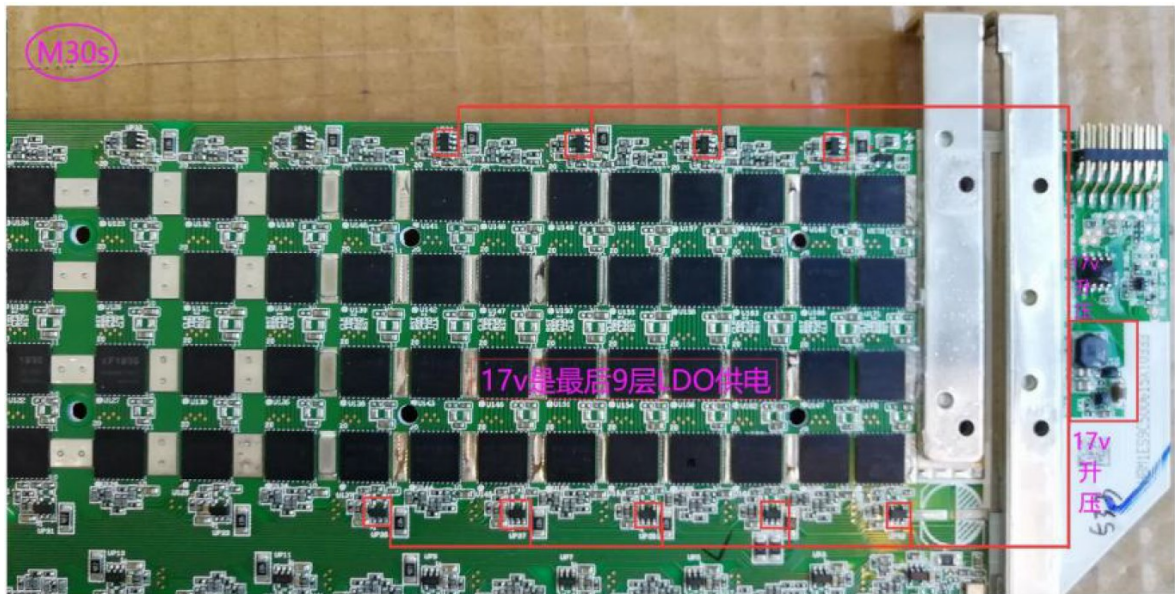


Figure 4-6

3.3 V is for temperature sensor and memory. In the following figure, the left arrow refers to the temperature sensor, and the right arrow refers to the memory.

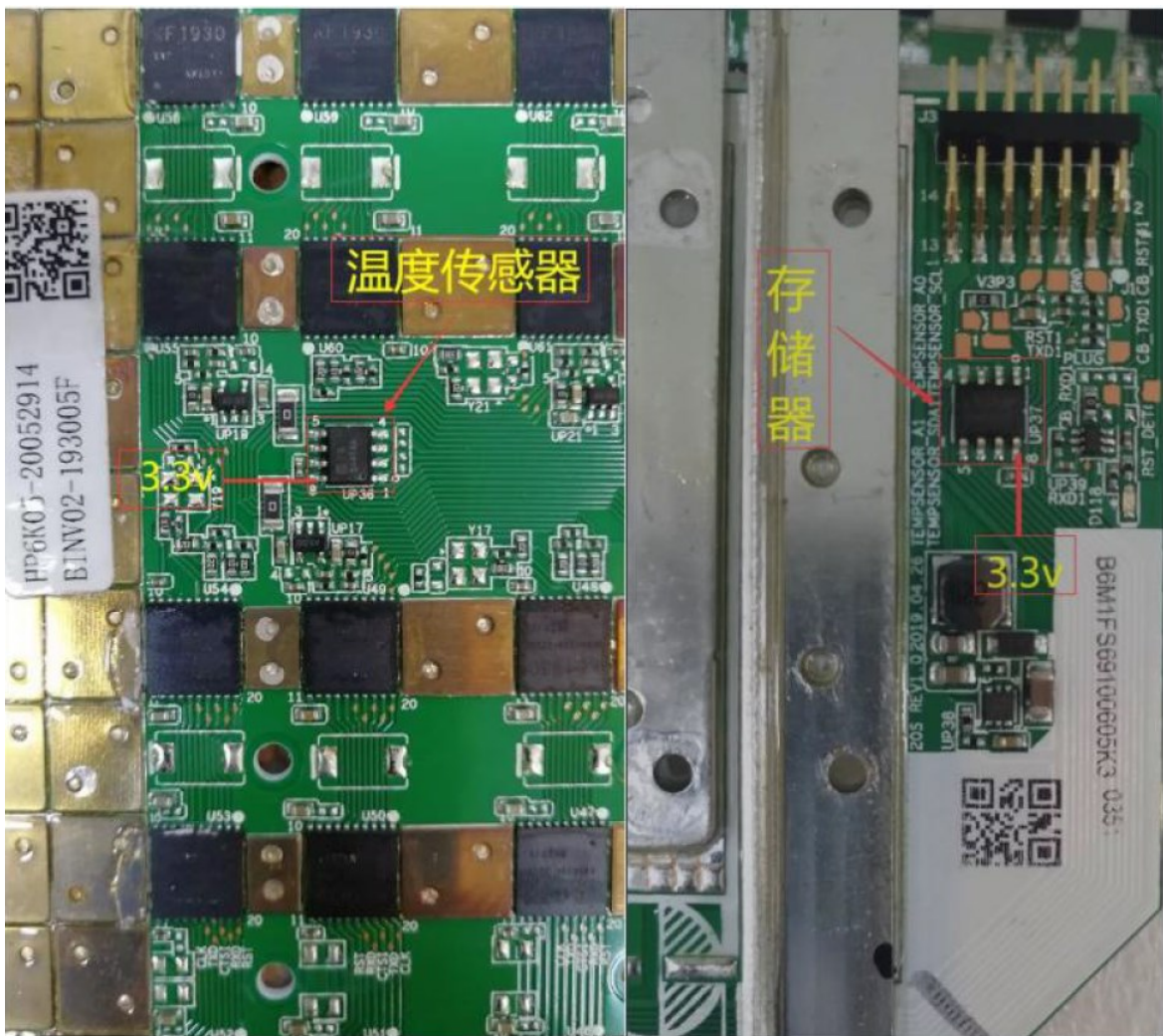


Figure 4-7

Voltage level conversion is between 3.3 V and 1.8 V. Details are shown in the following figure.

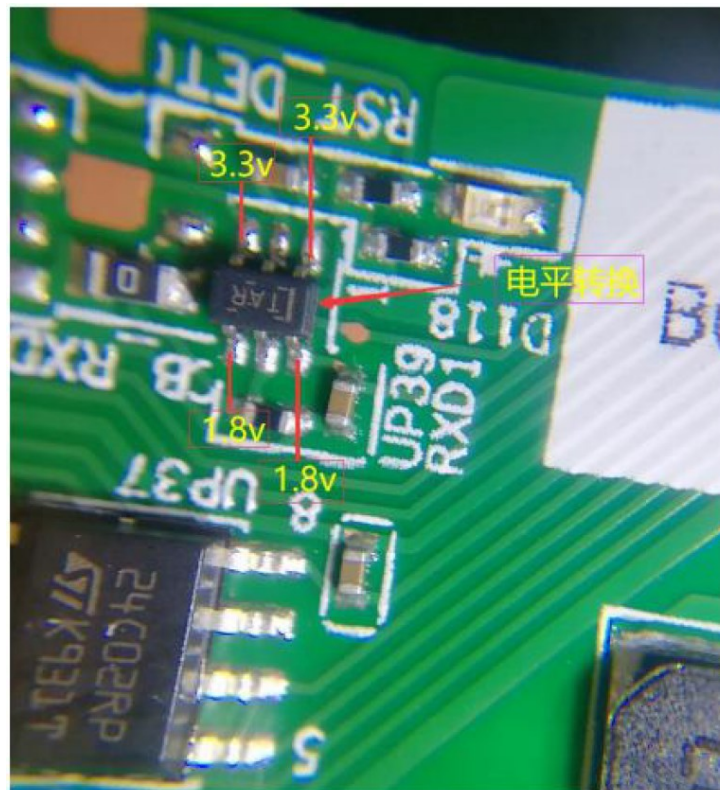


Figure 4-8

5. Case Study

5.1 Case Study for M20S

The following shows some repair experience.

1 Reset Failed, LED On

During the test, the LED lights up as soon as the hashboard is powered on. This is because the RST signal of the hashboard outputs a high level of 1.8 V, which drives the LED to be on. A normal board's RST is at a low level of 0 V, and the light is not on. At this time, start from U1, follow the signal flow, trace which chip causes the 0 V level signal of RST to change and increase, and find the change point to repair the relevant circuit.

2 Reset Failed, LED Not On

This is because the RST signal is interrupted during transmission from U1 to U105 and cannot be transmitted to the end. Use the command **echo 1 > /sys/class/gpio/gpio99/value** to set the RST signal to a high level of 1.8 V, search from U1

to U105 for where the RST changes from a high level of 1.8V to low, and repair the relevant circuit.

At the place where the signal is abnormal, first check the RST signal entering and exiting the chip for comparison to determine whether there is a problem. If it is abnormal, replace the relevant chip.

Because three chips in the same group are connected in parallel, the other two chips may also cause the signal transmission to fail.

In addition, capacitance leakage in the chip group will also affect the normal operation of the chip. It is necessary to switch the multimeter to the resistance range for comparison and measurement.

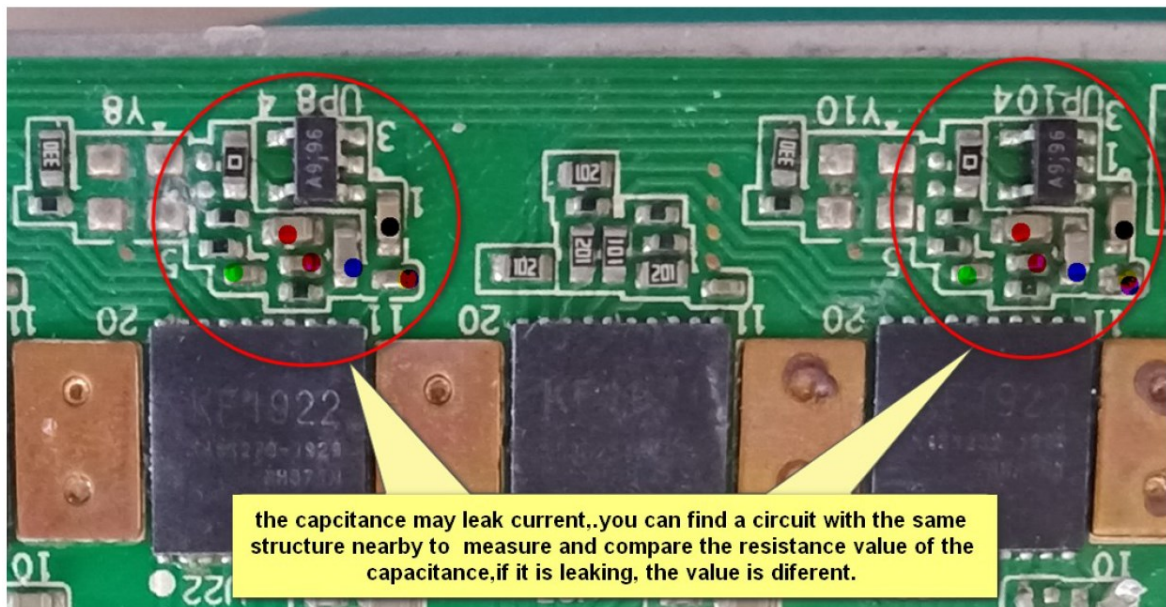


Figure 5-1

3 Reset Succeeded, Chip Reading Failed in Whole or in Part

The RST is normal, but chip reading fails. At this time, it is necessary to measure whether the transmission of the CLK 0.9V signal from U1 to U105 is interrupted. If yes, repair the relevant chip and LDO circuit, check the chip related to CLK (chips in the same group will be affected). If the CLK is interrupted at the crystal oscillator, the chips behind it will not be read out, and the crystal oscillator may be damaged. At the same time, check whether the capacitance at the interruption point is leaking.

If the CLK signal is normal, the next step is to measure whether the transmission of the 1.8V RXD signal from U1 to U105 is interrupted. If there is any abnormality, check whether

there is a problem with the chip and whether the LDO is normal. At the same time, measure whether the capacitance of the relevant layer is leaking.

If there is no problem in RXD measurement, then measure whether the transmission of the 1.8V TXD signal from U105 to U1 is interrupted. TXD interruption may also be caused by a faulty chip, a faulty related LDO, or leakage of related capacitance.

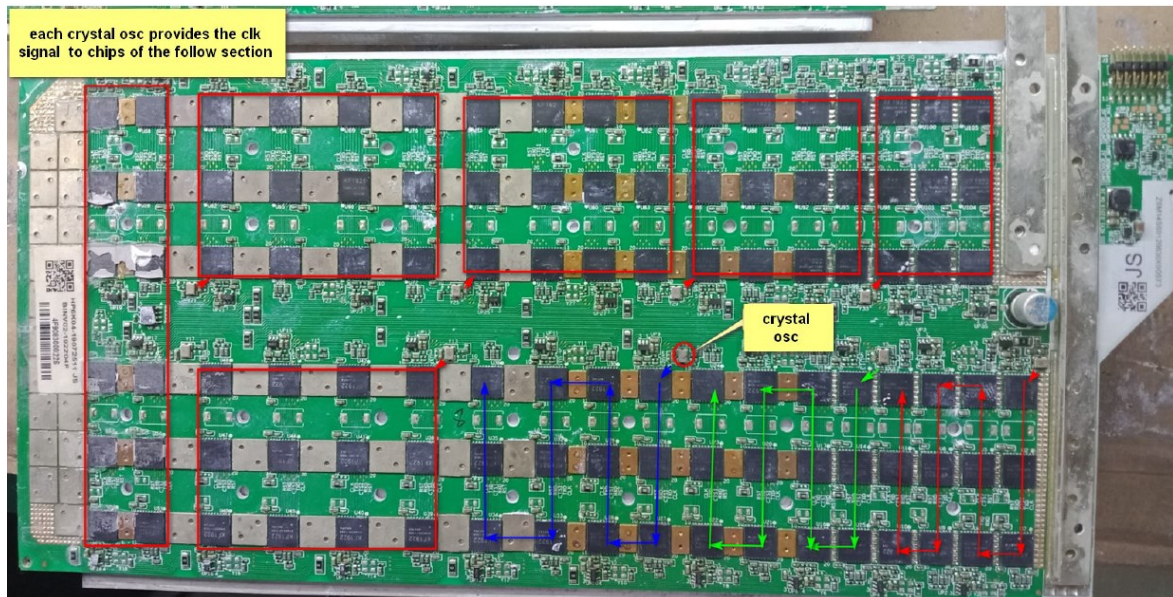


Figure 5-2

4 The repair of the whole board is mainly based on the measurement of signal voltage, supplemented by the measurement of the resistance value of signal test points and capacitance.

5 If the LDO output (Pin 5) does not have 1.8V, check whether the input (Pin 1) voltage is sufficient. If the input is not normal, find the relevant circuit before the input. If the input is normal but the output is not normal, replace the LDO chip. If the replaced LDO is still not normal, consider whether the chip group powered by it is faulty and pulls down the voltage, and whether the capacitance beside the LDO is leaking.

5.2 Case Study for M30X

The maintenance sequence is RST -> CLK -> RXD -> TXD.

You should use an oscilloscope to test the CLK voltage. A reading of 0.15V indicates normal operation.

Any error code must be checked in the daily log.

Case 1: M31S Reports Error Code 542 (Cannot Read Hashboard)

As shown in the screenshot.

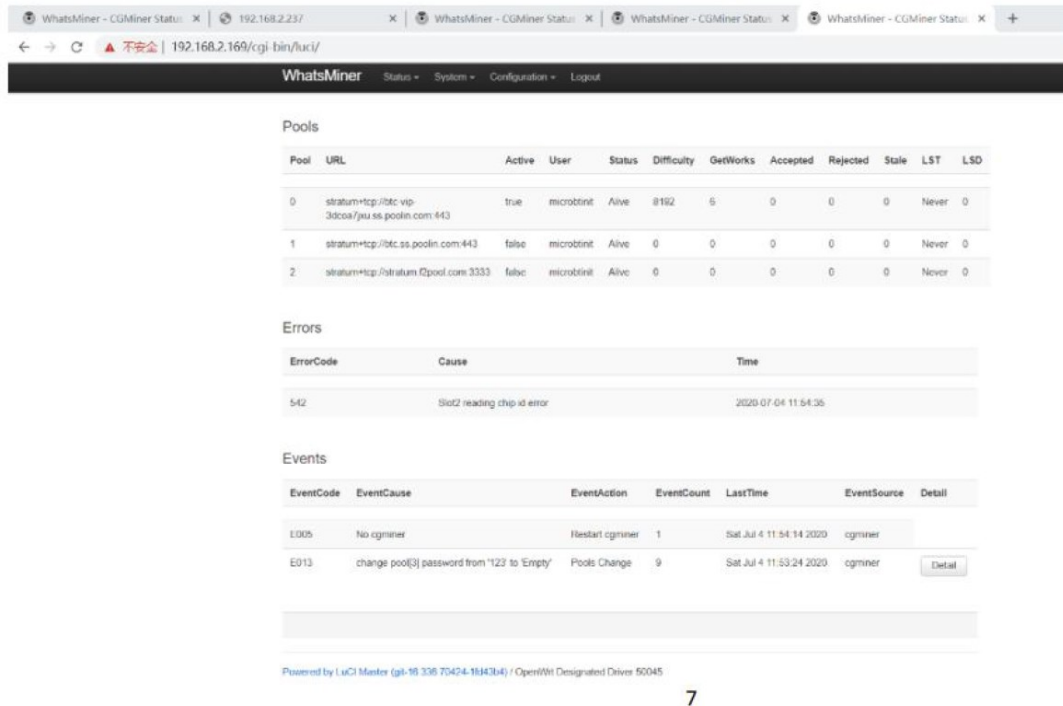


Figure 5-3

After removing SM2 and testing via the platform, it was indicated that “RST failed” . Four red arrows illustrate the status: “RST failed -> temperature normal -> chipset reading failed -> hashboard reading normal” .

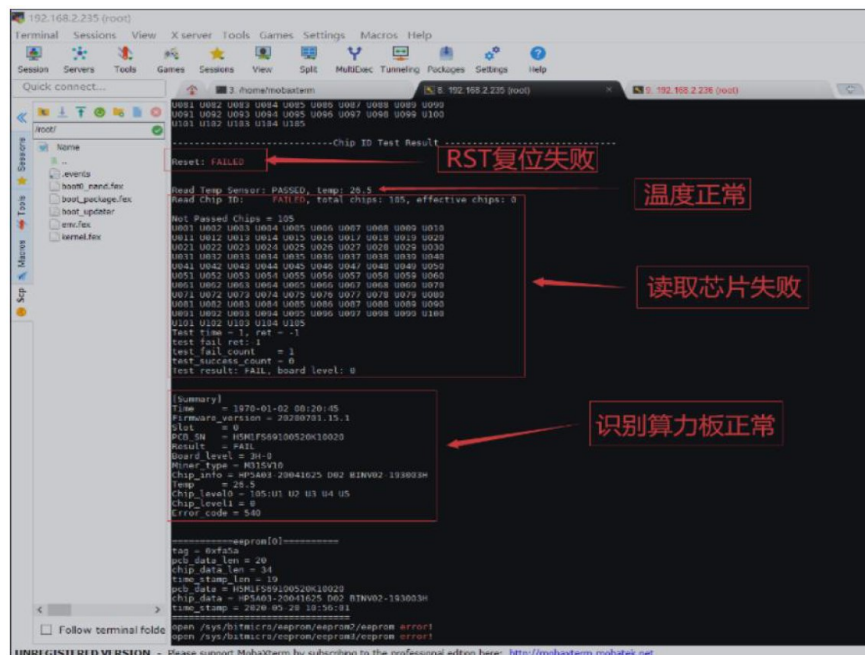


Figure 5-4

Troubleshooting Process

According to basic maintenance rules, the first step is to measure RST:

1. Use the software command `echo 1 > /sys/class/gpio/gpio99/value` to activate the level converter.
2. Measure RST points one by one. It is found that U6 RST output is 1.8V (normal), while U7 RST output is 0.5V (abnormal, not 1.8V), as shown in the screenshot.

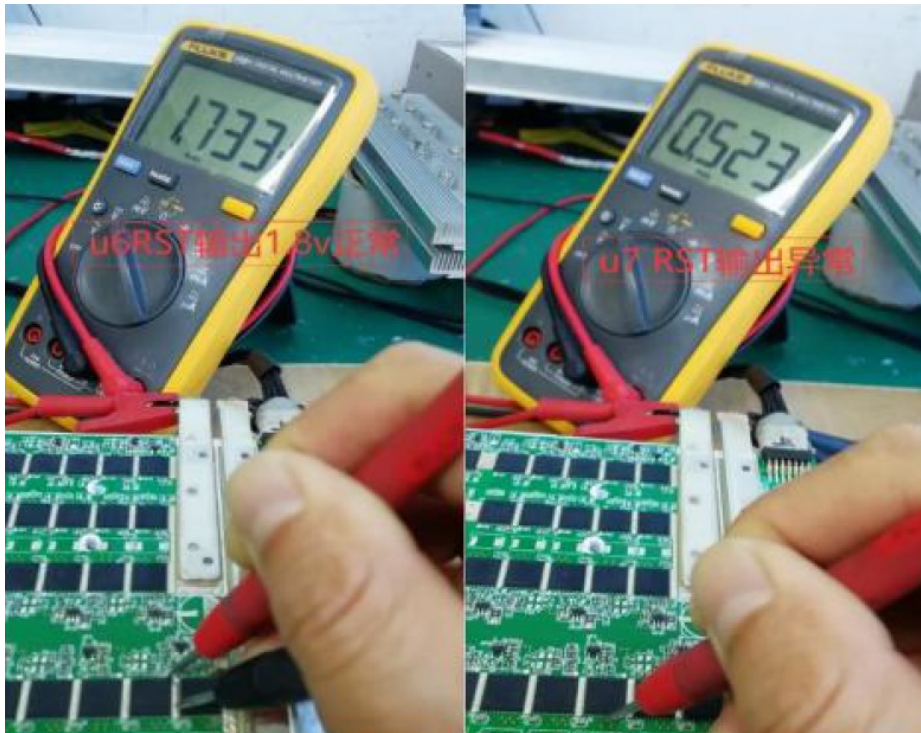


Figure 5-5

Root Cause and Repair

After measuring group by group, a fault is found in the 3rd group.

The LDO output is only 0.56V (abnormal).

Further measurement revealed that pin 8 of U8 has a resistance of $1.7\ \Omega$ (indicating a short circuit), which causes the LDO output voltage to drop.

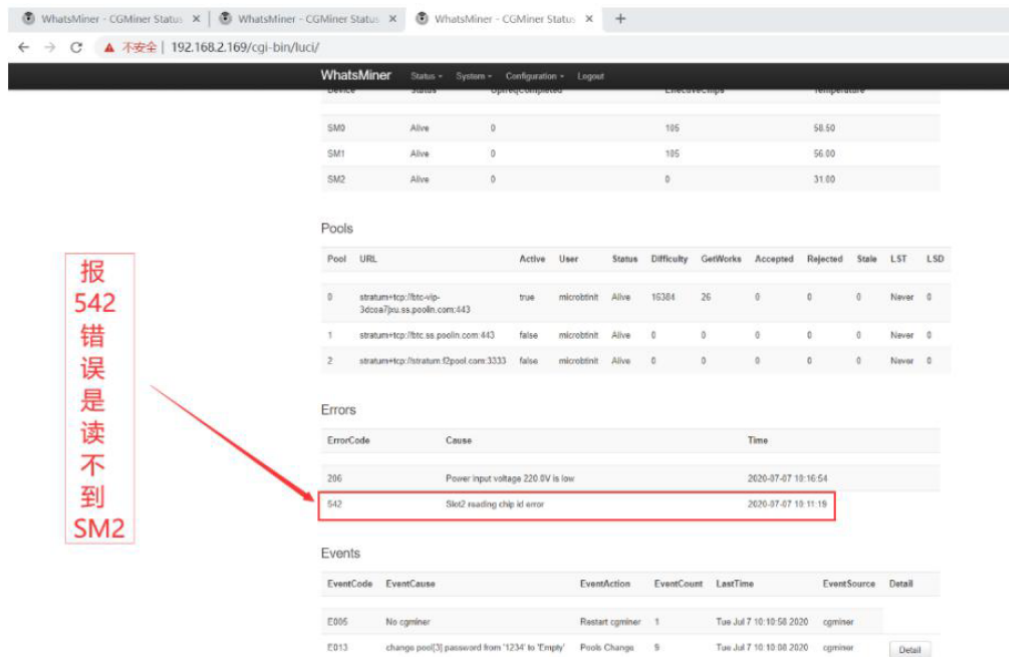


Figure 5-8

Remove SM2 and test it with software. It shows a total of 104 chips, missing 1 chip called U9.

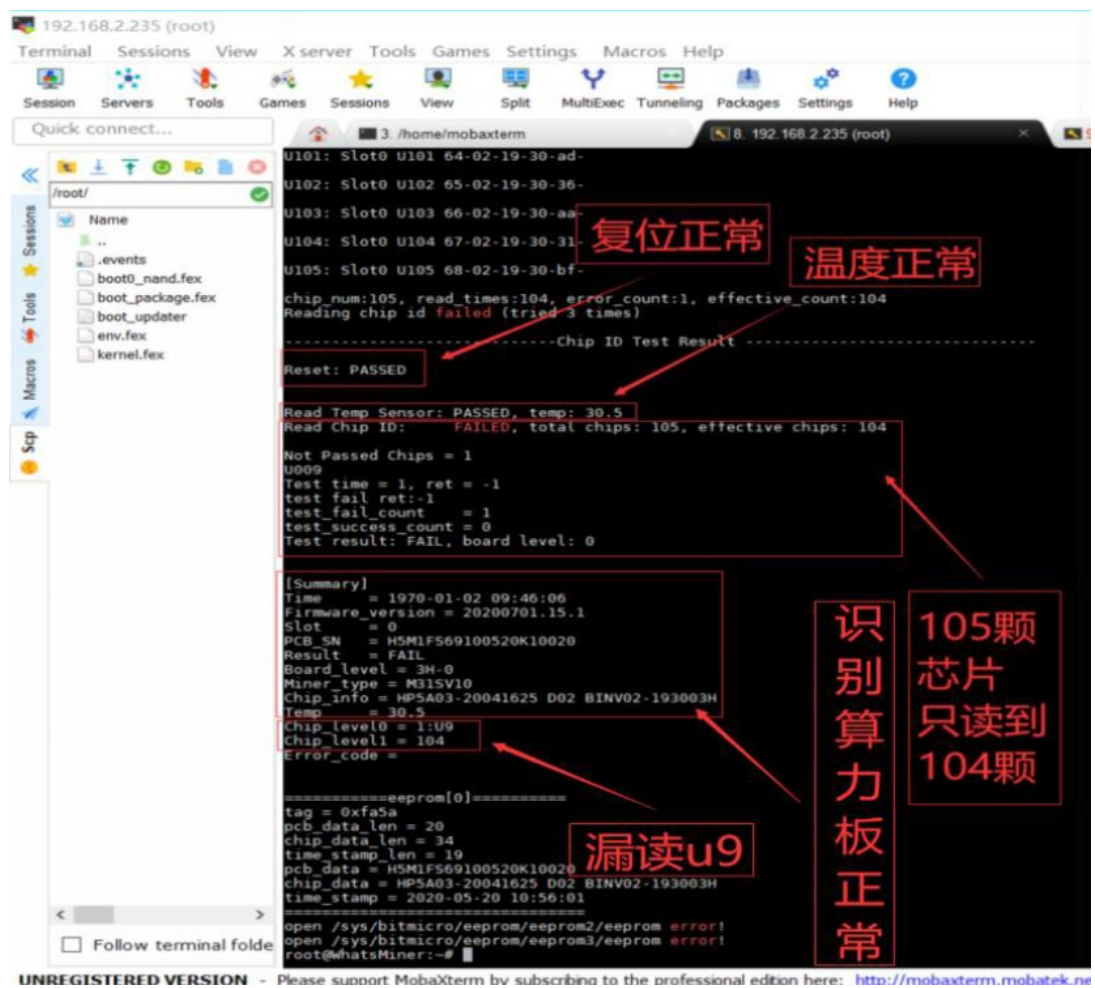


Figure 5-9

Remove the radiator, replace the U9 chip, test it via software. After successful testing, install it into the miner and conduct an aging test.



Note: You should ensure to check the correct sequence of the chips. The printing on some chips may not match their positions 100%.

Case 3: M31 Reports Error Code 561, 562 (Cannot Read SM1, SM2)

As shown in the screenshot.

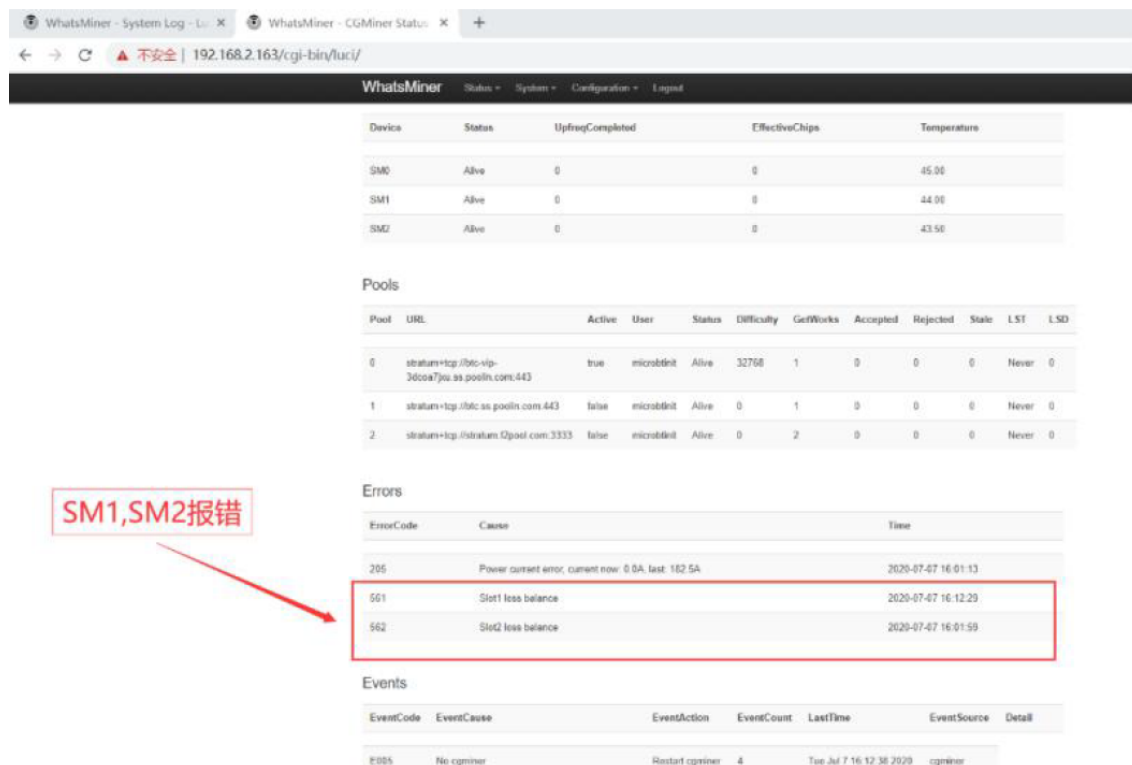


Figure 5-10

After being connected, the miner reboots, and the daily log is exported to check if it is a power supply issue.

Export log instruction, specific operations are shown in the following figure.

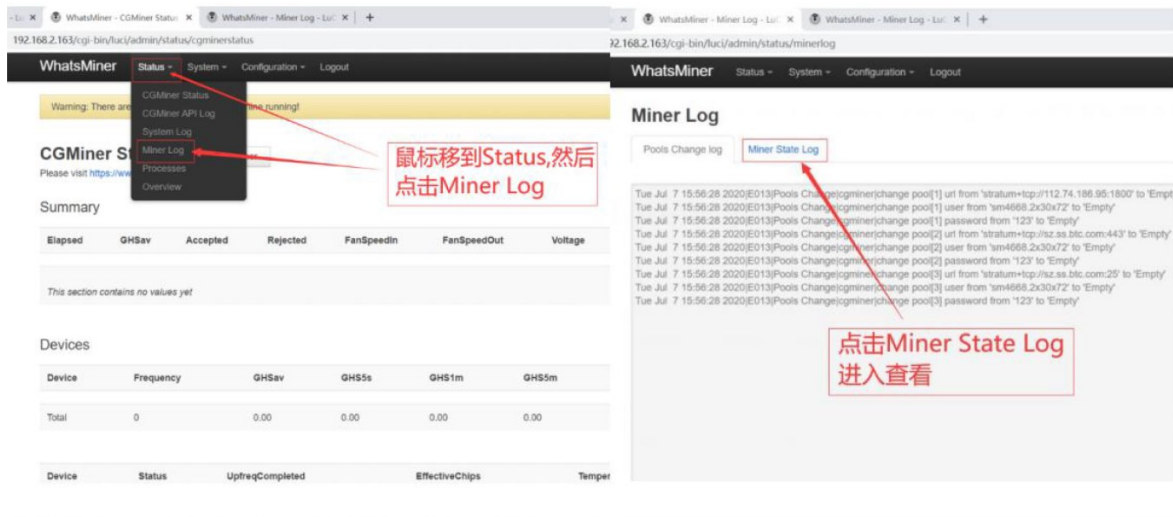


Figure 5-11

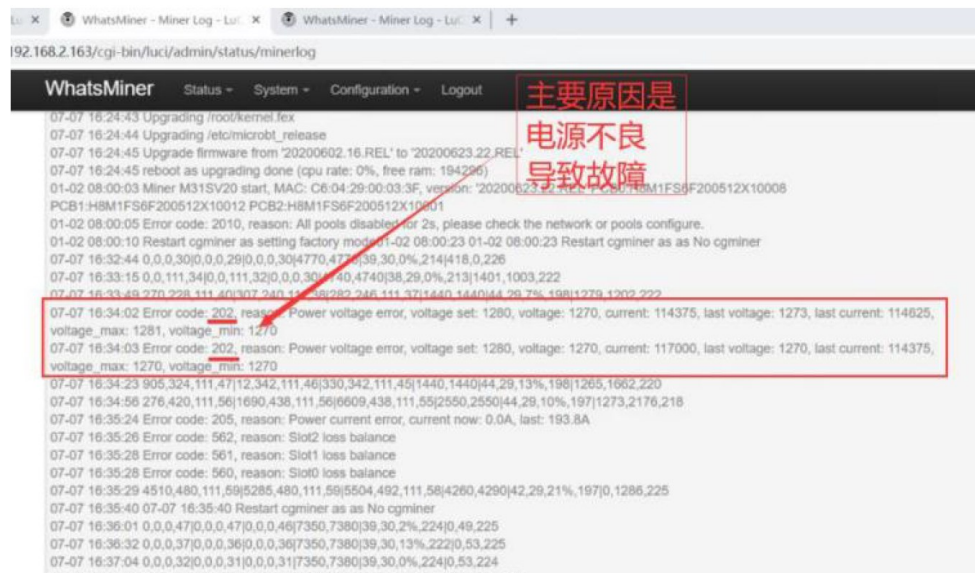


Figure 5-12

After analysis, it is confirmed that error code 202 indicated a power supply failure, which causes a miner to fail.

Case 4: M31+ Reports Error Code 540 (Cannot Read SM0 Chips)

As shown in the screenshot.

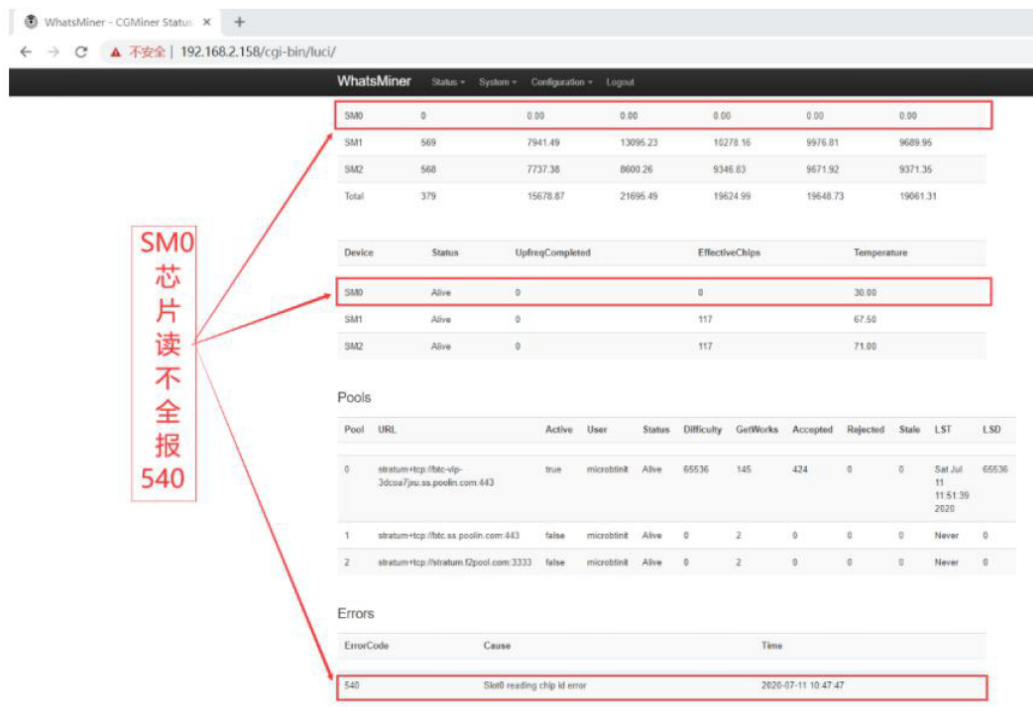


Figure 5-13

After testing via software, it shows that reading of chips U109, U119, and U111 fails.

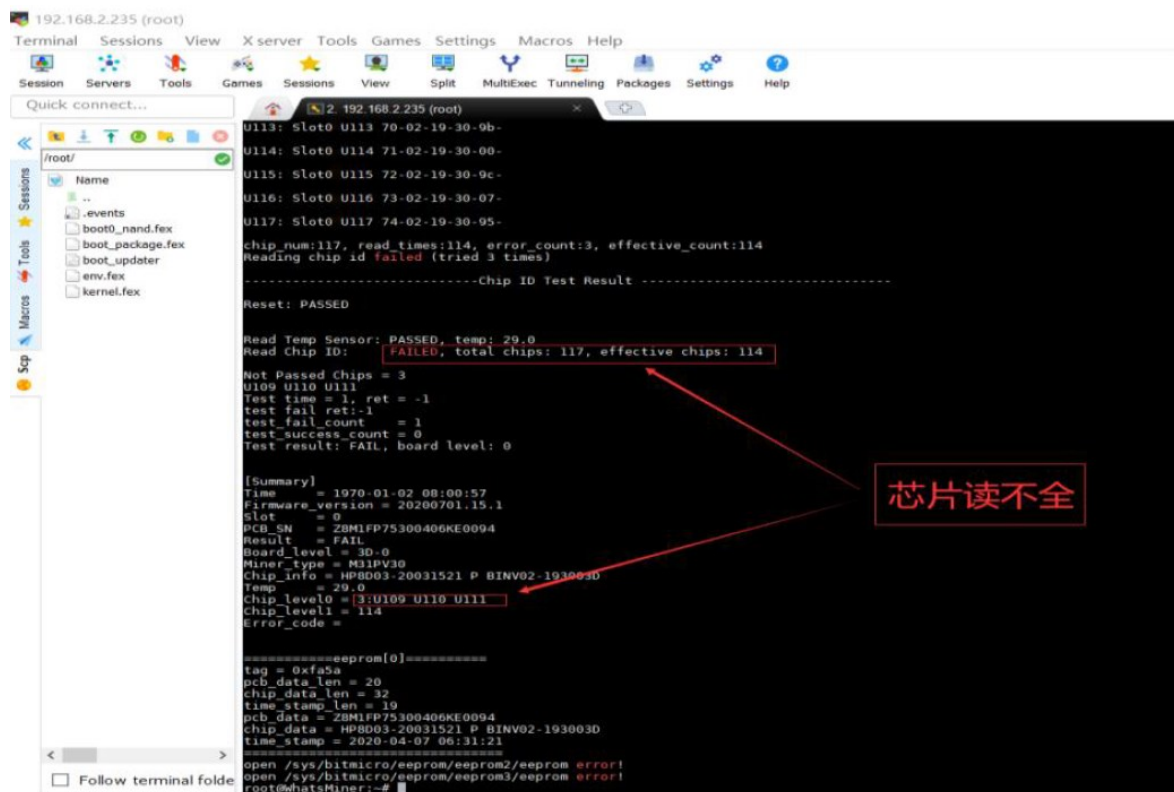


Figure 5-14

Check the group chipset, find a 1.8V shortage, and then further check the U110 circuit.



Figure 5-15

Replace U110, install it in the miner and conduct an aging test.

Case 5: M30S Reports Error Code 530 (Cannot Detect SM0)

As shown in the screenshot.

192.168.2.158 X WhatsMiner - CGMiner Status: X WhatsMiner - CGMiner Status: X

192.168.2.234/cgi-bin/luci/admin/status/cgminerstatus

Device	Frequency	GH/s	GH/s	GH/s	GH/s	GH/s
SM1	433	8000.17	18539.91	11412.70	5149.14	2088.61
SM2	424	9005.15	19113.11	11129.96	5038.23	2265.48
Total	428	16795.32	28753.02	22542.76	10687.38	4354.09

Device	Status	UpTime/Completed	EffectiveChips	Temperature
SM1	Alive	0	164	50.00
SM2	Alive	0	164	64.00

探测不到SM0算力板

Pool	URL	Active	User	Status	Difficulty	GetWorks	Accepted	Rejected	Stale	LS1	LS0
0	stratum-v1p1b://btc-vip-3dce7pou-ss.poolin.com:443	true	microbt	Alive	10384	0	136	0	0	Sat Jul 11 14:59:45 2020	10384
1	stratum-v1p1b://btc-ss.poolin.com:443	false	microbt	Alive	0	0	0	0	0	Never	0
2	stratum-v1p1b://btc-ss.poolin.com:3333	false	microbt	Alive	0	0	0	0	0	Never	0

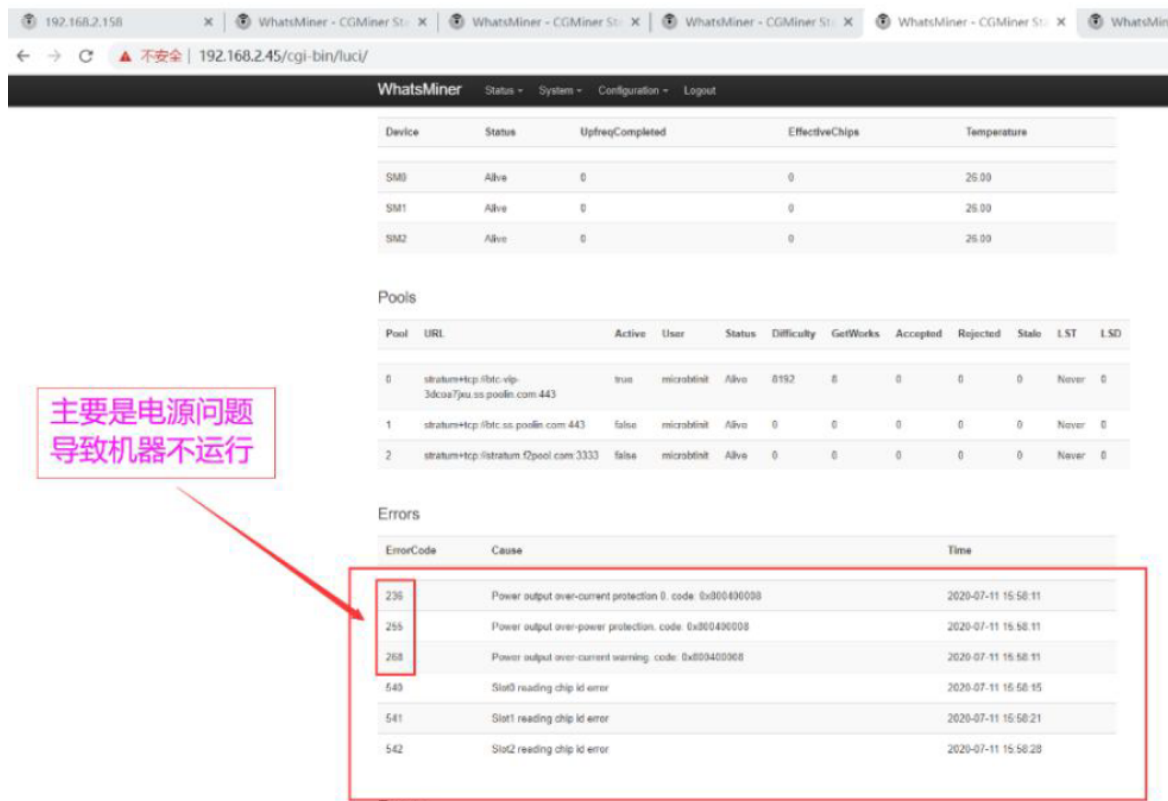
ErrorCode	Cause	Time
530	SM0 not found	1970-01-02 08:06:43

Figure 5-16

It is found that the fan is damaged and vibrated, which leads to the looseness of the cable. Plug the cable in again, and the power - on test is OK.

Case 6: M30S Reports Error Code 236, 255, 268 (Main Reason is Power Supply Failed)

As shown in the screenshot.



主要是电源问题导致机器不运行

Device	Status	UpfreqCompleted	EffectiveChips	Temperature
SM0	Alive	0	0	25.00
SM1	Alive	0	0	25.00
SM2	Alive	0	0	25.00

Pool	URL	Active	User	Status	Difficulty	GetWorks	Accepted	Rejected	Stale	LST	LSD
0	stratum+tcp://btc-vip-3dca7f9u.ss.poolin.com:443	true	microbtinit	Alive	8192	0	0	0	0	Never	0
1	stratum+tcp://btc.ss.poolin.com:443	false	microbtinit	Alive	0	0	0	0	0	Never	0
2	stratum+tcp://stratum.2pool.com:3333	false	microbtinit	Alive	0	0	0	0	0	Never	0

ErrorCode	Cause	Time
236	Power output over-current protection 0, code: 0x00400008	2020-07-11 15:58:11
255	Power output over-power protection, code: 0x00400008	2020-07-11 15:58:11
268	Power output over-current warning, code: 0x00400008	2020-07-11 15:58:11
540	Slot0 reading chip id error	2020-07-11 15:58:15
541	Slot1 reading chip id error	2020-07-11 15:58:21
542	Slot2 reading chip id error	2020-07-11 15:58:28

Figure 5-17

This error code is caused by the power supply. Replace the power supply and test whether it operates normally.

Case 7: M31 Reports Error Code 250, 25, 540, 541, 542 (Cannot Read SM1, SM2)

As shown in the screenshot.

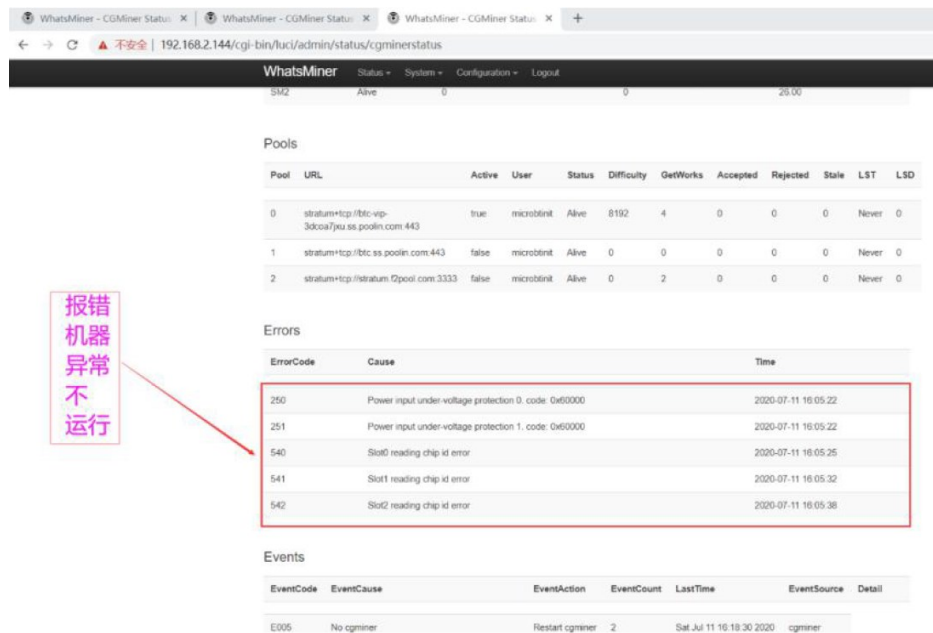


Figure 5-18

Export the miner log (as below) to further check the error reason. According to the log, the 202 error is caused by the power supply. After replacing the power supply, the test is OK.

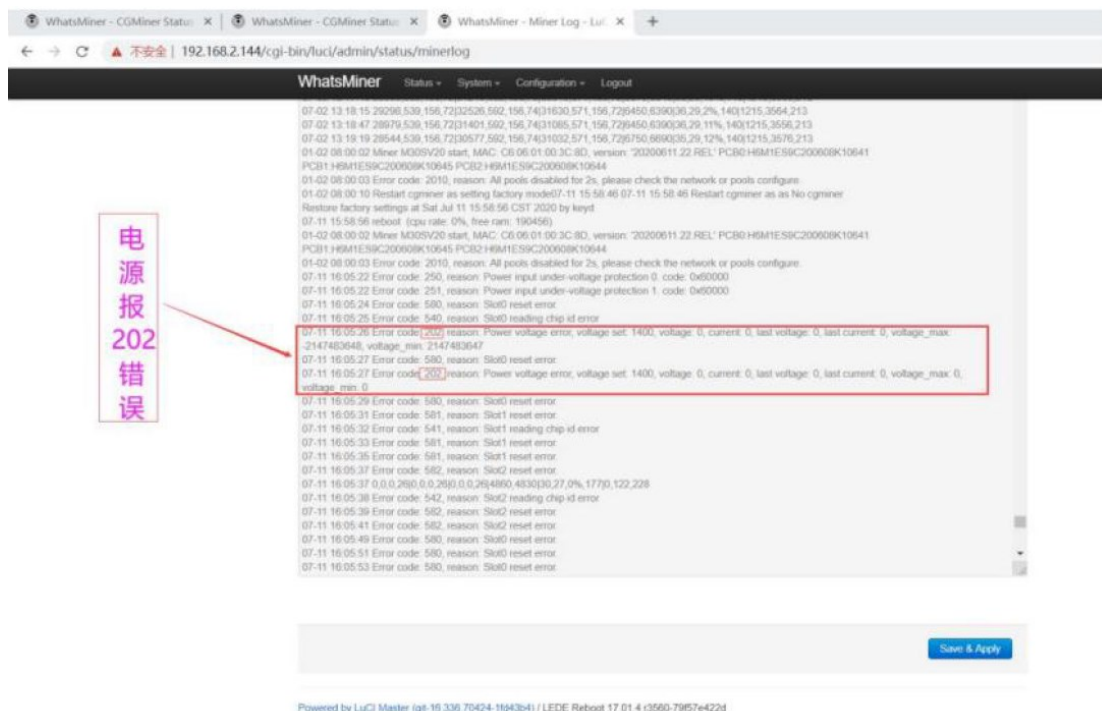


Figure 5-19

Case 8: M30S+ Reports Error Code 57, 540, 541, 542

As shown in the screenshot.

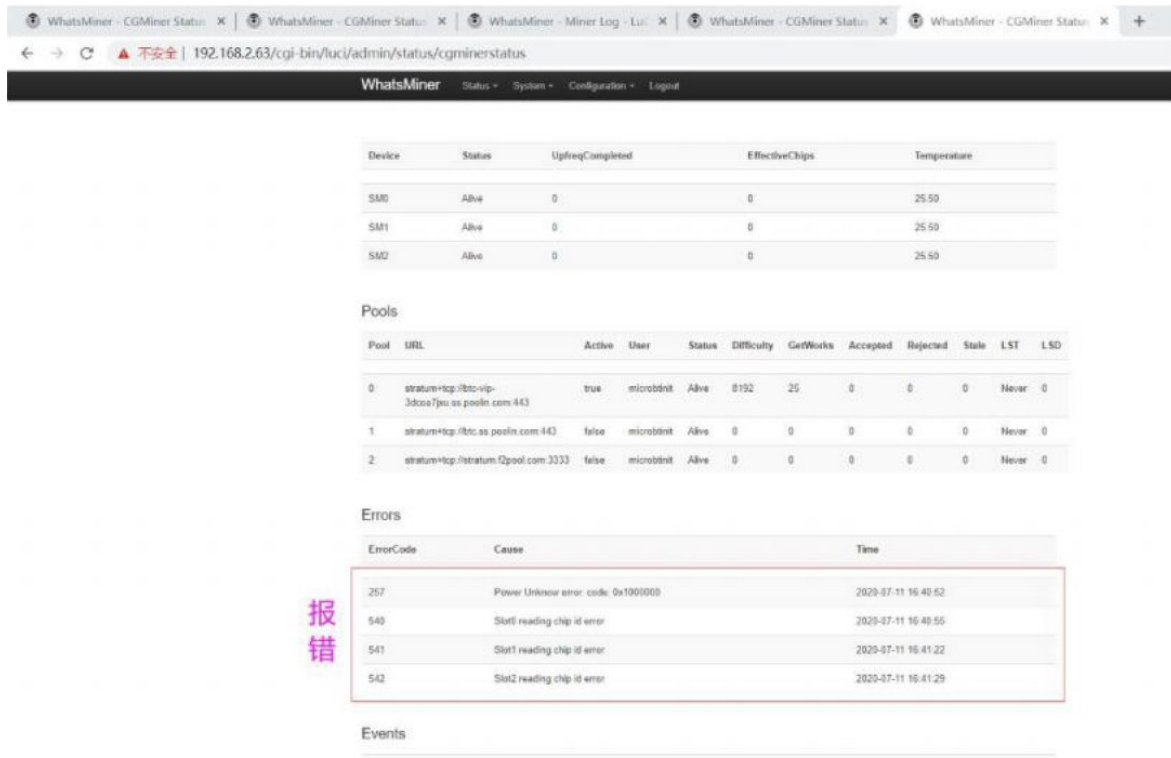


Figure 5-20

Check the miner log.

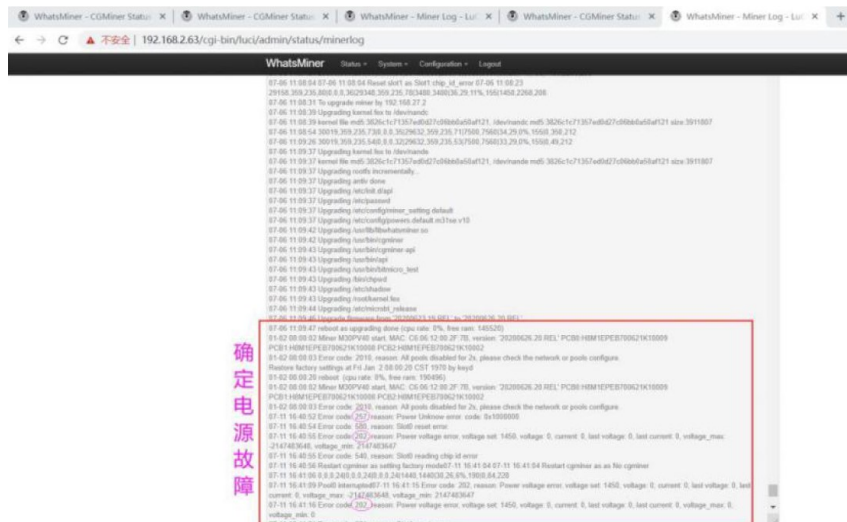


Figure 5-21

From the log, it can be told that errors 202 and 257 are caused by the power supply. Replace the power supply, and the test is OK.

6. Chip Welding Skills

Chip Sold Paste Melting

Step 1: Use a small brush to apply solder flux.



Note: Just coat a thin layer.

Step 2: Dip the solder paste with tweezers, and then apply it evenly on the side pad.



Note: A little solder paste can melt and cover a large area.

Step 3: Press gently with tweezers.



Note: The solder paste is spread with the chip and sintered evenly.

Step 4: Place the chip on the heating platform, and then heat until the solder paste melts.



Note: The temperature of the heating platform is set at 265 °C, and the chip is easy to be damaged over this temperature.

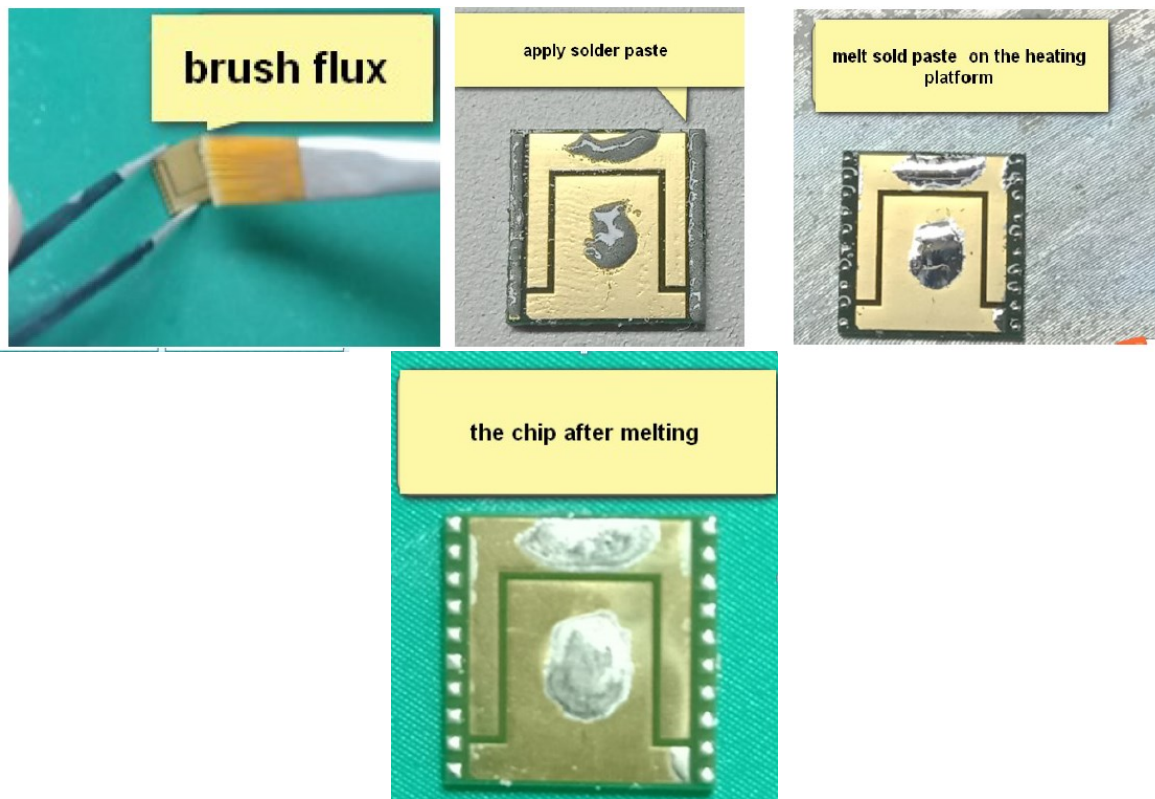


Figure 6-1

Remove Chip from PCB

Step 1: Brush flux onto the pins on both sides of the chip.

Step 2: Place the part of the circuit board where the chip needs to be removed on the heating platform for heating until the solder on the pins melts.

Step 3: Remove the chip with tweezers.



Note: Ensure the part of the board that does not need to be welded is placed on the platform to reduce temperature - related damage to components.

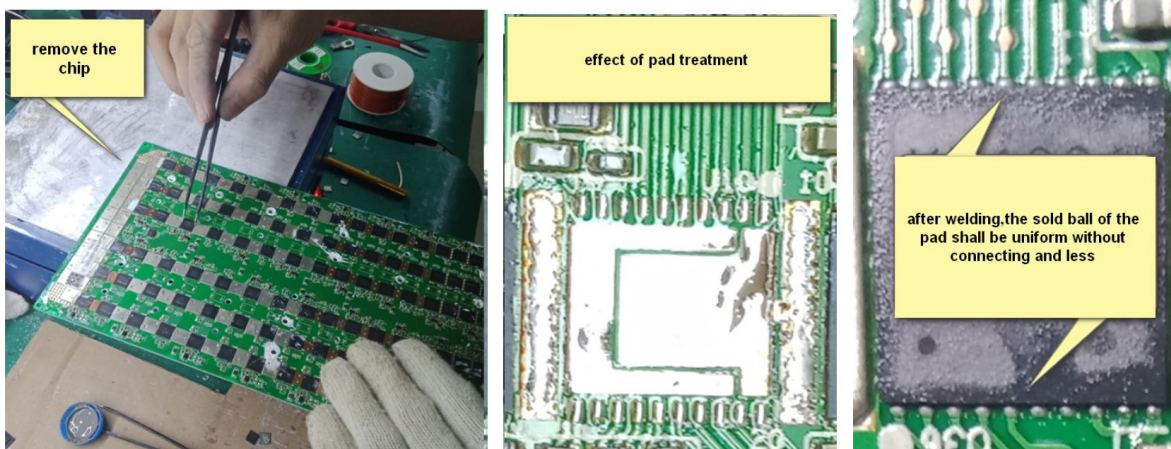


Figure 6-2

Pad Treatment

Step 1: After the chip is removed, use tweezers to apply a little tin on the pad.



Note: Be careful not to apply too much solder paste.

Step 2: Once the solder paste is melted, use the tips of tweezers to move the pad back and forth to make the tin on the pad even and tidy.

Mount Chip

Step 1: Align chip pins with pads, and then place a chip down on the pads.

Step 2: Heat on a heating platform until solder is melted, allowing the chip and the pads to connect automatically.

Step 3: Verify that the welded pins of the chip are even and full, with no solder excess or improper connection.



Note: Wear gloves when performing welding operations to prevent high-temperature scald.

7. Appendix

7.1 Guidance of Repairing with Oscilloscope

Oscilloscope Setup

Step 1 Press **RUN/STOP** button, and wait for a LED light to turn green.

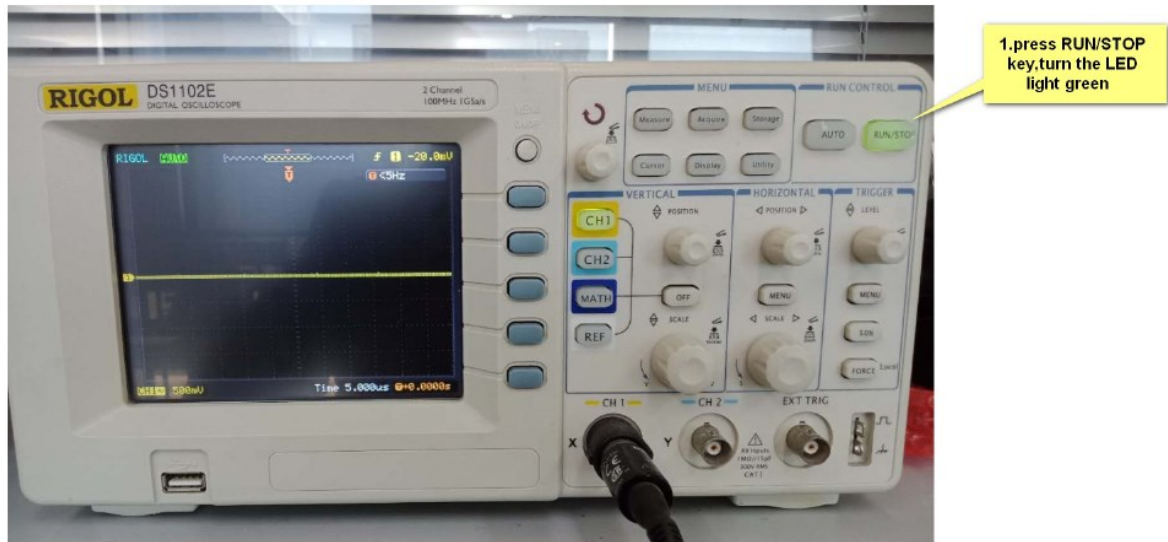


Figure 7-1

Step 2 Press **CH1** button to display **CH1** menu on a screen, and then set **Coupling** to **AC** and set **Probe** to **10X**.



Note: The LED turns green, indicating a measurement channel is selected

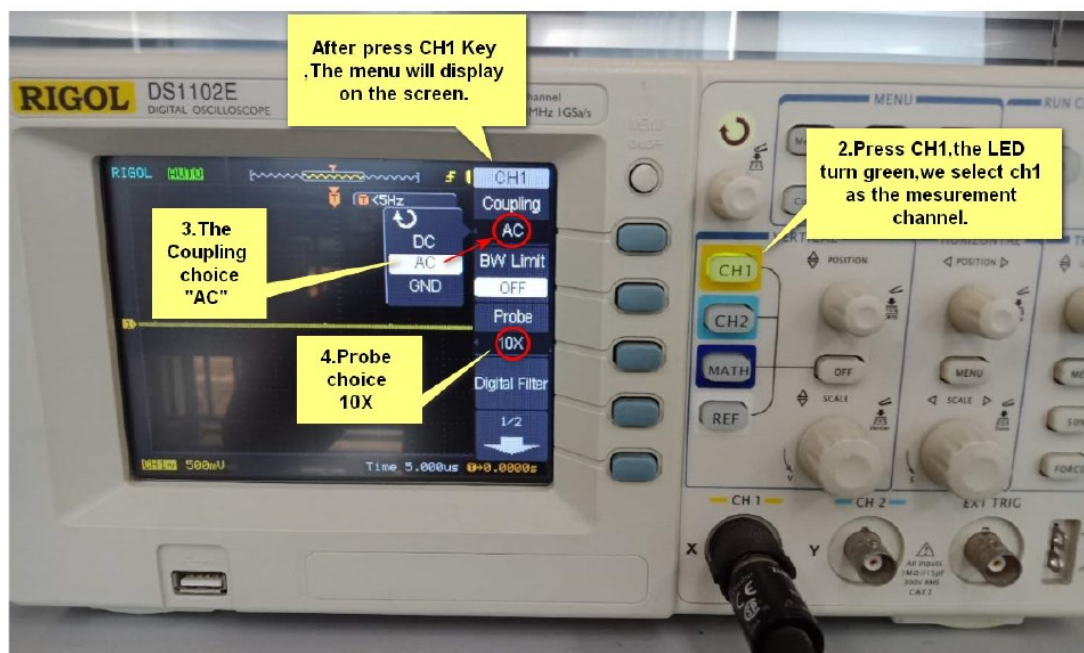


Figure 7-2

Step 3 For triggering settings, press **Menu** button to display **Trigger** menu on the screen, and then set **Mode** to **Edge**, **Source** to **CH1**, and **Slope** to **Auto**.

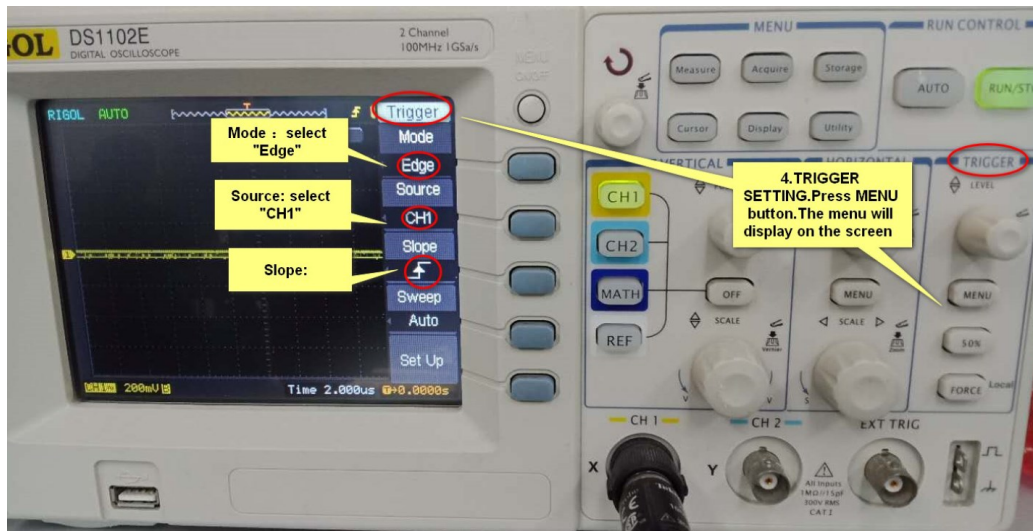


Figure 7-3

Probe Connection

Connect the probe ground wire to the negative pole of the power supply.

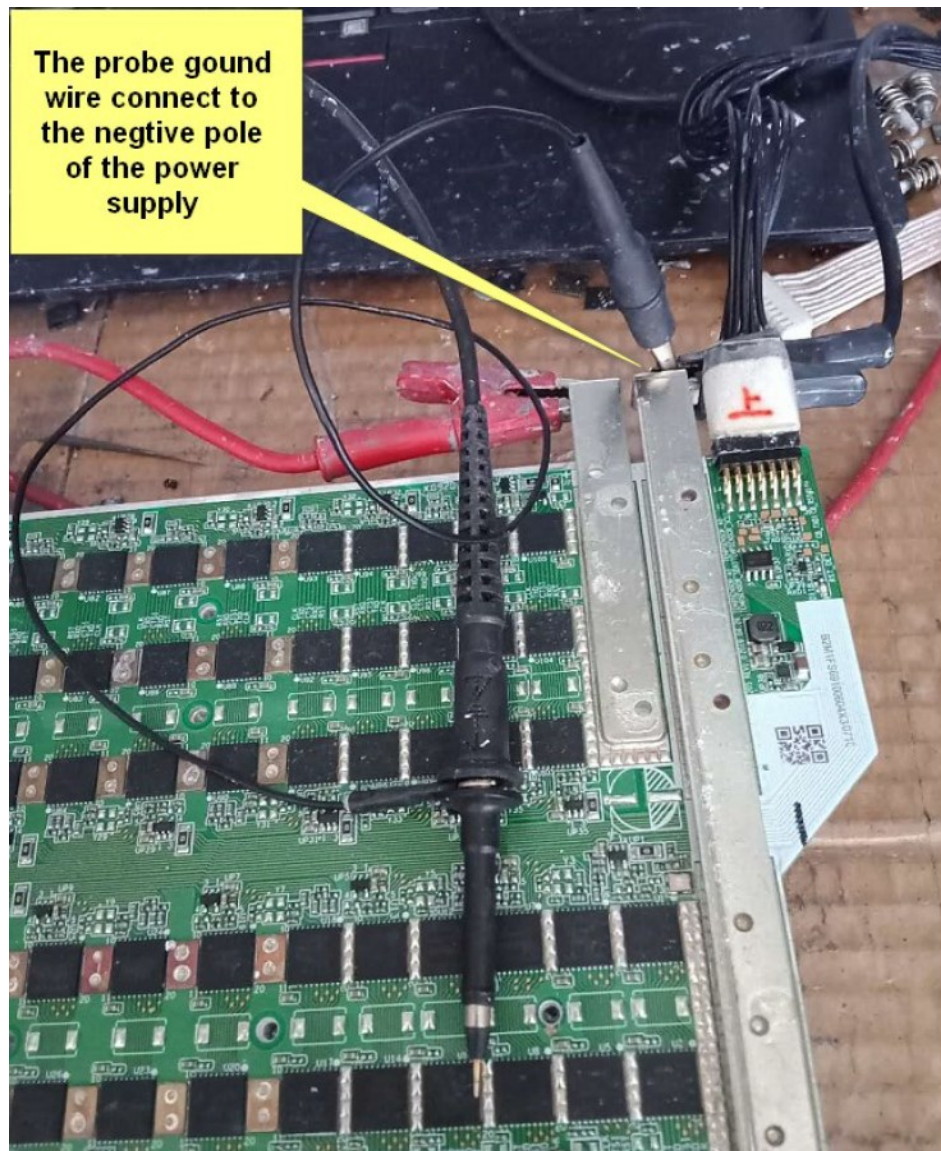


Figure 7-3

Power Supply Settings for Different Series

- **M20X:** Usually set the test power supply at 13 V.
- **M30X:** The repair method is the same as the M20x. The test power supply is set as 0.31 V multiplied by the number of chip groups on the hashboard. For example, if a hashboard has 37 groups of chips, then $0.31 \times 37 = 11.47$ V, so you can set the test power supply to 11.5 V.

Signal Measurement

After setting up an oscilloscope, you can measure signals as follows.

1. CLK Wave Shape Measurement

Step 1 Take a probe, and then place it on a CLK signal test point.

Step 2 Rotate knobs on the oscilloscope: one to adjust the voltage (up and down range), and the other to adjust the time (left and right range), until a CLK wave shape is clearly displayed on a screen.

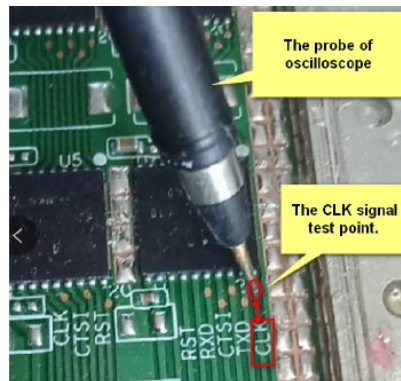


Figure 7-4

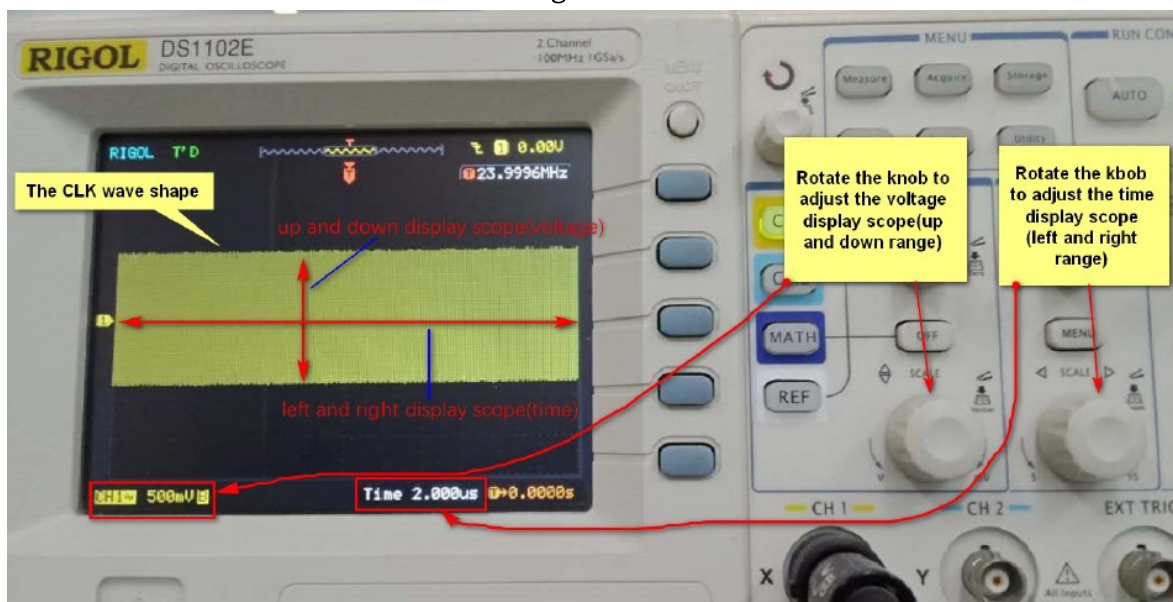


Figure 7-5

2. RXD Signal Wave Shape Measurement

You can capture a RXD signal wave shape only when running **test-readchipid** command. If the command is not running or has finished running, the wave shape cannot be captured.

Method

Step 1 Place the probe on a RXD test point.

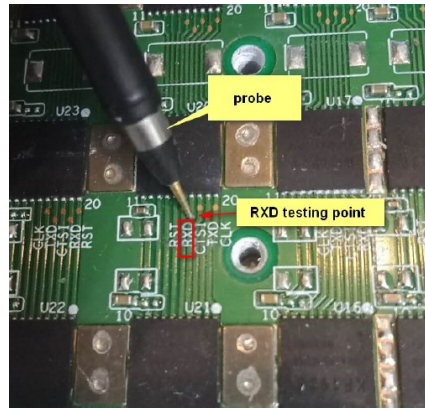


Figure 7-6

Step 2 Power on a test power supply.

Step 3 Run **test-readchipid** command in a MobaXterm program, and then observe a RXD wave shape simultaneously.



Figure 7-7



Note: If an input RXD signal wave shape is normal but an output wave shape is not the same, a chip may be faulty.

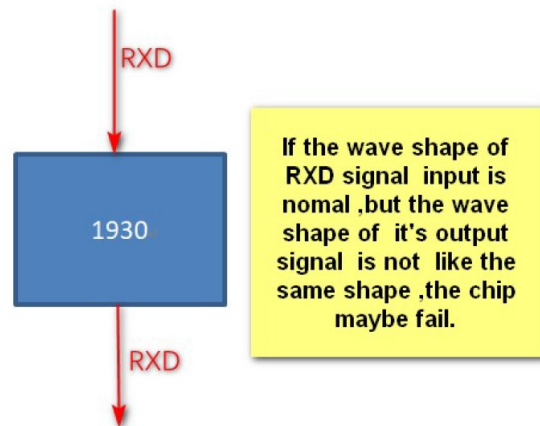


Figure 7-8

3. TXD Signal Wave Shape Measurement

You can capture a TXD signal wave shape only when running **test-readchipid** command. If the command is not running or has finished running, the wave shape cannot be captured.

Method

Step 1 Place the probe on a TXD test point.

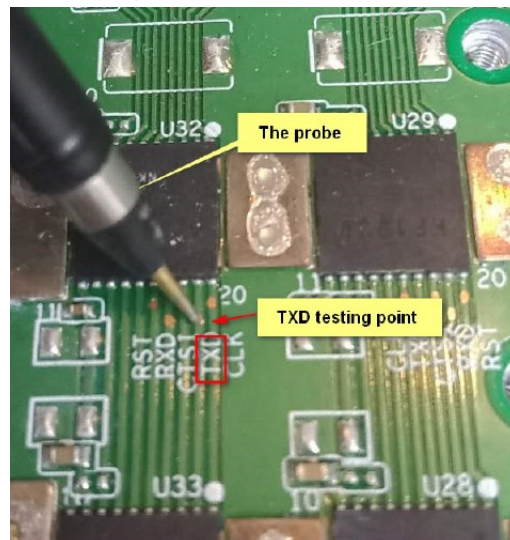


Figure 7-9

Step 2 Power on the test power supply.

Step 3 Run **test-readchipid** command in the MobaXterm program, and then observe a TXD wave shape simultaneously.

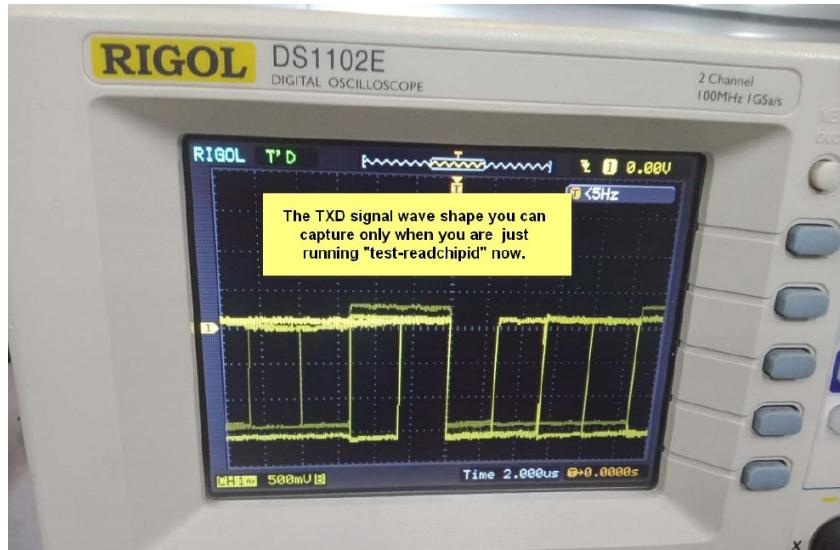


Figure 7-10



Note: If an input TXD signal wave shape is normal but an output wave shape is not the same, a chip may be faulty.

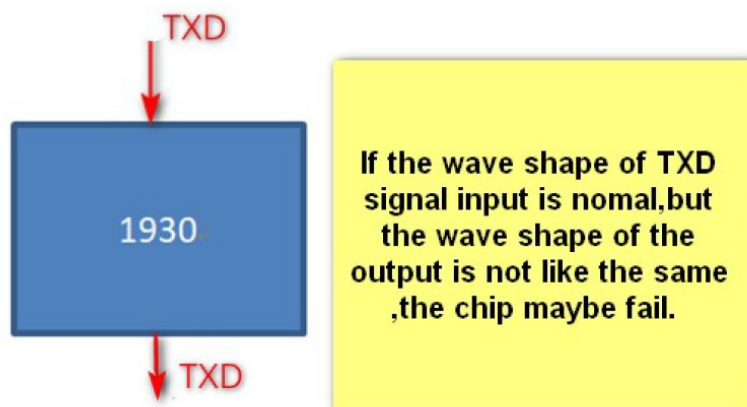


Figure 7-11

4. RST Signal

An RST signal does not require an oscilloscope to observe a wave shape.

Troubleshooting Flow

Step 1 Check if CLK wave shapes from the first chip to the last chip are normal. If any wave shape is abnormal, repair the CLK signal.

Step 2 If all CLK signal wave shapes are normal, a CLK signal is good. Next, check RXD signal wave shapes from the first chip to the last chip. If any wave shape is abnormal, repair the RXD signal.

Step 3 If all RXD signal wave shapes are normal, a RXD signal is good. Next, check TXD signal wave shapes from the last chip to the first chip. If any wave shape is abnormal, repair the

TXD signal.

7.2 Connection on Sub board

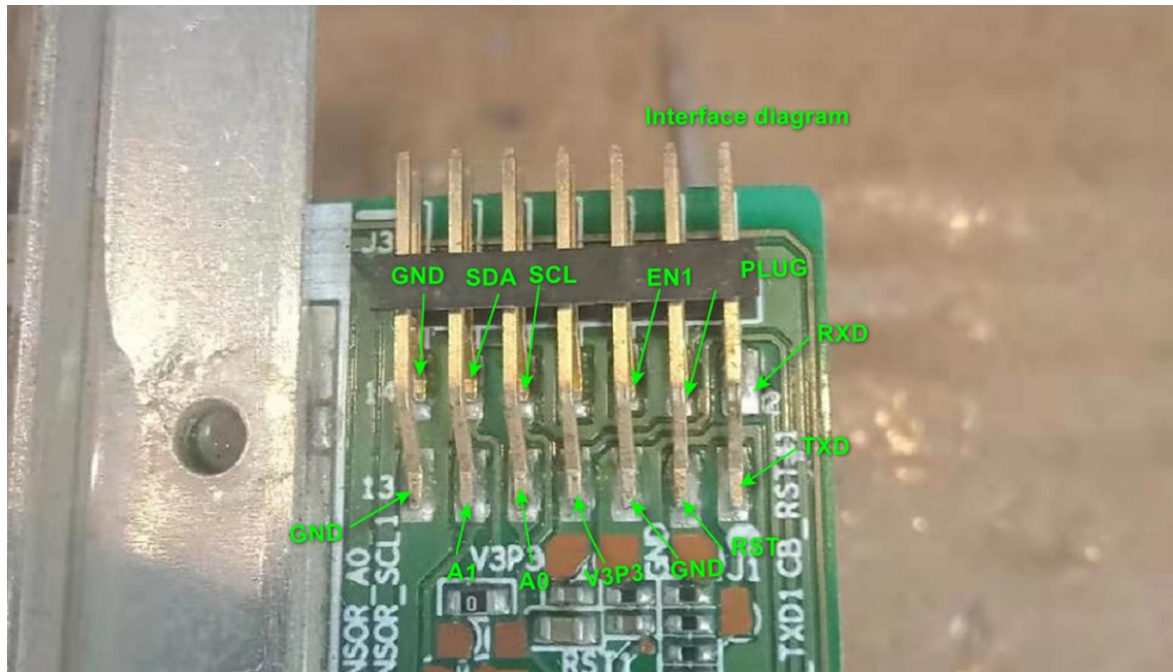


Figure 7-12

LED ON THE sub board

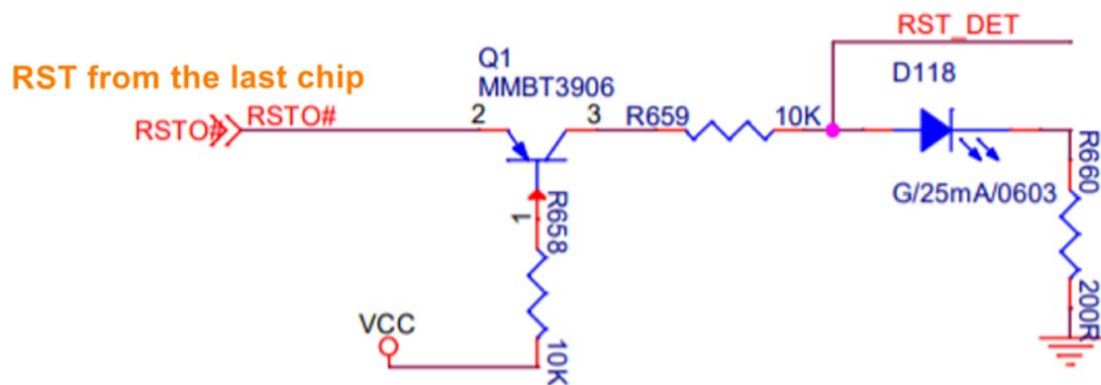


Figure 7-13

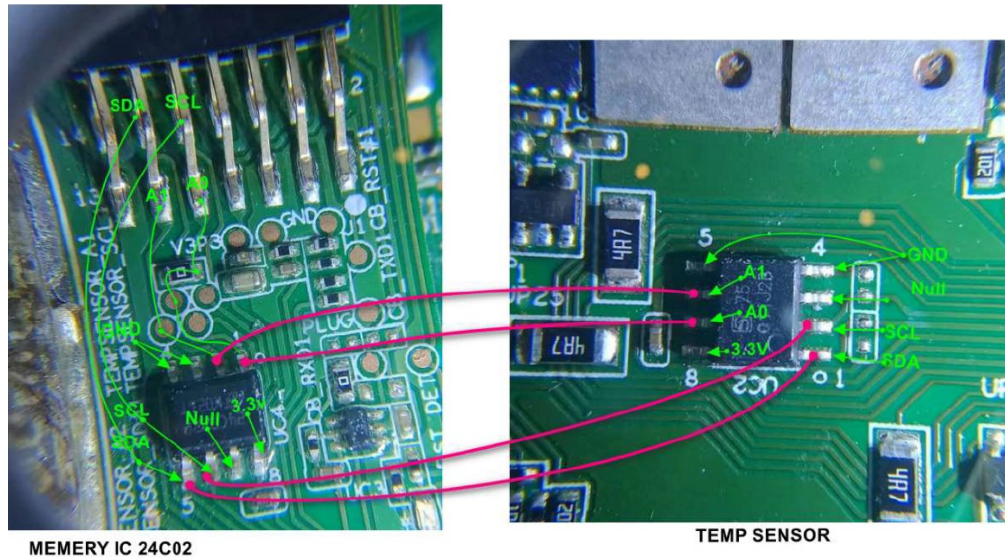


Figure 7-14

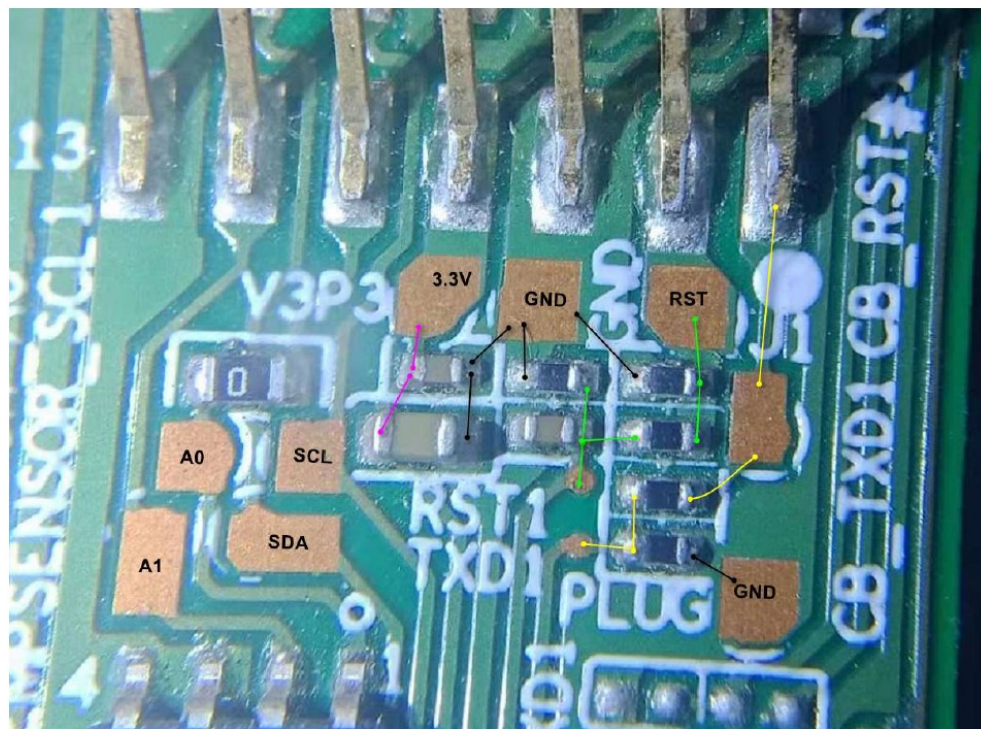


Figure 7-15

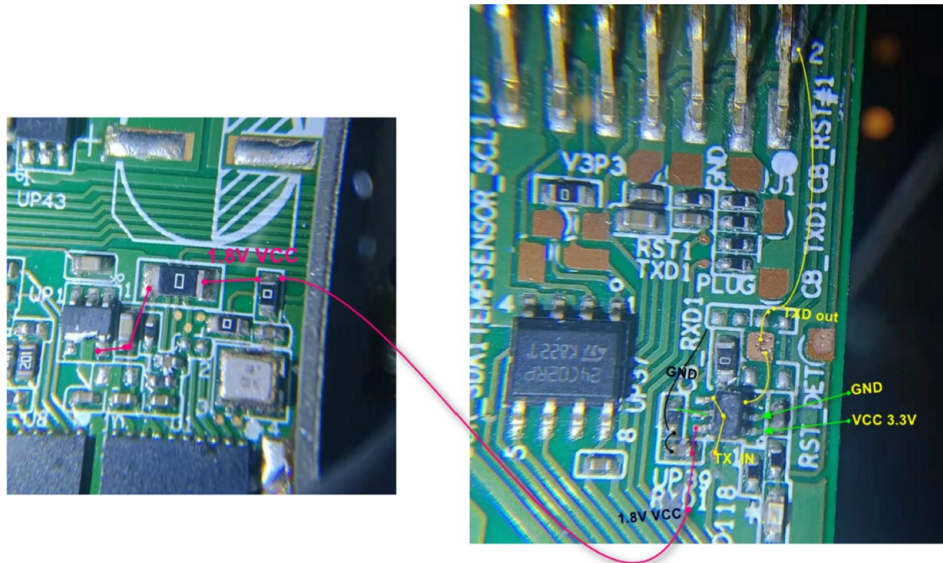


Figure 7-16

7.3 LDO Output Defect Case

LDO Output Fail Repair Procedure

Under normal conditions, LDO outputs are 1.8 V and 0.8 V. Often, if the LDO output is lower than 1.8 V or 0.8 V, it can still pass **test-readchipid** test in MobaXterm. However, when installed in the chassis and during the upfreq process, the board will fail.

In the initial state, when the board is cold and hasn't been run in the chassis, all LDO outputs are normal. Such a problem can't be detected with a multimeter. We need to run the board in the chassis until it fails, then quickly take it out and measure with a multimeter. We'll find that the LDO output is lower than normal. Sometimes, the upfreq process needs to be done several times to detect the LDO output lower problem.

When repairing, wait for the board to fail in the chassis, then quickly pull it out. Do not cool it down with a fan. Measure the LDO as soon as possible while the board is at a high temperature. This helps find the LDO lower output defect.

This defect is usually caused by unstable chips. This unstable fault is troublesome because it requires testing in the chassis.

Repair Procedure

If the LDO output is abnormal, first determine if the LDO is faulty. If so, directly replace it with a new one.

After replacing with a new LDO, if the output is still abnormal, check the chips in the domain. 90% of LDO output abnormalities are caused by unstable chips.

If there are 3 chips in a domain, first ensure all LDOs are good. To find the faulty chip:

- First, remove the chip farthest from the LDO, keep the nearest one in place, and measure the LDO. If the LDO becomes normal, the removed chip is faulty; replace it with a new one.
- If the LDO is still abnormal, put the removed chip back, remove the middle chip, and check the LDO again. If the LDO becomes normal, this chip is faulty; replace it with a new one.
- If the LDO is still abnormal, the chip nearest to the LDO is faulty; replace it with a new one.

LDO 1.8V and 0.8V need to pass U1 to be delivered to U2 and U3. So, U1 must be kept in place when removing U2 or U3. Otherwise, the path will be broken, and the LDO 1.8V output voltage will show 2.3V or more, which is higher than normal.

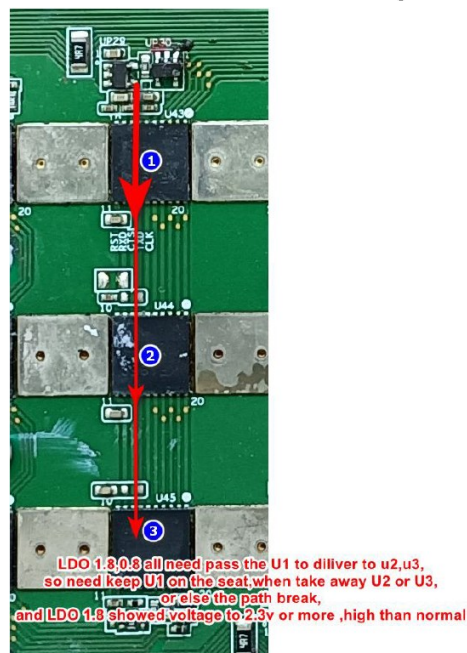


Figure 7-17

Check the LDO capacitors; they may have current leakage. The 6 capacitors are likely to leak current.

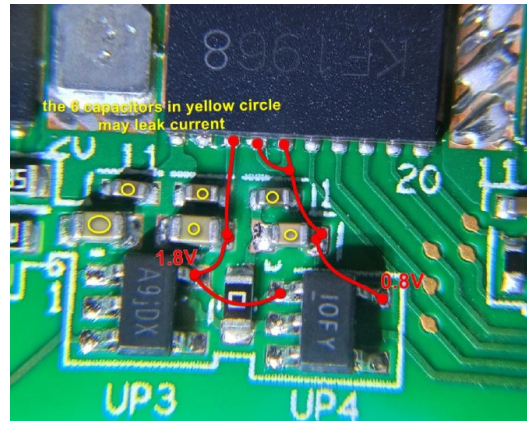


Figure 7-18

Check the 4R7 1208 resistors. Their soldering may be poor and can't be detected by inspection. Resolder all 4R7 resistors on the board.

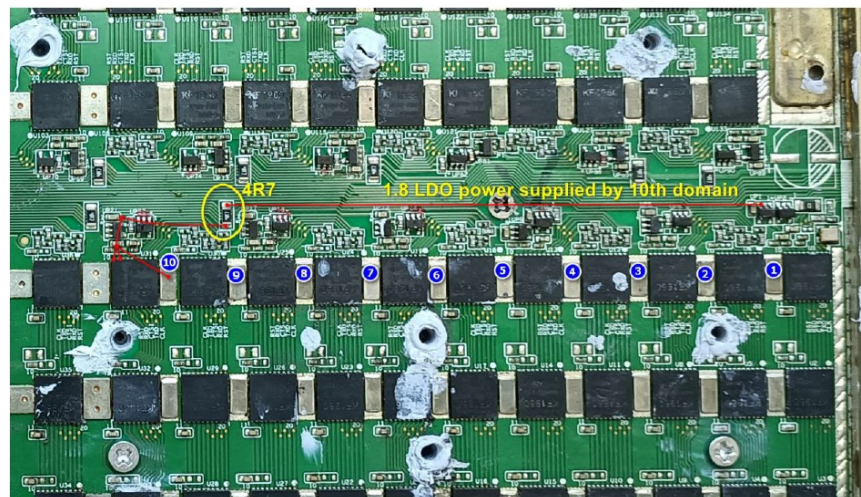


Figure 7-19

If there are 10 domains and each domain is only 0.15 V, then $10 \times 0.15 = 1.5 \text{ V}$, which means the input is insufficient. Adjust the voltage of several domains in these 10 by replacing chips or swapping chips between high - voltage domains and low - voltage domains on the board. Ensure that the total voltage of the 10 domains is at least over 2.2 V.

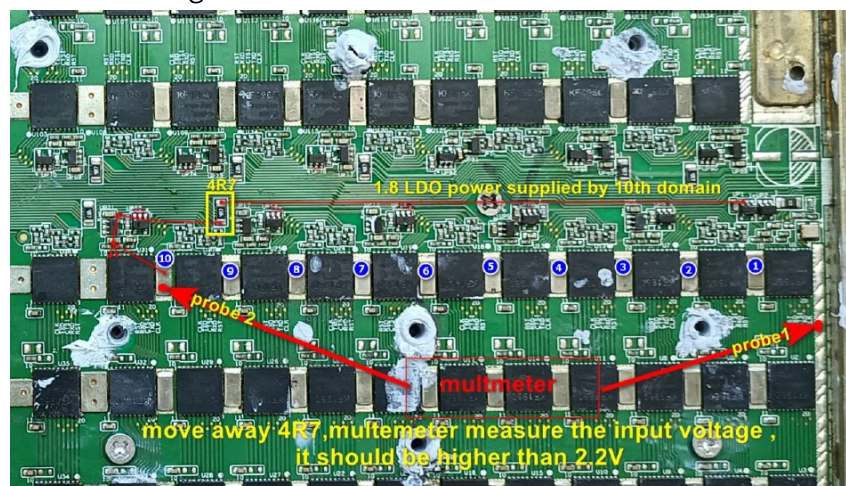


Figure 7-20

Corrosion Problem

- In the first domain, if covered by dust, corrosion can occur. The traces on the board, resistors, and chip pins are all possible to be corroded.
- Remove resistors and chips and check the pads on the board. If there is corrosion, it's better to replace them with new components or new chips.

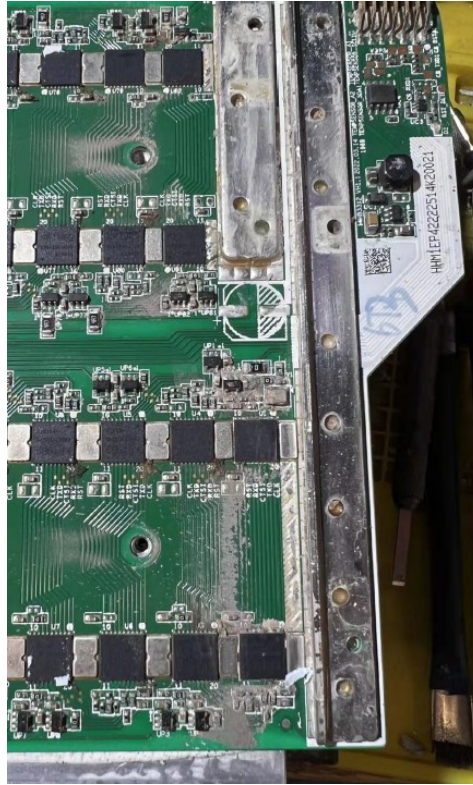


Figure 7-21

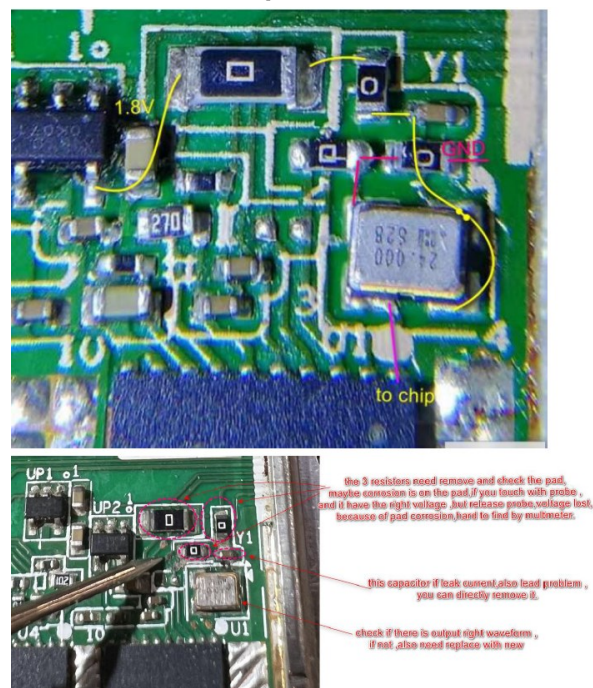


Figure 7-22



Figure 7-23

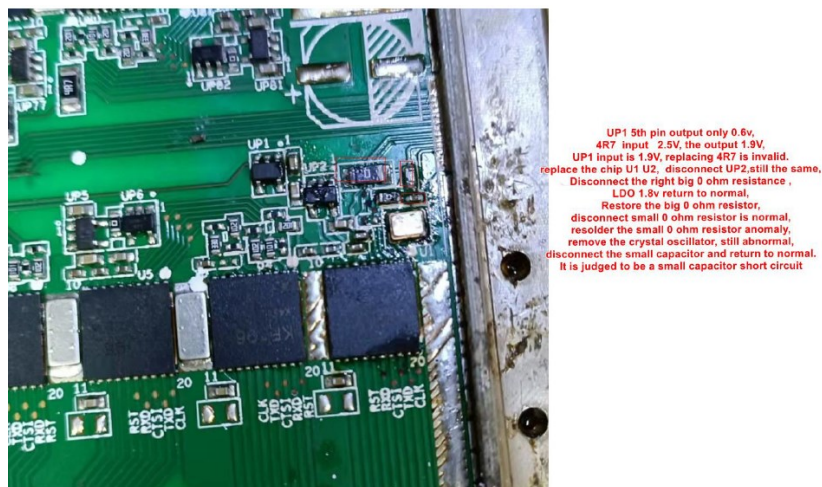


Figure 7-24

Signal Check Sequence and Repair

The signal check sequence is RST → CLK → RXD → TXD.

1. RST

RST has echo and echo1 to assist. For CLK, we can use an oscilloscope for help. For RXD and TXD, besides using a multimeter for measurement, we can also use tweezers for assistance.

On a good board, RXD is sent from U1 to the last chip and is kept at 1.8 V. We can always consider RXD as good. But sometimes, in the transmission route, there is a broken chip that keeps the RXD output at 1.8 V and can't output 0 V. We can't find it, so we need to use tweezers to short - circuit RXD to GND at U1, making the RXD send 0 V from U1 to the end. At the same time, measure RXD at the end chip. If it can drop to 0 V, it's okay. If RXD still stays at 1.8V, it means RXD can't be sent to the end, and we need to find the bad chip.

Method: Keep a multimeter measuring RXD at the final chip. At the same time, use tweezers to short RXD to GND at an RXD test point (the route is from U1 to the final chip).

- i. If short - circuiting RXD and the multimeter shows it can drop to 0, this indicates the RXD route from the test point to the final chip is good. 0 V RXD can be sent to the final chip, so the bad chip is before the test point. Move the tweezers to short RXD backwards, measure again until you locate a chip. If the RXD output can drop to 0 when shorted and the RXD input can't drop to 0 (still 1.8 V), judge this chip as the bad one.
- ii. If short - circuiting RXD and the multimeter can't drop to 0 (still 1.8 V), this indicates the RXD route from the test point to the final chip is not good. 0 V RXD can't be sent to the final chip, so the bad chip is behind the test point. Move the tweezers to short RXD forwards, repeat several times until you locate a chip. If the output RXD can drop to 0 when short - circuited and the input RXD can't drop to 0 V (still 1.8 V), judge this chip as the bad one.

2. TXD

On a good board, TXD is sent from the last chip to U1 and is kept at 1.8 V. We can always consider TXD as good. But sometimes, in the transmission route, there is a broken chip that keeps the TXD output at 1.8 V and can't output 0 V. We can't find it, so we need to use tweezers to short - circuit TXD to GND at the end chip, making 0 V TXD sent from the end chip to U1. At the same time, measure TXD at U1. If it can drop to 0 V, it's okay. If TXD still stays at 1.8 V, it means 0 V TXD can't be sent to U1, and we need to find the bad chip.

Method: Keep a multimeter measuring TXD at U1. At the same time, use tweezers to short - circuit TXD to GND at a TXD test point (the route is from the final chip to U1).

- i. If short - circuiting TXD and the multimeter shows it can drop to 0, this indicates the TXD route from the test point to U1 is good. 0 V TXD can be sent to U1, so the bad chip is before the test point. Move the tweezers to short TXD backwards, measure again until you locate a chip. If the TXD output can drop to 0 when shorted and the TXD input can't drop to 0 (still 1.8 V), judge this chip as the bad one.
- ii. If short - circuiting TXD and the multimeter can't drop to 0 (still 1.8 V), this indicates the TXD route from the test point to U1 is not good. 0 V TXD can't be sent to U1, so the bad chip is behind the test point. Move the tweezers to short TXD forwards, repeat several times until you locate a chip. If the output TXD can drop to 0 when short - circuited and the input TXD can't drop to 0 V (still 1.8 V), judge this chip as the bad one.

3. Example and Repair Method

Example: A board has good RST, CLK, RXD, and TXD. Even when RXD and TXD are short -

circuited with tweezers, there is still no problem. U1 and U28 have been replaced, but it doesn't help.

```
Slot0 U65 40-00-00-01-00-a6-
Slot0 U66 41-00-00-01-00-75-
Slot0 U67 42-00-00-01-00-31-
Slot0 U68 43-00-00-01-00-02-
Slot0 U69 44-00-00-01-00-b9-
Slot0 U70 45-00-00-01-00-6a-
Slot0 U1 read error.
Slot0 U2 read error.
Slot0 U3 read error.
Slot0 U4 read error.
Slot0 U5 read error.
Slot0 U6 read error.
Slot0 U7 read error.
Slot0 U8 read error.
Slot0 U9 read error.
Slot0 U10 read error.
Slot0 U11 read error.
Slot0 U12 read error.
Slot0 U13 read error.
Slot0 U14 read error.
Slot0 U15 read error.
Slot0 U16 read error.
Slot0 U17 read error.
Slot0 U18 read error.
Slot0 U19 read error.
Slot0 U20 read error.
Slot0 U21 read error.
Slot0 U22 read error.
Slot0 U23 read error.
Slot0 U24 read error.
Slot0 U25 read error.
Slot0 U26 read error.
Slot0 U27 read error.
Slot0 U28 read error.
Slot0: chips init error, read: 42, error: 28/70, U1-U2-U3-U4-U5-U6-U7-U8-U9-U10-U11-U12-U13-U14-U15-U16-U17-U18-U19-U20-U21-U22-U23-U24-U25-U26-U27-U28-
chip_extra_init:483: Slot0 init error, retry: 2
Slot0 U29 1c-00-00-01-00-3a-
Slot0 U30 1d-00-00-01-00-a9-
Slot0 U31 1e-00-00-01-00-ad-
Slot0 U32 1f-00-00-01-00-7a-
Slot0 U33 20-00-00-01-00-9f-
Slot0 U34 21-00-00-01-00-4c-
Slot0 U35 22-00-00-01-00-08-
```

Figure 7-25

Repair Method: Use tweezers to assist in short - circuit signal repair as follows:

For example, keep the RXD test point of U4 shorted to GND and run **test - readchipid** test at the same time. If the result shows 4 chips passed, then move the tweezers to the RXD test point of U5, keep RXD shorted to GND, and run **test - readchipid** test at the same time. If the result shows failure, it can be concluded that U5 is faulty. Use this method to find the defective chip.

4. Soldering Chips Standard

- Ensure each pin of the chip has a tin drop (each pin is well - welded).
- Adjacent pins have no connection (no short - circuit between pin and pin).