Antminer Z11 Hash Board Repair Guide

Contents of this booklet: Mainly describe the troubleshooting of the Antminer Z11 hash board and use the test fixture to locate it accurately.

Scope: Applicable to all Antminer Z11 production, after - sales, and outsourcing maintenance sites.

I. Maintenance platform requirements:

1. Constant temperature soldering iron (370° - 400°), the pointed soldering iron tip is used for soldering small patches such as chip resistors and capacitors.

2. The desoldering gun and BGA repair station are used for chip disassembly and soldering. Be careful not to heat it for a long time to avoid PCB blistering.

3. APW3 / APW3+ / APW5 power supply (output 12V, 140A Max) and power adapter cable (made by yourself) are used for hash board testing and measurement.

4. Multimeter, tweezers, Z11 test fixture, or oscilloscope.

5. Flux, washing water, and absolute alcohol; washing water is used to clean up the solder residue and appearance after maintenance.

6. Tin tool, tin tool steel sheet, solder paste; when replacing a new chip, the surface pad of the chip PIN pin needs to be cleaned, and the chip is soldered using a BGA repair station.

7. Antminer thermosetting adhesive, used to apply on the chip or heat sink after repair.

II. Job requirements:

1. The maintenance personnel must have specific electronic knowledge, more than one year of maintenance experience, and be proficient in BGA / QFN / LGA package soldering technology.

2. After repairing, the hash board must be tested more than two times, and it is 0K before it can pass!

3. Pay attention to the operation method when replacing the chip. After replacing any accessories, the PCB board has no obvious deformation. Check the replacement parts and the surrounding parts for open and short circuits problems.

4. Determine the maintenance object, corresponding test software parameters, and fixtures.

5. Check whether the tools and test fixture can work normally.

III. Principle and structure:

1. Principle overview:

1) Z11 comprises 3 BM1744 chips, and each IC is controlled by a separate power management IC.

2) The working voltage of the BM1744 chip used by Z11 is 0.84V, and the chip has ID0 to provide VDDIO 1.8V and VDDPLL 0.8V.

3) The Z11 clock is a 25M crystal oscillator transmitted from the first chip to the third chip in series.

After the repair and replacement chip test is passed, you need to evenly apply thermosetting adhesive on the IC surface and tighten the screws to ensure that the heat sink flatly contacts the chip to achieve heat dissipation. There are test points on the chip side of the PCB board for easy maintenance without heat sinks. Please use a fan to dissipate the PCBA during the power - on test and analysis. It is recommended to use a low frequency of 200M for inspection and maintenance. After the low - frequency test is passed, the installed heat sink is tested according to the default frequency value.

2. Z11 hash board signal trend:

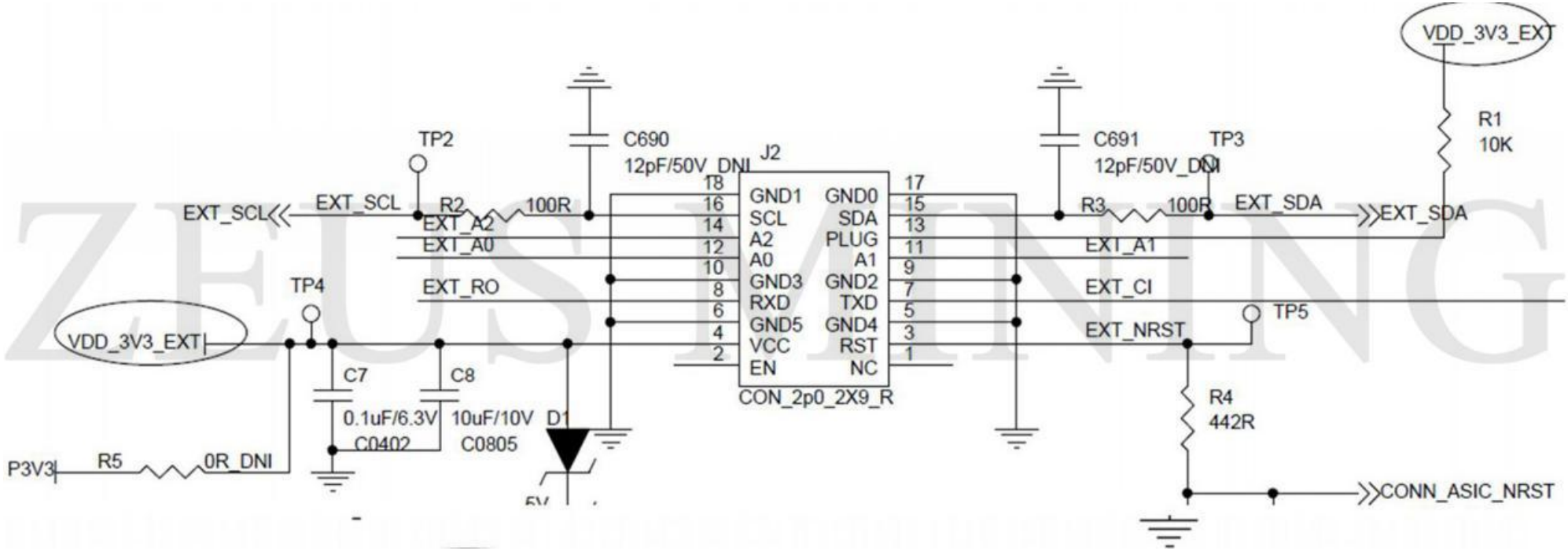
CLK (XIN) Signal flow direction, by Y1 25M crystal, is generated from No. 01 chip to No. 03 chip transmission; during operation, the voltage is 0.85V.

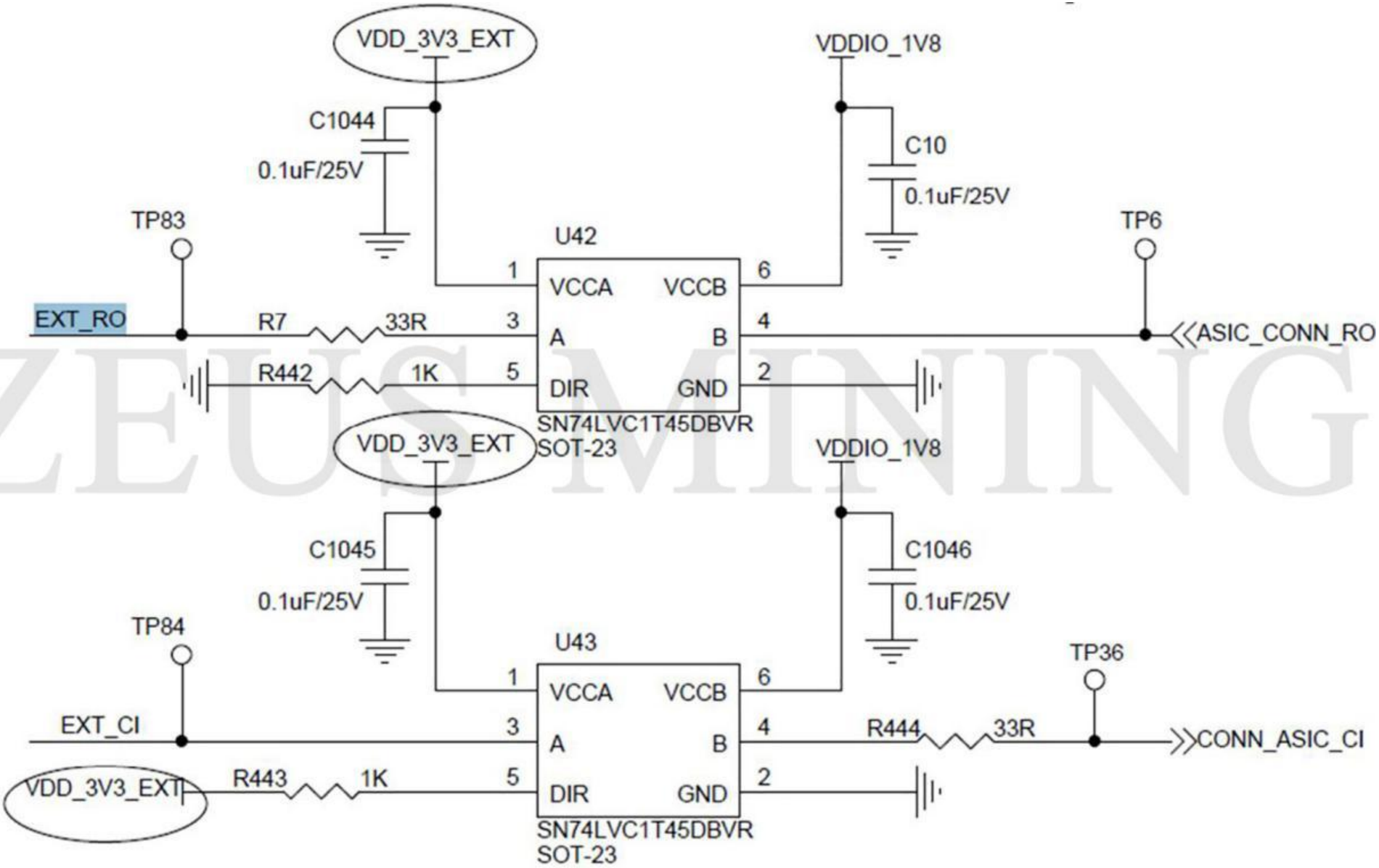
TX (CI, CO) signal flow direction, from IO port 7 pins (3.3V) into the level conversion IC U43, and then transmitted from the No. 01 chip to the No. 03 chip; the voltage is OV when the IO cable is not inserted, and the voltage is 1.8V during calculation.

RX (RI, RO) signal flow direction, from No. 03 chip to No. 01 chip, return to the signal cable terminal pin 8 through U42 and return to the control board; when the IO signal is not inserted, the voltage is 0.3V, and the voltage is 1.8V during calculation.

BO (BI, BO) Signal flow direction, by No. 01 chip to No. 03 chip; fluke 15b+ multimeter measurement 0V.

RST Signal flow from IO mouth 3 Foot in, then by No. 01 chip to No. 03 chip transmission; not inserted IO Signal and standby 0V, when calculating 1.8V.




VDD_3V3_EXT
C1044
0.1uF/25V
VDDIO_1V8
C10
0.1uF/25V
TP83
U42
TP6
1
VCCA
VCCB
6
EXT_RO
R7
33R
3
A
B
4
ASIC_CONN_RO
R442
1K
5
DIR
GND
2
SN74LVC1T45DBVR
SOT-23
VDD_3V3_EXT
VDDIO_1V8
C1045
0.1uF/25V
C1046
0.1uF/25V
TP84
U43
TP36
1
VCCA
VCCB
6
EXT_CI
3
A
B
4
R444
33R
CONN_ASIC_CI
VDD_3V3_EXT
R443
1K
5
DIR
GND
2
SN74LVC1T45DBVR
SOT-23
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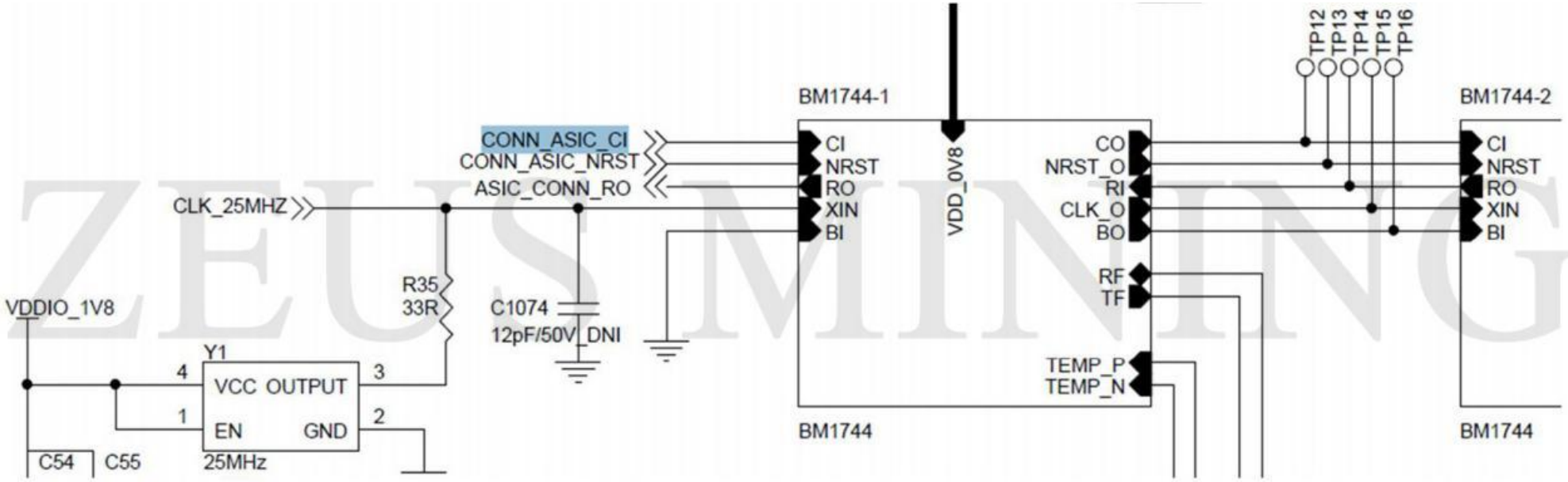


3. The critical circuit of the Z11 hash board:

When overhauling, mainly test the 10 signal voltages before and after the chip (five before and after the chip: CLK, CO, RI, BO, RST); CORE voltage; LD0 - 1.8V, PLL - 0.8V; 12V to 5V voltage.

Detection method (each chip has a lead test point):

After plugging in the IO cable and pressing the test fixture button, the PIC starts to work. At this time, the average voltage of each test point should be:

CLK: 0.85V

CO: 1.6 - 1.8V.

RI: 1.6 - 1.8V; during calculation, if the voltage is abnormal or too low, it will cause the hash board to be abnormal, or the hash rate will be 0.

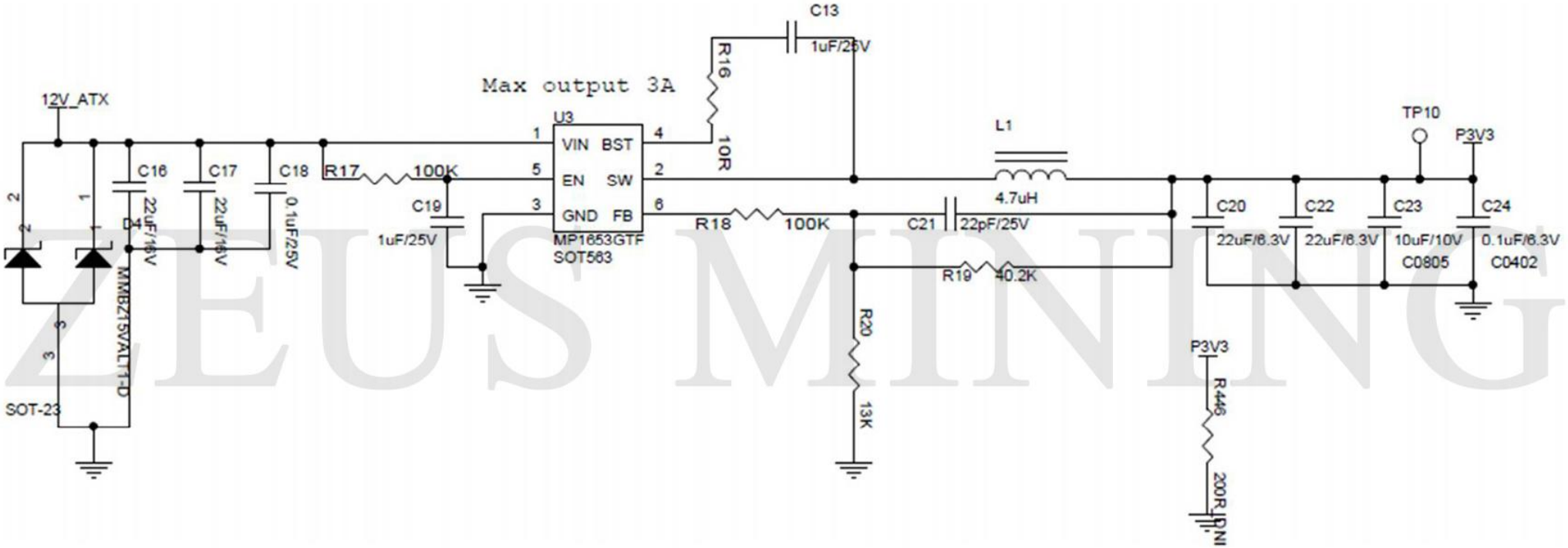
BO: It is OV when there is no operation, and it is also 0 V when it is calculated.

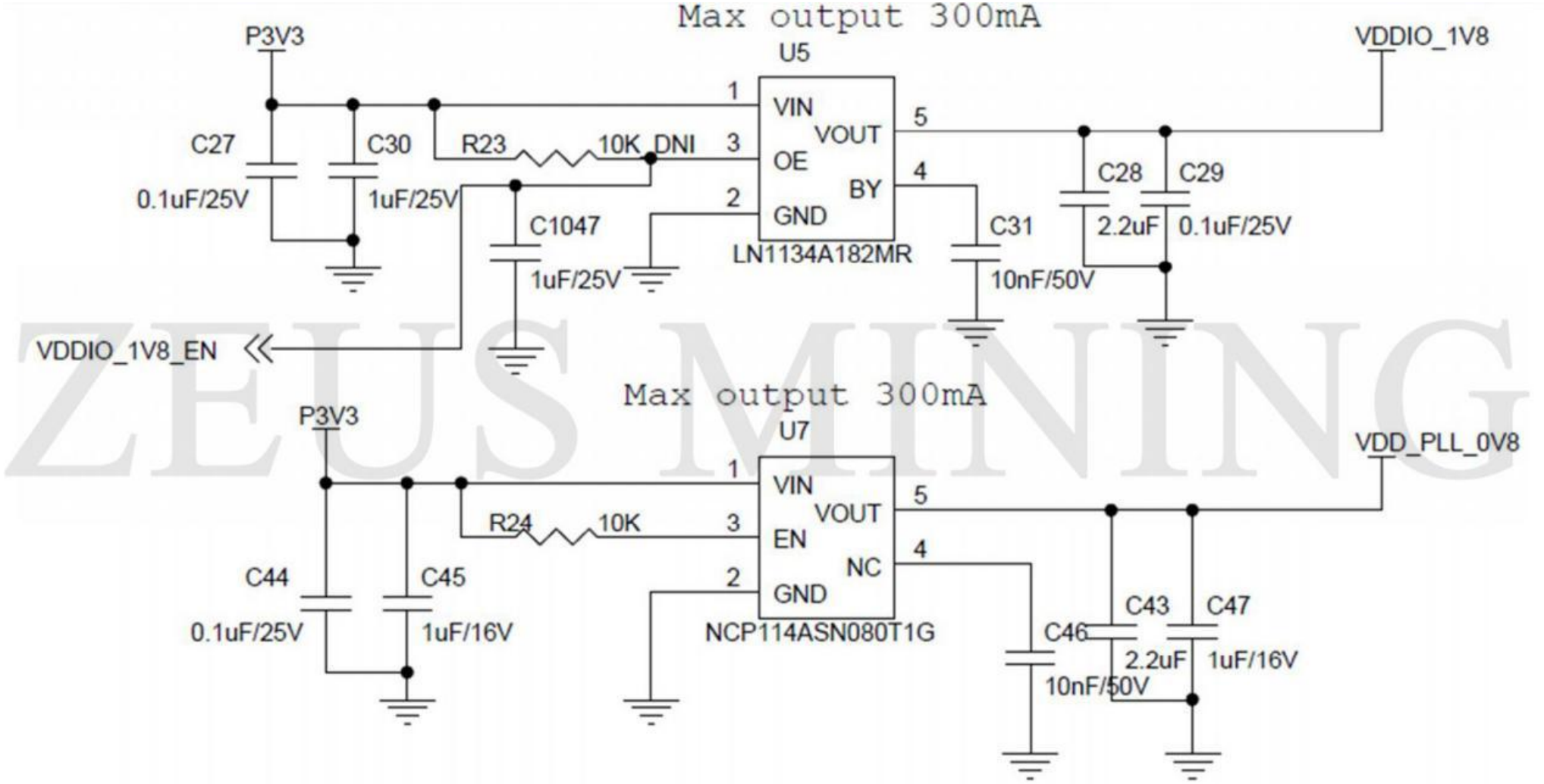
RST: 1. 8V. Each time you press the test button of the fixture, the reset signal will be output again.

When the test mentioned above point status and voltage is abnormal, please estimate the fault point based on the circuit before and after the test point.

IV. Faults and undesirable performance

1. LDO 1.8V or PLL 0.8V is abnormal. This is an alarming problem, the single board shows that the chip is not red thoroughly, and the data is X; the whole miner shows that there are few chips, or the hash board is dropped, or the chip is X.



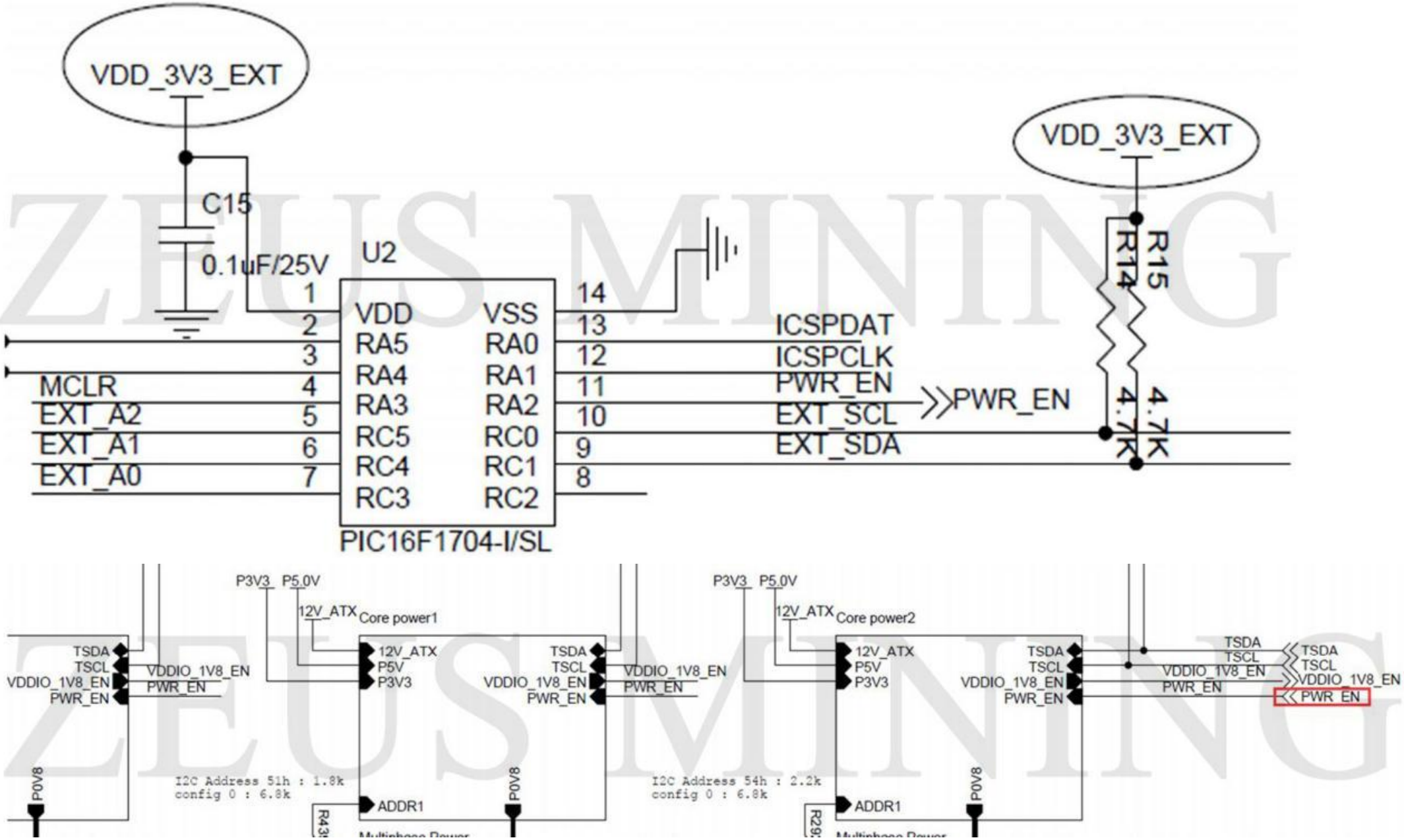


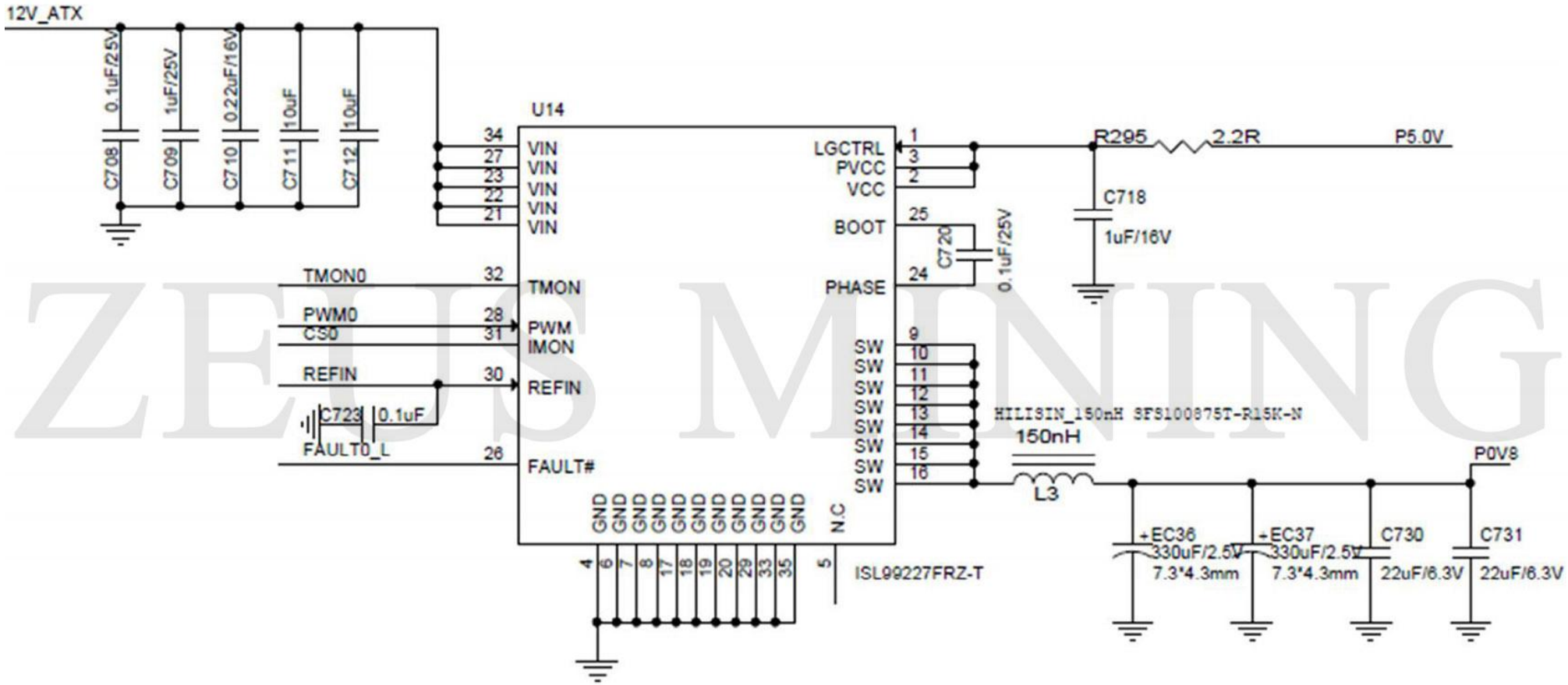
2. The working voltage of the chip (the corresponding value can be measured at the config setting value, the default value is 0.84V). This problem is abnormal: the performance of the single board reads the number of chips abnormally; the whole miner has few chips or dropped the board.

Please check PIC soldering and programming.

Please check the welding and programming of the corresponding power management IC.

Check whether the MOS of the corresponding group (the circuit is the same, only one circuit example is listed) is short - circuited.





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1) If you need to replace the power management IC and need to burn online, please follow the steps below.

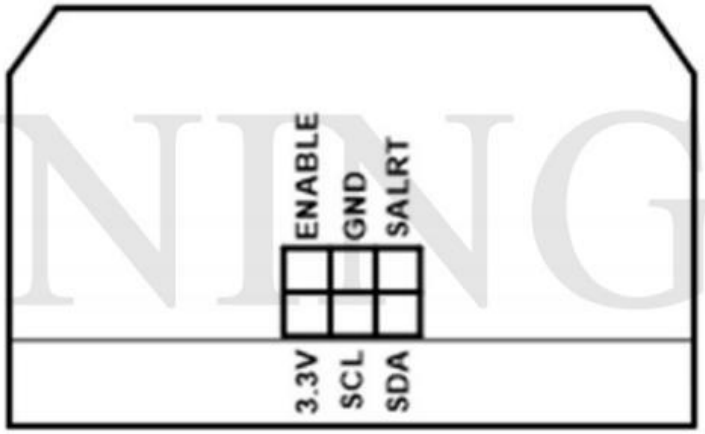
a. Power controller firmware (there is no program download address)

Download the line programming program (general maintenance) as follows:

BEZ24601_V03. hex

b. Download tool

Intersil PMbus download cable and interface sequence are as follows:



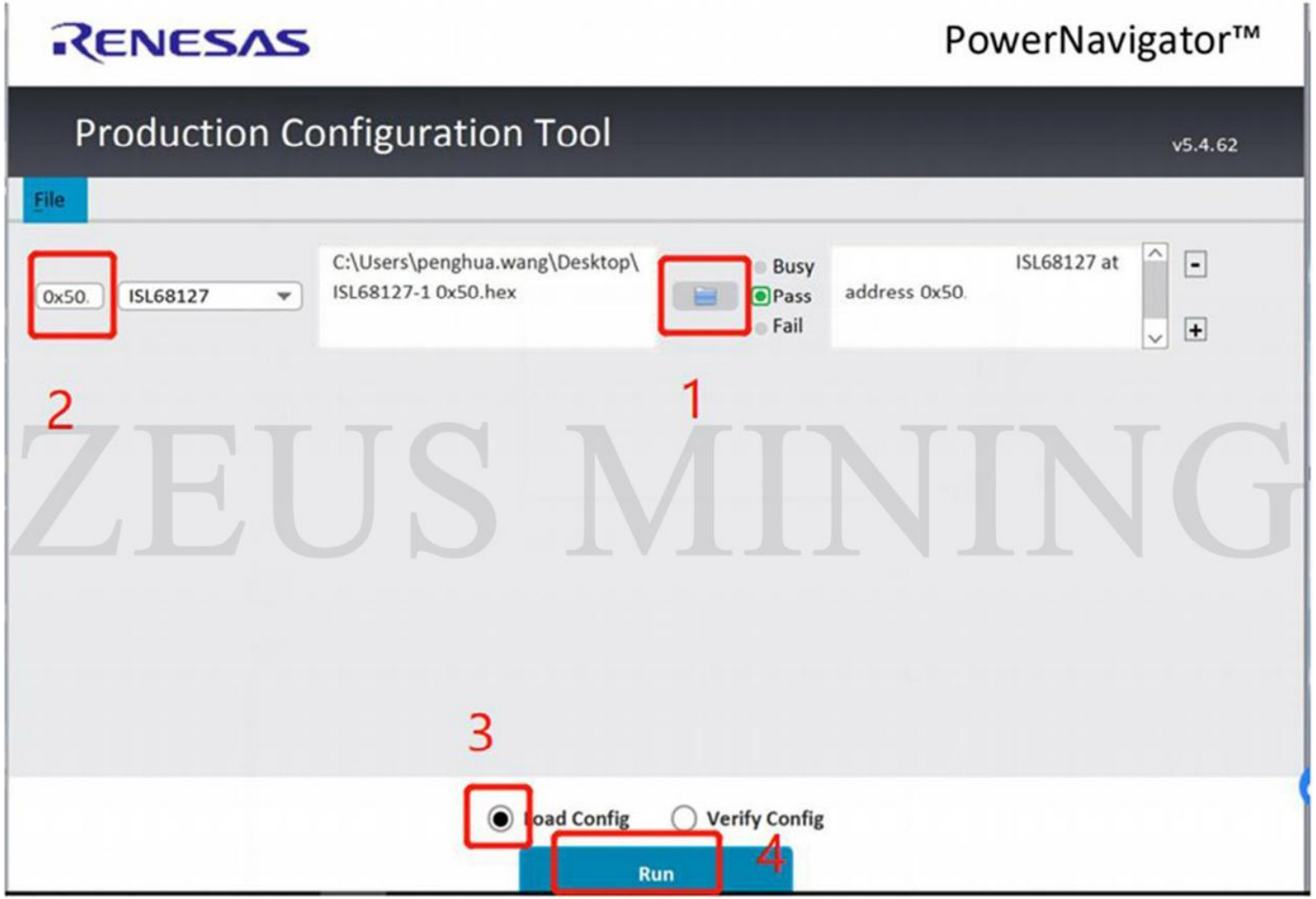
PIN CONFIGURATION DIAGRAM

The download data cable is connected to the J10 of the PCB, and it needs to be connected to GND, SDA, and SCL.

c. Burning software

Run Production Configuration Tool, click the 1 position to select the latest firmware BEZ24601_V03.hex, then change the 2 positions to 0x50 (set according to the corresponding chip address: the address of chip 01 is set to 0x50, the address of chip 02 is set to 0x51, the address of chip 03 is set 0x54), select load config at position 3, and finally click Run to burn.

Note: The power management IC has only 8 programming lifetimes, so please be cautious when programming.



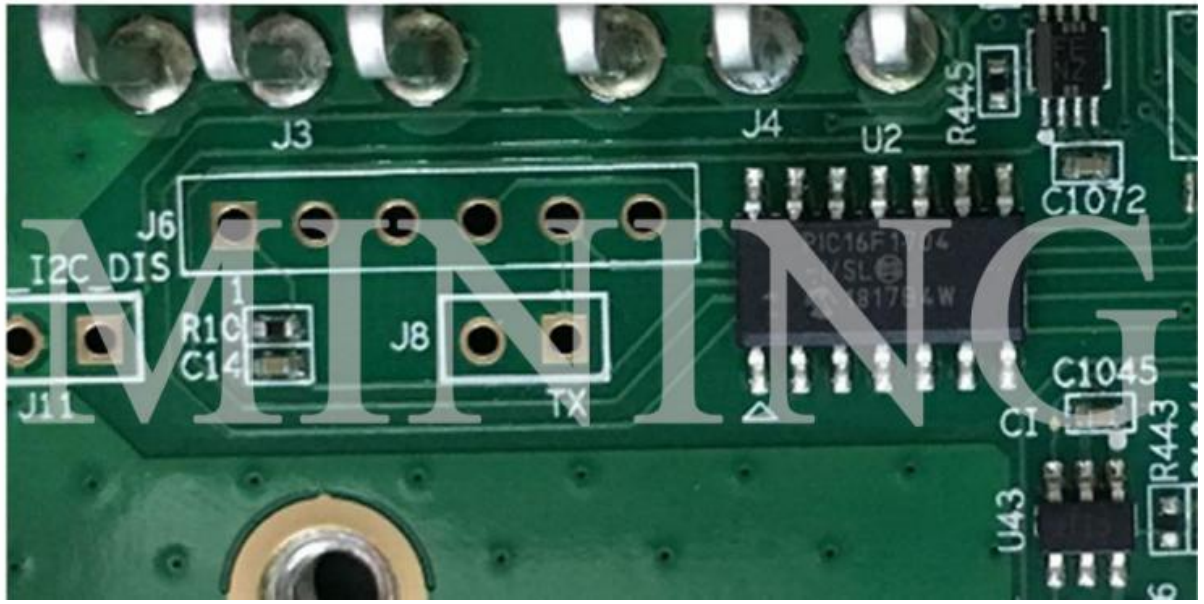
2) Hash board PIC program burning.

a. Procedure

PIC16LF 1704 - BM1744 - APP. X. production - 1902121649 - V3

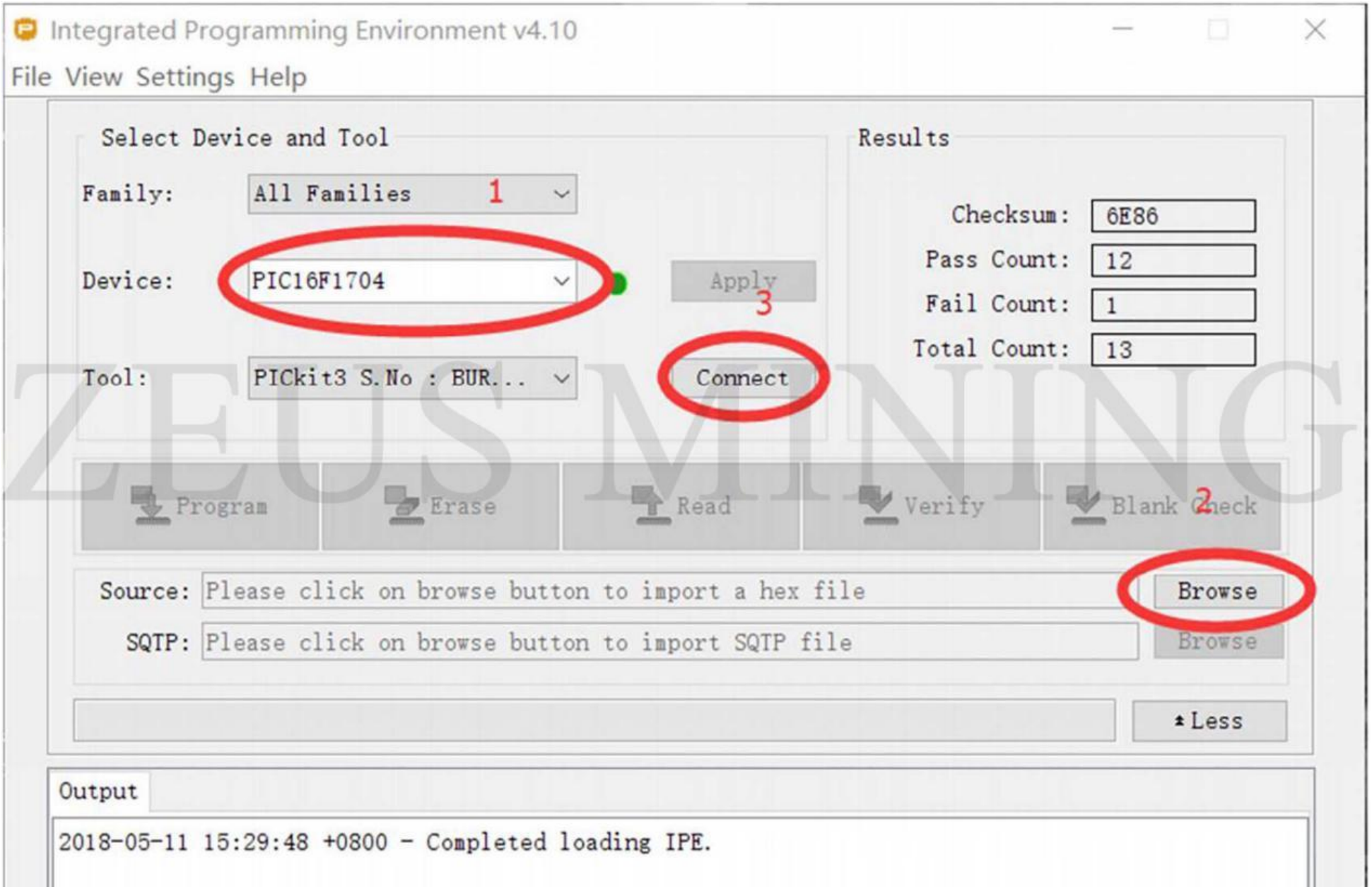
b. Download tools

Pin 1 of the PIC kit3 and PIC kit3 data cable corresponds to pin 1 of J3 on the PCB and only needs to connect to pins 1, 2, 3, 4, and 5.

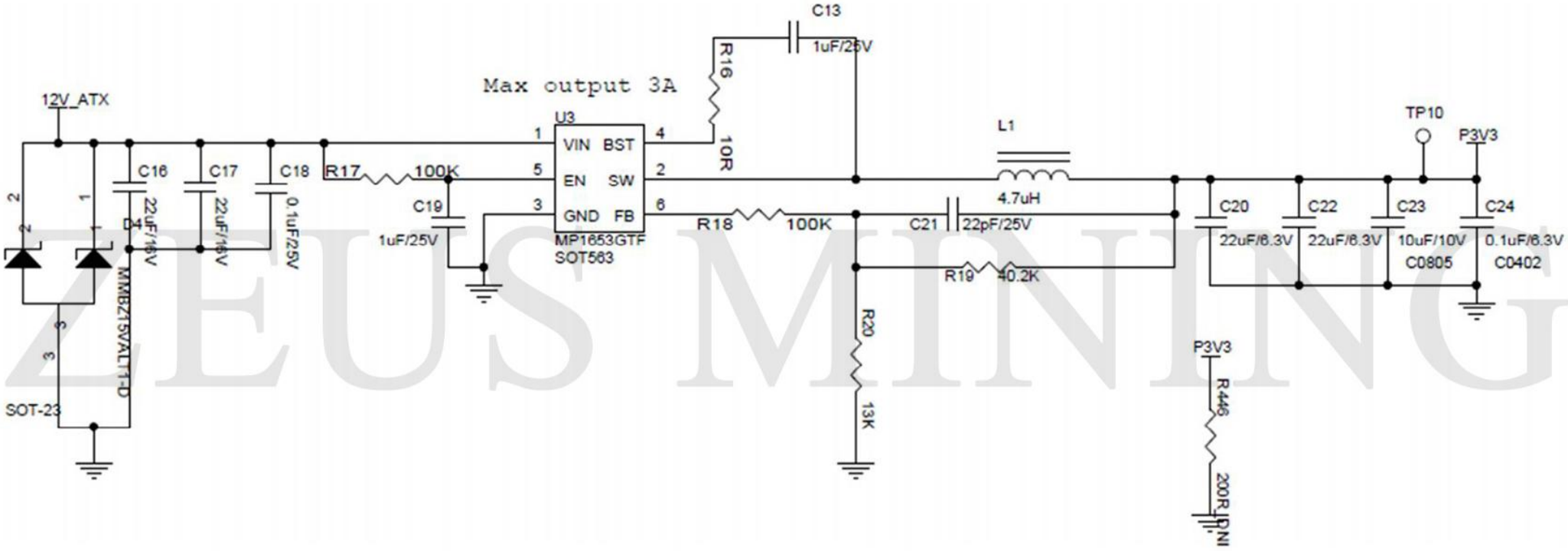


c. Burning software

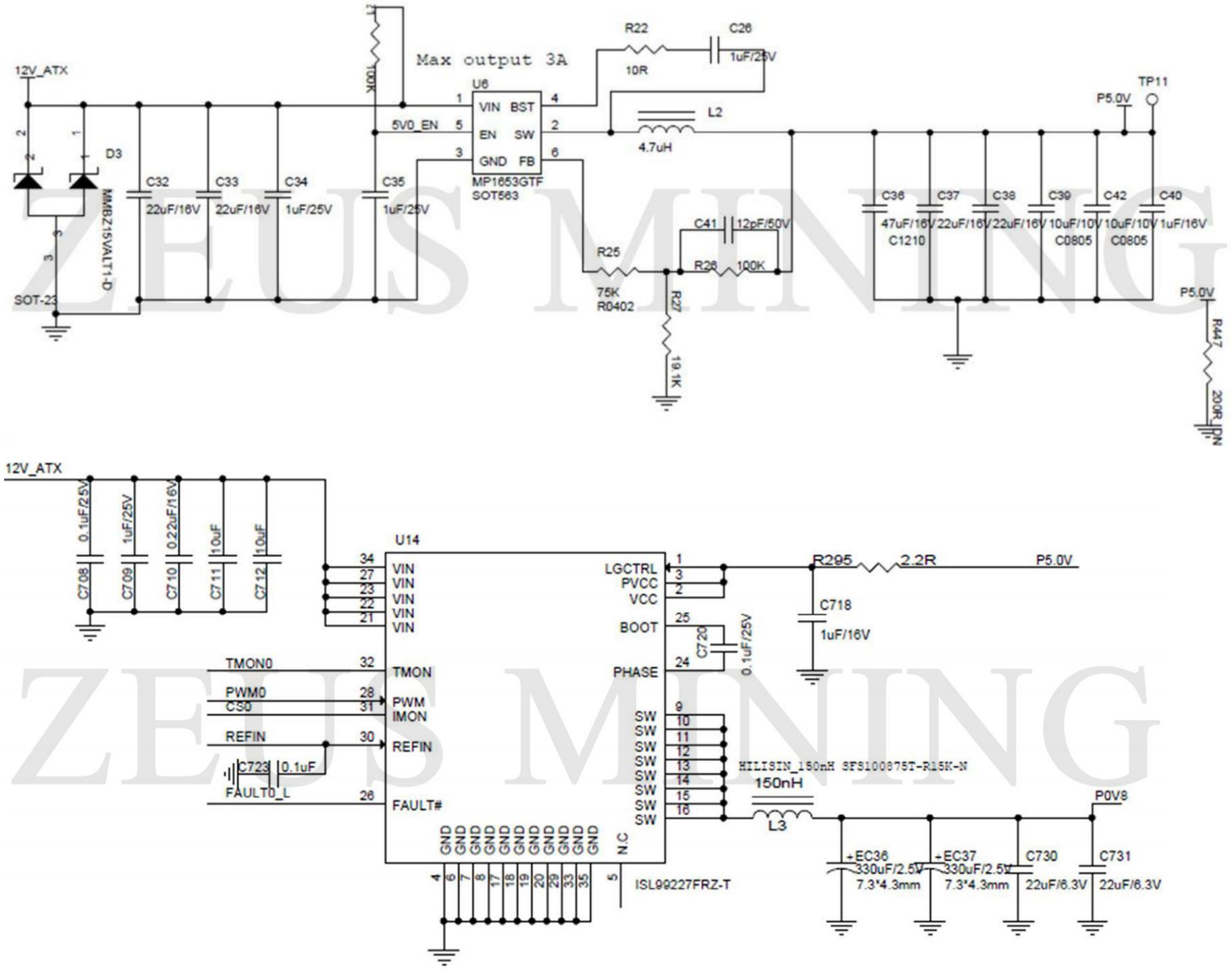
Open MPLAB IPE, select ① device: PIC16F1704, click ② Browse to select the .hex burning file, then click ③ connect; the connection is normal, and then click the program button; after completion, click verify, and the verification is completed to prove that the programming is successful.



3. 3.3V abnormal or no output. Please check the 3.3V related circuit. Check to solder first and make sure there are no shorts to the ground.



4. If the 5V is abnormal, refer to the above "1" point and check that 12V is normal. If 5V is not short - circuited to the ground (corresponding to the MOS tube without short - circuiting), check the U6 welding. If there is no abnormal welding, you can replace the material; if there is a short - circuit, check the parallel MOS circuit and parts.


12V_ATX
Max output 3A
U6
VIN BST
EN SW
GND FB
MP1653GTF
SOT563
5V0_EN
100K
R22
10R
C26
1uF/25V
L2
4.7uH
TP11
P5.0V
D3
MMBZ15VALT1-G
SOT-23
C32
22uF/16V
C33
22uF/16V
C34
1uF/25V
C35
1uF/25V
C41
12pF/50V
R25
75K
R0402
R26
100K
R27
19.1K
C36
47uF/16V
C1210
C37
22uF/16V
C38
22uF/16V
C39
10uF/10V
C0805
C42
10uF/10V
C0805
C40
1uF/16V
R447
200R_IDN
U14
VIN
TMON
PWM
IMON
REFIN
FAULT#
LGCTRL
PVCC
VCC
BOOT
PHASE
SW
GND
N.C
ISL99227FRZ-T
C708
0.1uF/25V
C709
1uF/25V
C710
0.22uF/16V
C711
10uF
C712
10uF
TMON0
PWM0
CS0
REFIN
C723
0.1uF
FAULT0_L
C720
0.1uF/25V
R295
2.2R
C718
1uF/16V
HILISIN_150nH SFS100875T-R15K-N
150nH
L3
P0V8
+EC36
330uF/2.5V
7.3*4.3mm
+EC37
330uF/2.5V
7.3*4.3mm
C730
22uF/6.3V
C731
22uF/6.3V
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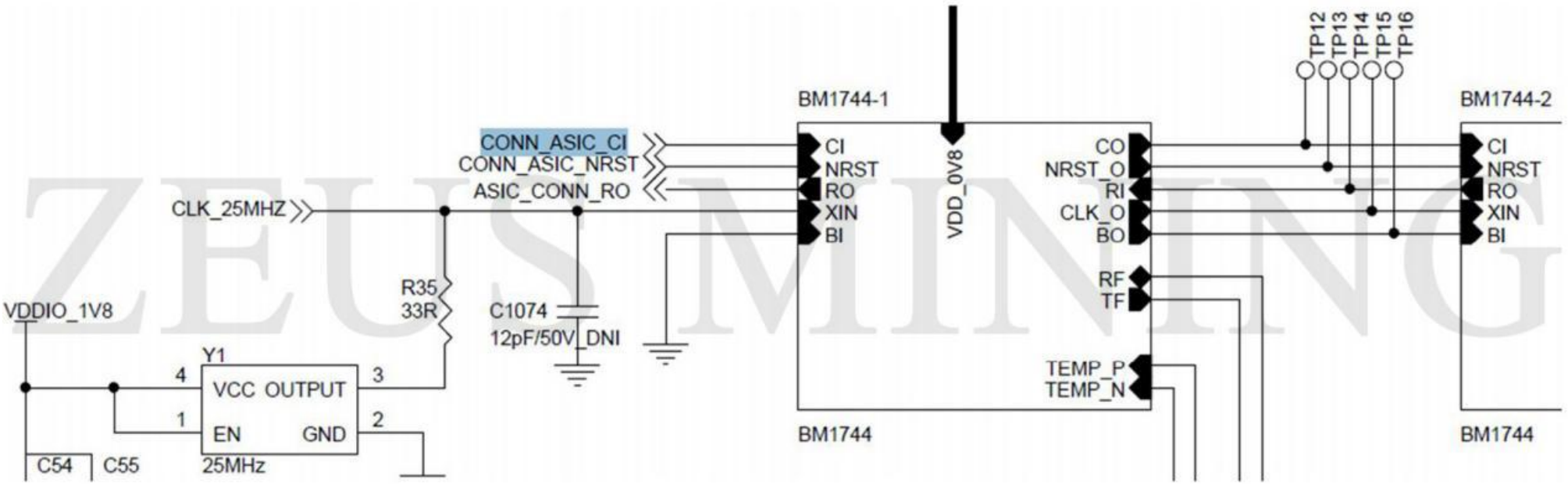
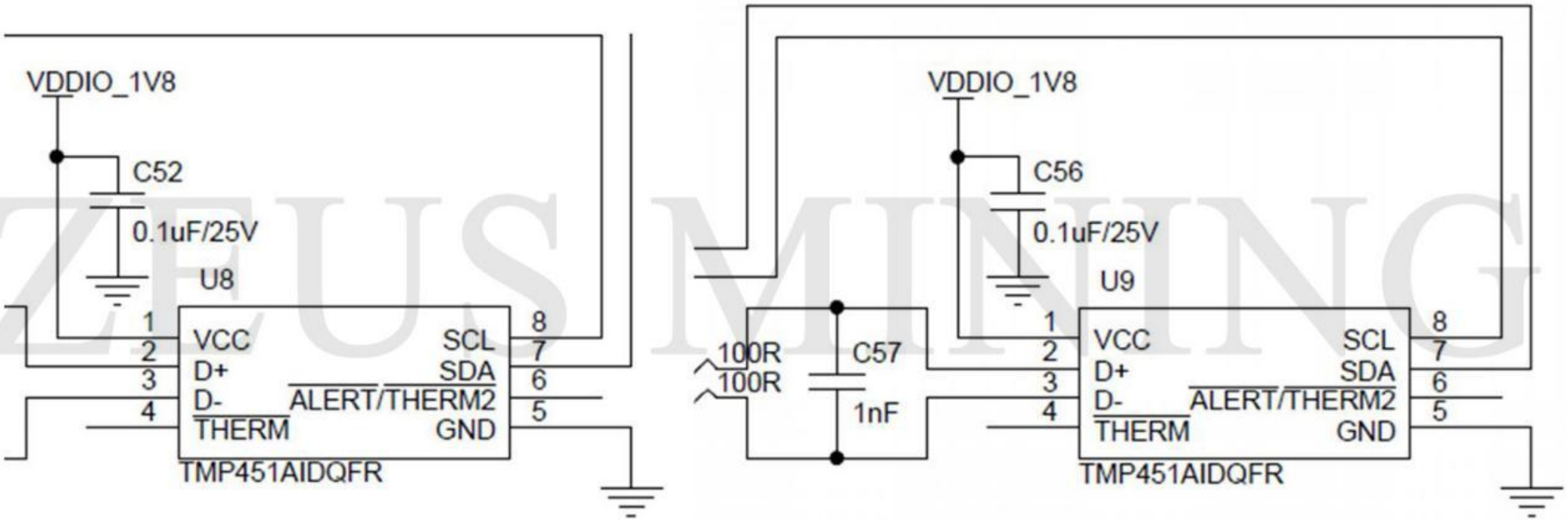
5. The chip signal pin output is abnormal (BO / RST / CO / RI / CLK). Determine the wrong position according to the signal direction.

Please turn off the power first to measure the chip - to - ground impedance (compared with a good board or an adjacent group). Then, if possible, you can use X - RAY to check the chip's welding effect.



6. Abnormal temperature reading. This bad board is shown as temp NG (the test fixture interface can display the temp NG, log synchronization test results); the whole miner shows that the temperature reading is 0°C or the temperature cannot be read.

The temperature sensor is connected to the corresponding BM1744 chip. Please check whether the temperature sensing chip welding and the temperature sensing working voltage are normal for the fault.

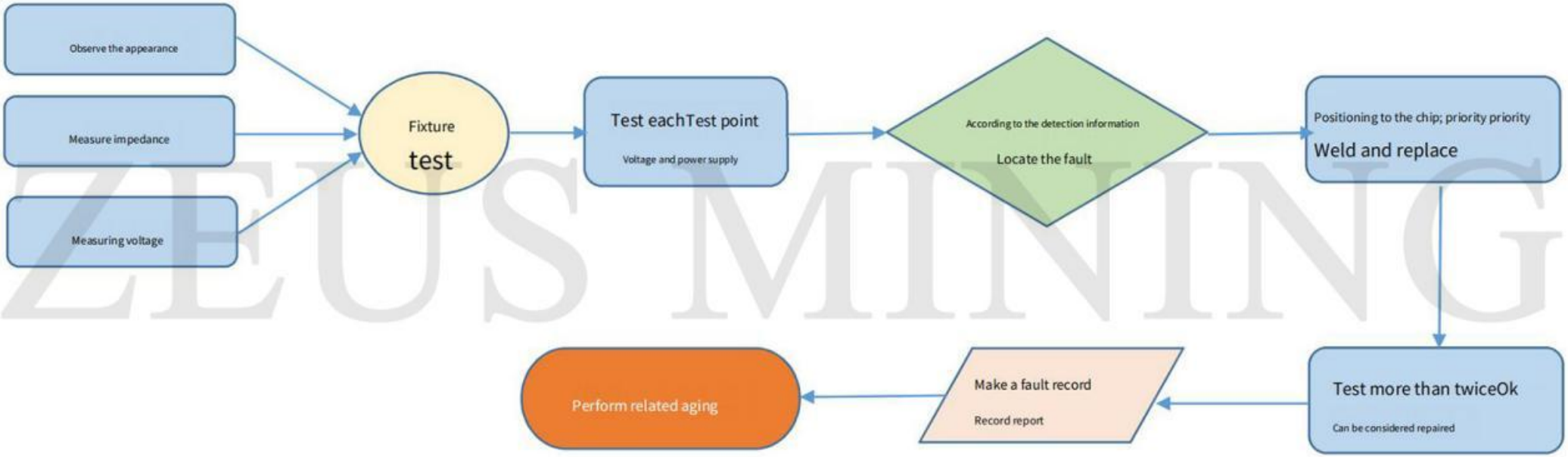


7. Insufficient return nonce. This is an alarming problem: the single board shows that the nonce returned by a single chip is insufficient, and the whole miner shows that the error rate is high or the chip is X.

Please check the soldering according to the defective chips displayed in the log. After checking that there is no problem with the soldering around the chip, it is recommended to re - solder the chip or replace the corresponding NG chip.

Note: In the test fixture interface, you can see the chip with the abnormal return value and the abnormal display "X."

V. The reference steps for the maintenance of the hash board:



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1. Routine testing:

First, visually inspect the hash board to be repaired to observe whether the PCB is deformed or burnt, it must be dealt with first; check whether there are apparent burnt marks on the parts, impact offset or missing parts, etc.

Secondly, after the visual inspection is no problem, the impedance of each voltage domain can be tested first to detect whether there is a short circuit or an open circuit. If found, it must be dealt with first.

Again, check whether each group of voltage has 0.84v, and if a group of measurements does not have 0.84V, it is necessary to troubleshoot programming problems or MOS abnormalities.

2. After the conventional test is no problem (the short - circuit test of the general routine test is necessary to avoid burning the chip or other materials due to short - circuit when the power is turned on). Then, the chip test can be performed with the test fixture, and the test result is carried out according to the test fixture to determine the positioning.

3. According to the displayed results of the test fixture, start from the vicinity of the faulty chip, check the chip test points (C0 / NRST / RO / XIN / BI), and voltages such as VDDOV8 and VDD1V8.

4. According to the signal flow, the RX signal is transmitted in the reverse direction (chips 3 to 1), and several signals CLK CO BO RST are transmitted in the forward direction (1 - 3), and find abnormal fault points through the power supply sequence.

5. When locating the faulty chip, the chip needs to be melt - soldered again. The method is to add flux solder paste around the chip (preferably no - clean flux), heat the solder joints of the chip pins to a dissolved state so that the chip pins and the pads are re - runs in and collect the tin. To achieve the effect of re - tinning. You can directly replace the chip if the fault remains the same after re - soldering.

6. After repairing the hash board, it must be passed more than twice to be judged as a good product when testing the fixture. For the first time, after replacing the parts, please wait for the hash board to cool down, use the test fixture to test the pass, put it on the side, and then cool it down. Then, for the second time, wait a few minutes for the hash board to cool down before proceeding with the test. The time interval between the two tests is only a few minutes, not affect work efficiency.

7. After the hash board is repaired, relevant maintenance / analysis records (requirements for maintenance reports: date, SN, PCB version, tag number, lousy cause, bad liability attribution, etc.) should be prepared for feedback to production after sales, research and development departments.

8. After the record is prepared, install the entire miner for conventional aging.