SOME NOTES ON STABILOCK 4040 CPU BATTERIES

ORIGINAL OBSERVATIONS October 2009

As with many radios and items of test equipment from the same period, the Stabilock 4040, and no doubt other models too, uses a rechargeable Ni-Cad battery on the CPU board to provide backup for the RAM that stores test sequences.

These batteries should be changed regularly but are often left in the equipment for many years and the resulting damage can prove catastrophic.

The original battery in my 4040 was a 2.4volt GE DataSentry Gold Top Ni-Cad in a 4 pin PCB mount plastic encapsulation.
IC markings put my PCB date as around 1984 and although the battery didn't look to have leaked it didn't look to have been replaced either.
Whilst the original was rated at 100mAH a Dantona recommended modern equivalent is a 2.4volt NiMh battery in a similar package and rated at 150mAH.
The Dantona part number for this is COMP-24-2.4NMH, but Dantona also make reference to this as a Varta part and I ordered the Varta version from Farnell in the UK.
The Varta part number is 55615702012, Farnell stock number 434-3712.

After removing the original battery I found it had leaked after all, around the negative pin on the base of the unit, and the seepage had flowed under the conformal coating on the PCB and caused a circle of localised surface corrosion on the upper ground plane around the pin, with a diameter of just over 1/4 inch.
After removing the circle of lifted conformal coating the PCB was cleaned successfully by a combination of scraping away the corroded surface deposits and polishing with steel wool to leave clean copper.
Despite the 83/84 date codes on the ICs the battery itself was dated 8045 on the underside.

I also noticed that R15, the resistor in series with the battery, was 3k3 on the board as opposed to the 825 ohms shown in the service manual and this looked to have been there from new.
That value seems high to me, and the resulting charge current is likely to be rather low, but I'll recalculate it anyway before fitting the new battery.

Having had plenty of previous experience of leaking Ni-Cads, in Racal receivers and various other items of test gear, I seem to have got off extremely lightly this time and initially assumed that was mainly due to the plastic encapsulation.
However, when Googling for a replacement I came across several horror stories of damage caused by leaking DataSentry batteries so I may just have been very lucky.

I would certainly advise any user who isn't sure to check their battery and change it if there's any doubt at all, especially as mine looked fine until removed.

A few words of caution though, the plated through holes in the circuit board are very delicate and without the right tools and experience it's more than likely the circuit board will be damaged when removing the old battery.
There's much less chance of damage if the pins can be removed one at a time and it might be worth carefully breaking apart the case and removing the old cells so that the base can be cut or broken into four with the pins then separated.
Just be very careful if doing this, if the cells have corroded there could be quite a mess inside the plastic encapsulation.

The battery pins are on a 0.1inch grid and I intend to fabricate a suitable battery holder from a turned pin IC socket rather than solder the replacement battery directly to the board. Individual pins could be used but modifying the entire socket should allow securing the battery with cable ties.
Adding the socket will make the CPU board deeper but fortunately, on my 4040 anyway, there is space covered by a blanking plate adjacent to the CPU board.

Another option would be to mount the battery remotely and wire it back to the PCB, in which case it doesn’t matter quite so much to go for the “correct” battery, but the plastic encapsulation might make mounting easier.

FITTING REPLACEMENT BATTERY November 2009

It had been intended to mount the replacement battery in a modified turned pin IC socket, the battery pins are on a 0.1 inch grid with 0.3 inch spacing, but it was realised this would not fit.
Although, as viewed from the rear, there is an empty compartment to the right of the CPU module, that would otherwise contain the control interface option, metal screens are fitted either side of the CPU board and the screen on the right was already a very close fit against the battery.

Note that these screens are of a "springy" material and fastened at the top only, the bottom "screws" are actually screwed pegs attached to the bottom lip of the screen that locate in holes in the bottom chassis panel. To remove a screen it is necessary to remove the top screws and then flex the screen to lift out the bottom pegs before withdrawing it, still flexed, from the rear. Once released it will spring back into shape.

In order to gain some space the metal screen between the CPU board and the Control Interface compartment was removed and an alternative screen fabricated from sheet aluminium was fitted into the guides that would normally take the Control Interface PCB. The metal sheet used had a 1/4 inch lip at the inner end and the lip was faced away from the CPU PCB and butted against the PCB connector for the Control Interface.
This modification should have increased the battery clearance by approximately 1/4 inch but the battery had already been pressing against and distorting the original screen so the gain was probably nearer to 1/8 inch and there still wasn't room for a socket.

Because of this, and also because an attempt to test fit the battery into a socket resulted in the positive pin pushing back slightly into the battery housing, the battery was mounted on its side and attached to the CPU board with strong double sided tape. Two holes were drilled through the ground plane, and the conformal coating cleared, so that a tinned copper wire restraining link could also be fitted over the battery and soldered to the ground plane on the other side of the PCB.

The two spare pins on the battery, normally used for mounting purposes only, were cut back to the body and red and black flexible wire links soldered to the positive and negative terminals respectively. The red lead was soldered to the original positive PCB pad but the original negative PCB hole was now covered by the battery so a small patch was cleared on the ground plane nearby and the black lead soldered to that. As a result it will be much easier to remove the battery in the future and the risk of PCB damage when doing so significantly reduced

The recommended trickle charge for the Varta NiMh battery is 4.2mA, although a 14mA continuous overcharge is specified as acceptable, and the value of R15 was recalculated accordingly.

The supply voltage, Vcc, is specified as 5.2 volts and the BSY26-45 Schottky diode in series with Vcc is specified as having a forward volt drop of 0.55 volts. With a battery voltage of 2.4 volts this leaves 2.25 volts across R15 which would need to be 536 ohms in order to produce a 4.2mA charge current.
The 3k3 resistor originally used for R15 was replaced with 470 ohms, giving a calculated charge current of 4.79mA, slightly higher than specified but well within the continuous overload rating.
Whilst the original specified value of 825 ohms for R15 does seem a bit high this might be explained by lower trickle charge requirements for the original 100mAH Ni-Cad battery but I can see no reason for fitting 3k3, and do wonder if this was an unnoticed error from the time of manufacture.

The photos that follow show, in order……..

1 – The PCB with original battery removed and corroded area cleaned.

2 – Close up of top of PCB with battery removed.

3 – Close up of bottom of PCB with battery removed.

4 – PCB with new battery temporarily positioned as per the original.

5 – Top of PCB showing added holes for TCW strap.

6 – Bottom of PCB showing added holes for TCW strap.

7 – Top of PCB showing replacement battery fitted.

8 – Close up of fitted battery, left hand side.

9 – Close up of fitted battery, right hand side.

It can be seen from the photos that I wasn't entirely successful at avoiding pad damage when removing the original battery so there's no way I would want to risk further damage by having to remove another.

The 4040 is now back together again and although it might seem to be a lot of work just to change a battery I'm very pleased with the result and very happy knowing that it will be so much easier to change in the future.

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GM8PZR


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SN74LS240N
MC68488P
P9W8609
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6W
SE-TIME
MC6802P
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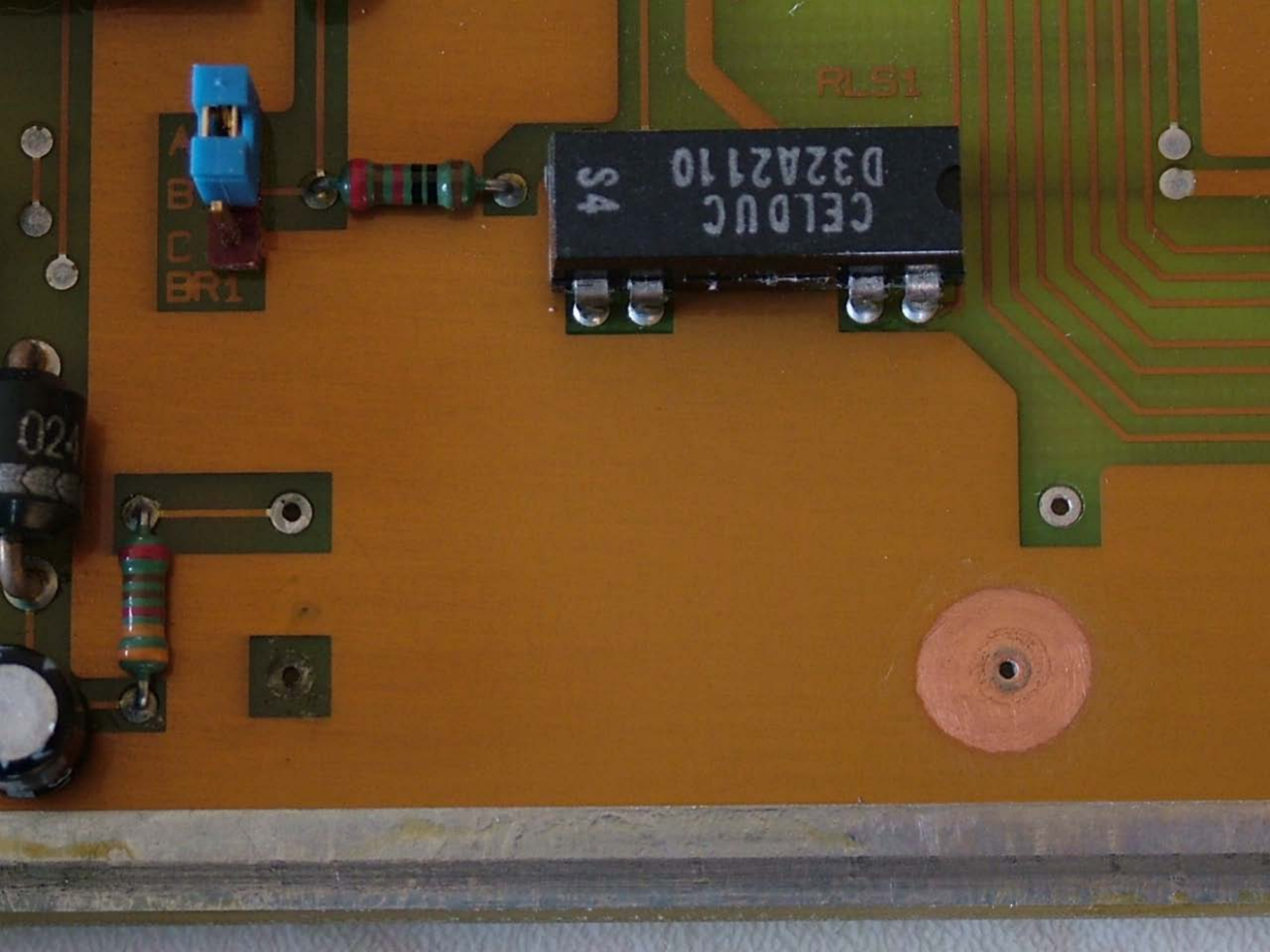
MICRO COMPUTER 250 040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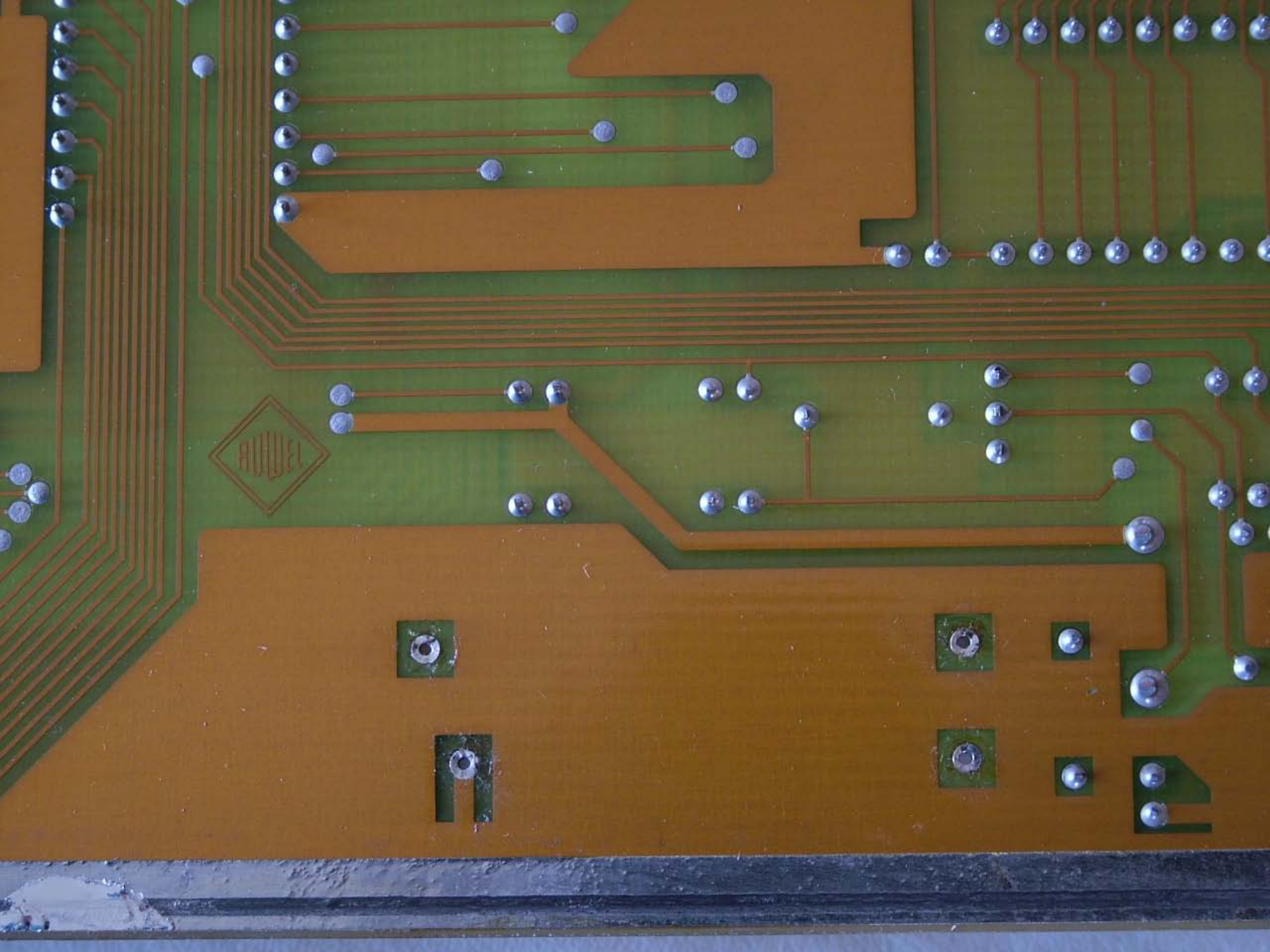

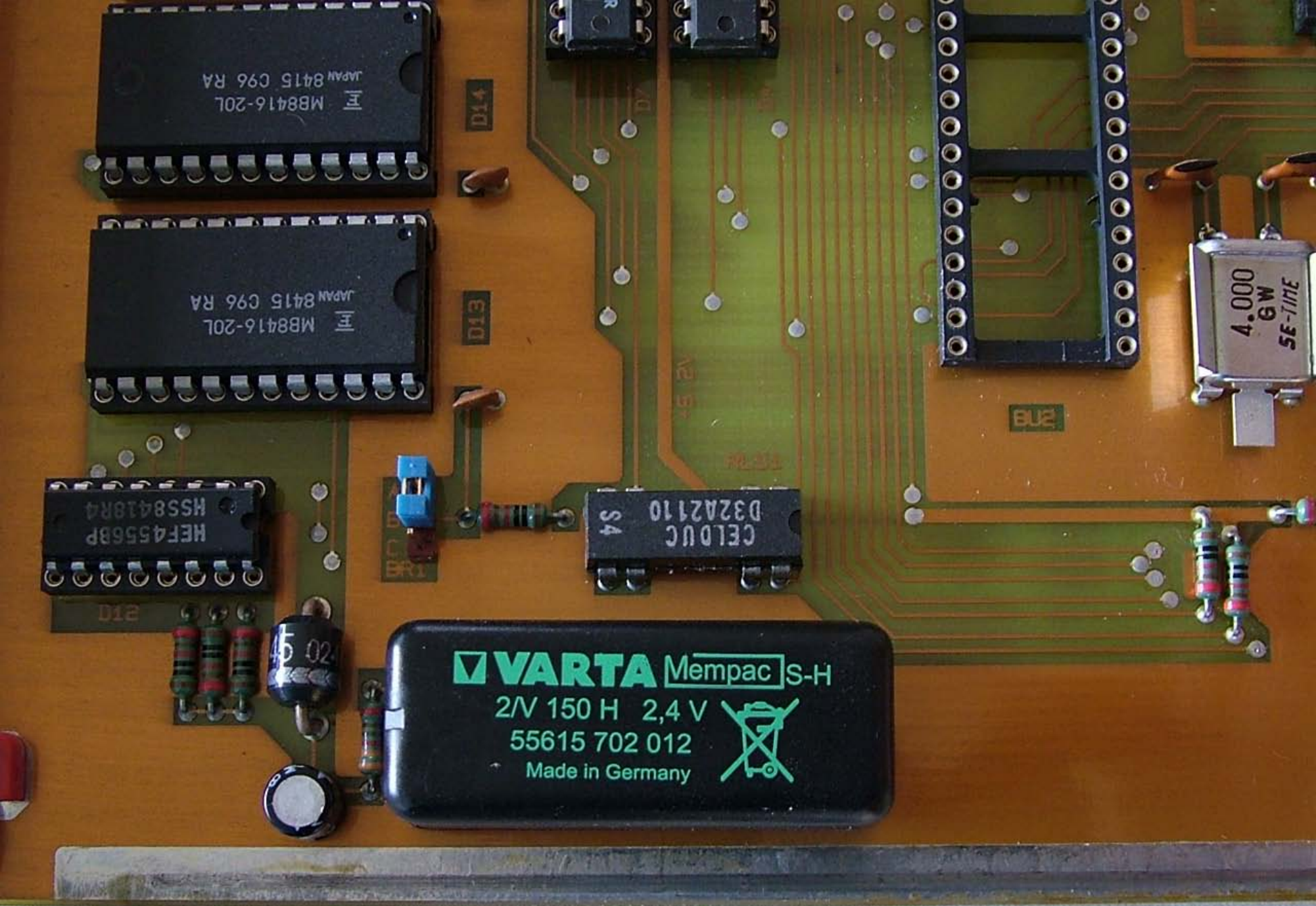
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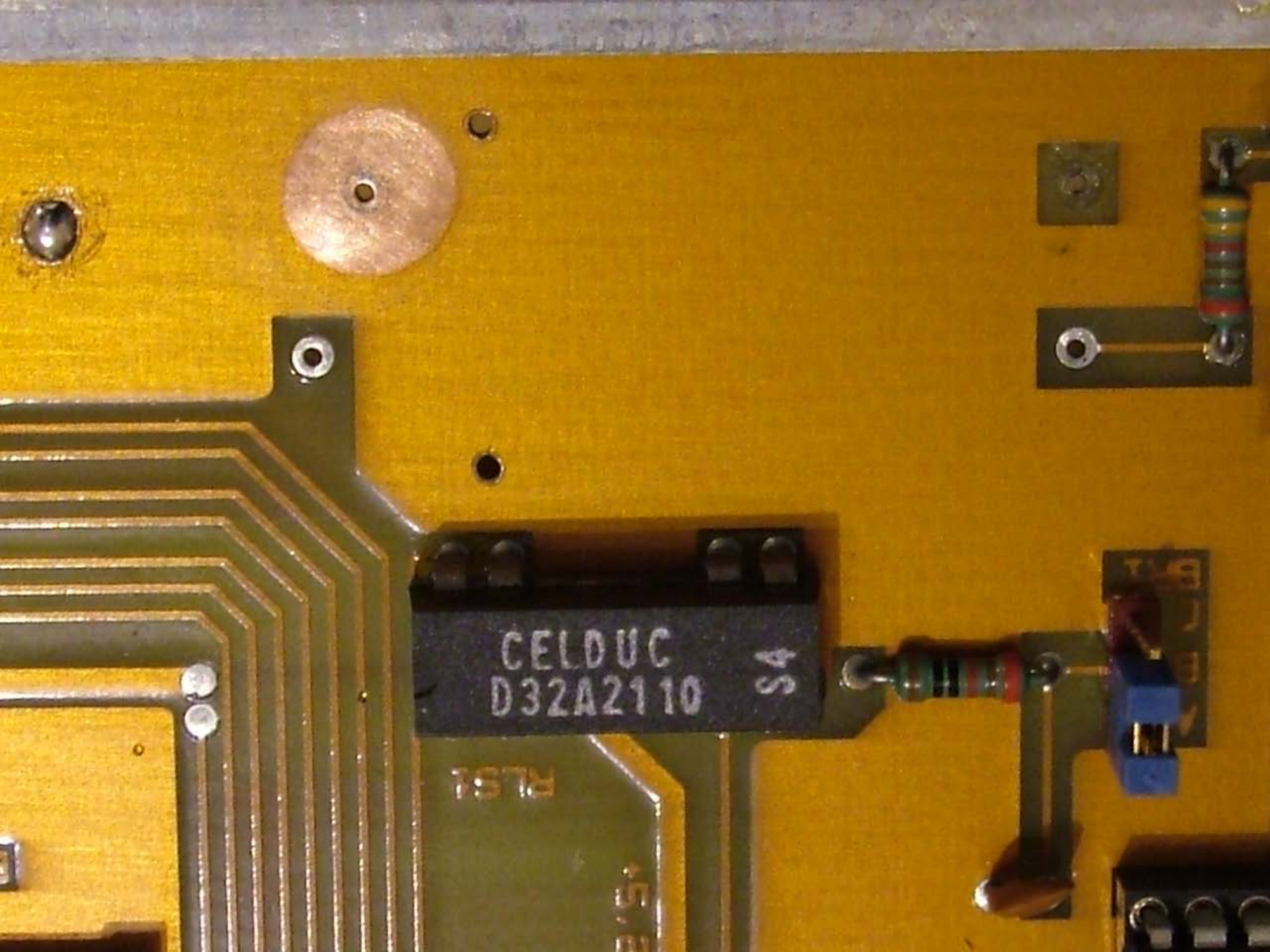
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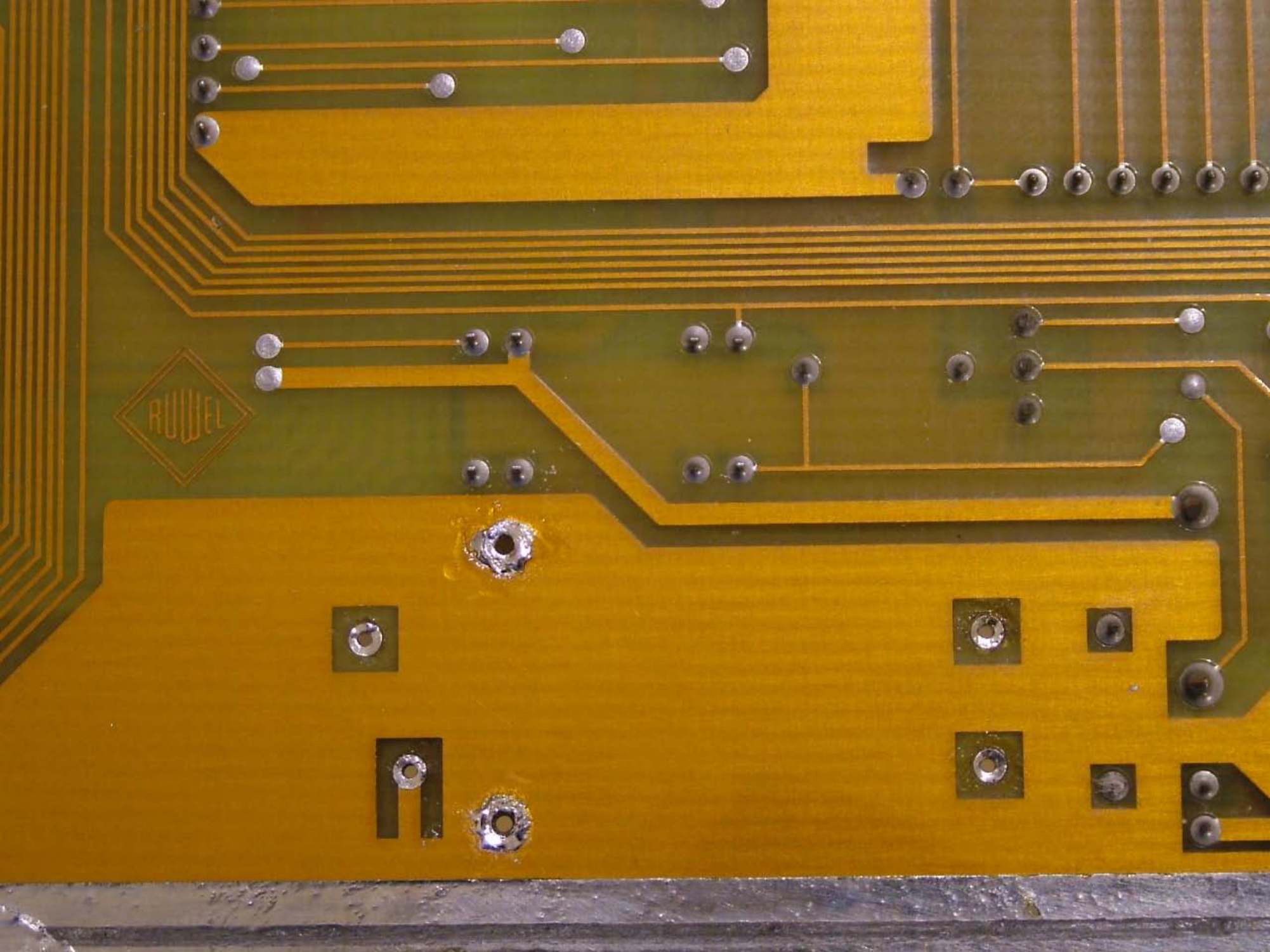
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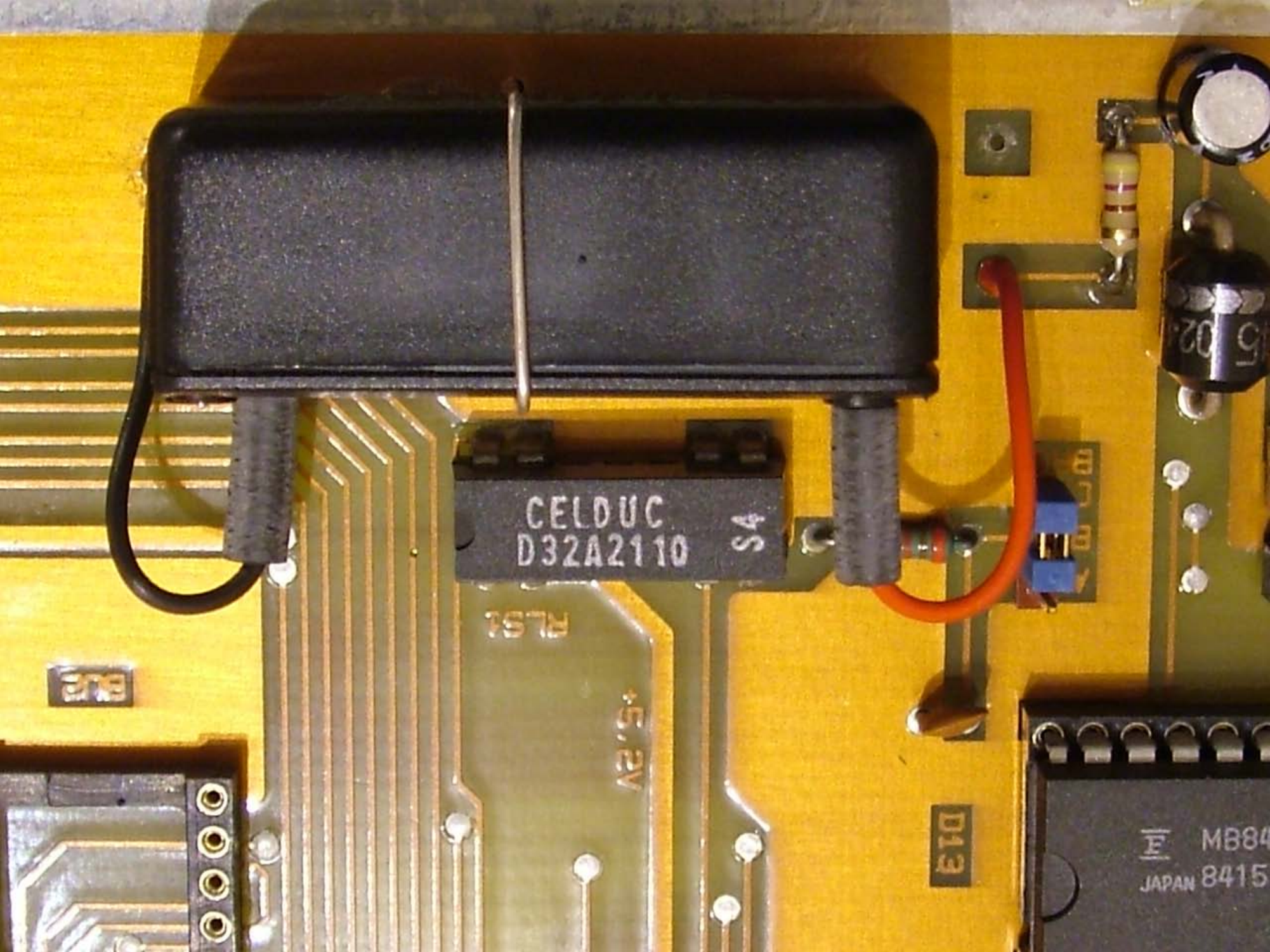
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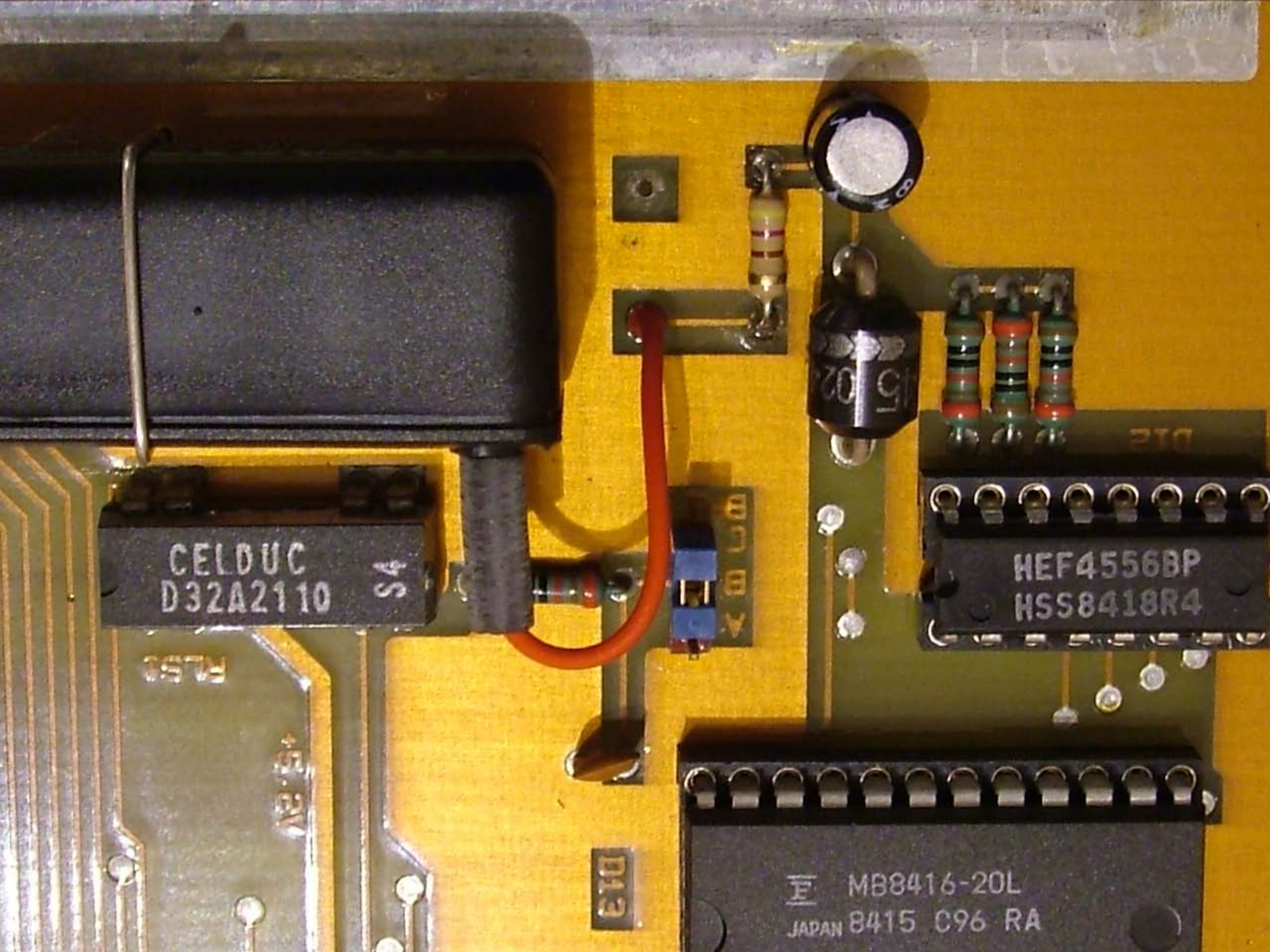
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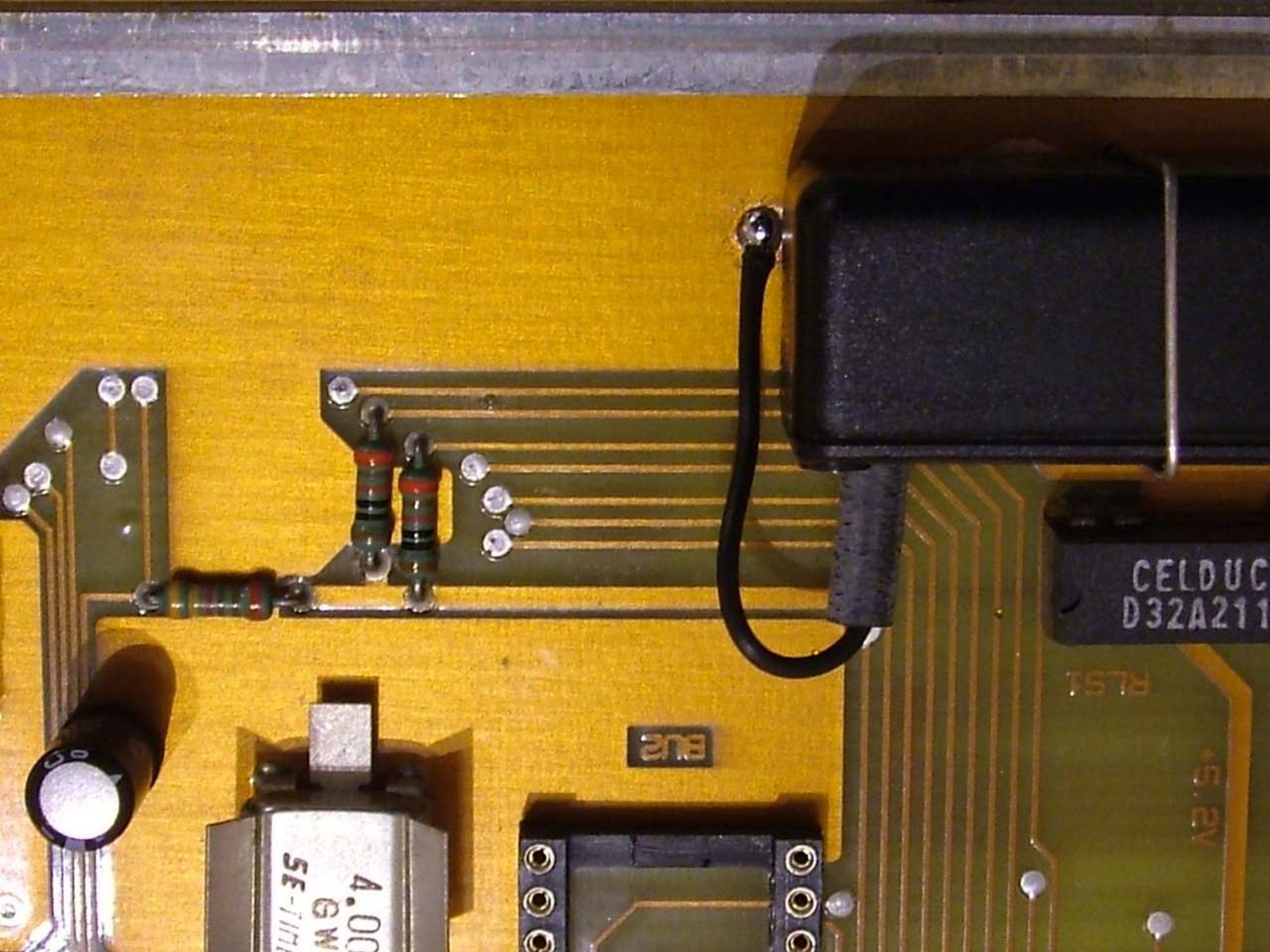
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