M100
5MHz Upgrade

April 2022

Version 1.1

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Modifications to your computer are done at your own risk!

[Bitchin100 5MHz Upgrade hacks page]

Change record

1.0	Initial document.
1.1	fixed errors: no 1kohm. Modified change to A* circuit.

Overview

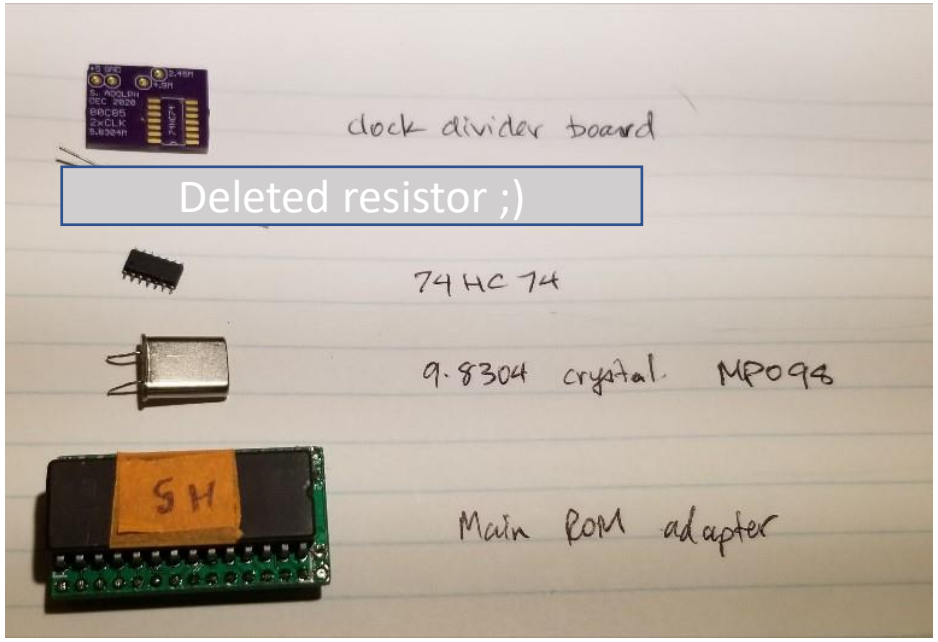
Goal: Upgrade the circuitry of the M100 to run at 2x clock rate.

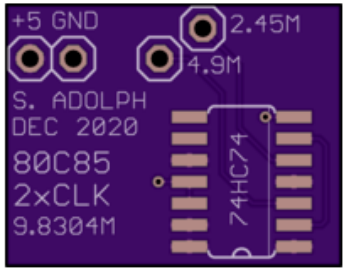
How: - increasing the clock rate to 4.9152 MHz

- piggybacking a clock divider on the CPU to generate system 2.4578MHz
- modifying the PCB slightly to accept the new clock signal
- speeding up the memory: faster main ROM, and improved main RAM speed

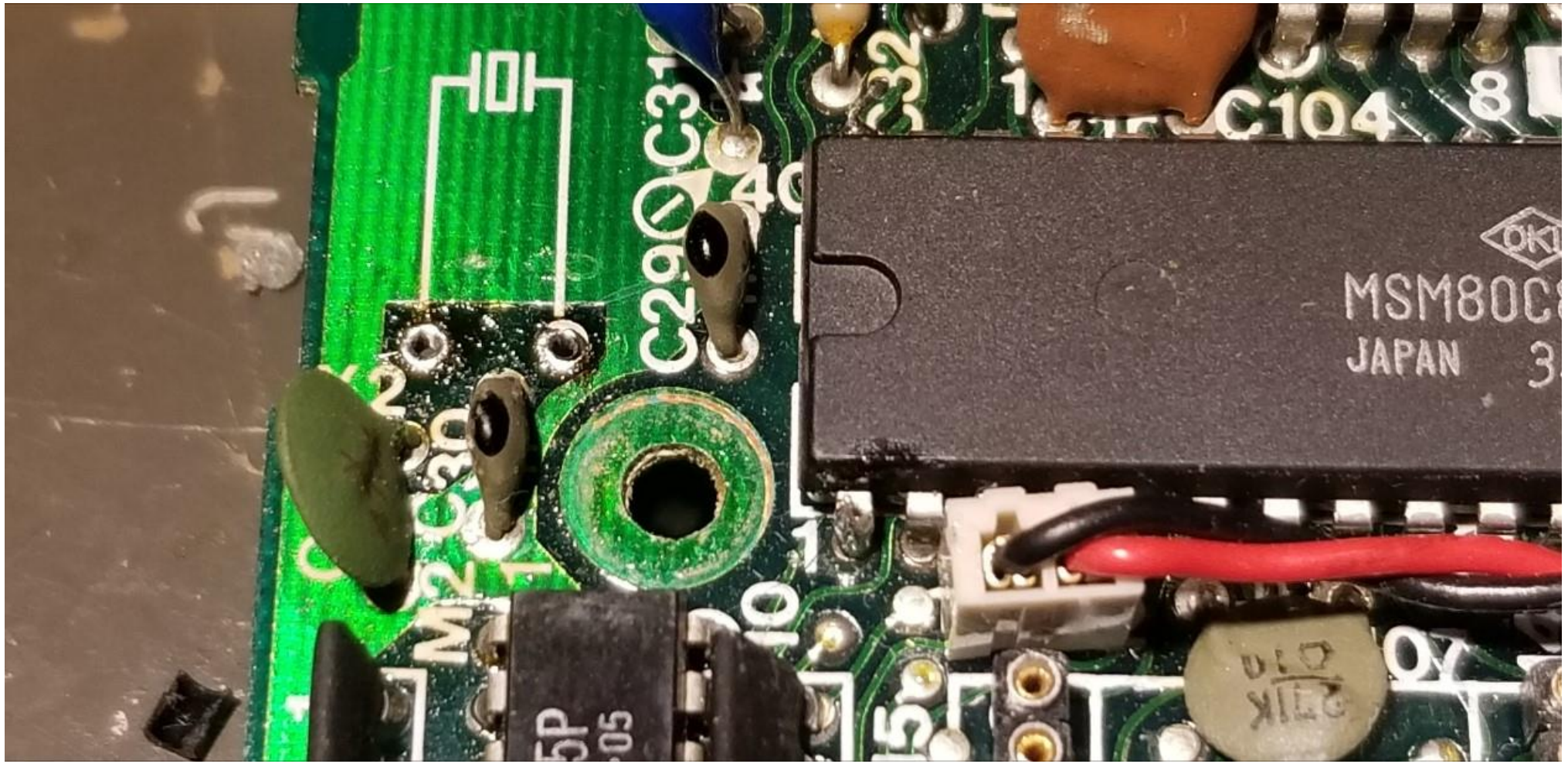
Note: The 80C85, 81C55 were not rated for 5MHz. While it appears to tolerate 5MHz operation, this is OVERCLOCKING beyond datasheet support.

Parts:



Part	Source	Reference	Comment
/2 clock PCB	posted		Non switchable. Switchable version available. 
74HC74D	Digikey	74HC74D	3.9mm width, variety of parts can work
9.8304MHz	Digikey	CTX084-ND	HC-49/U 20pF, 30pF may work also. Lots of possibilities
Fast Main ROM	various		You may need a fast Main ROM. Various solutions are available.

Remove the original 4.9152MHz crystal

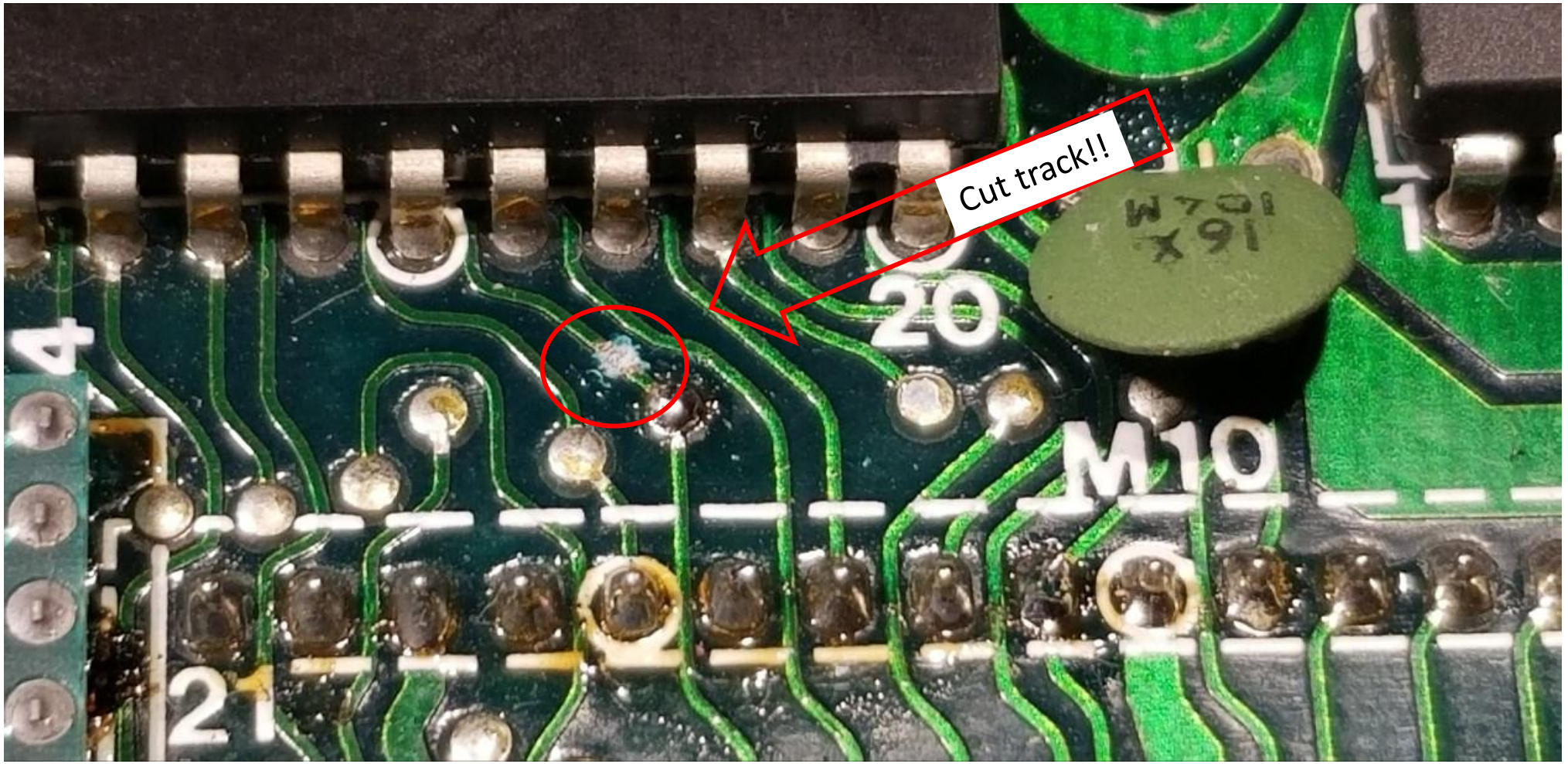


Remove the M100 PCB from the case. Using whatever means, remove the crystal and clean out the vias. Save crystal if you want to revert.

Install the 9.8304 MHz crystal

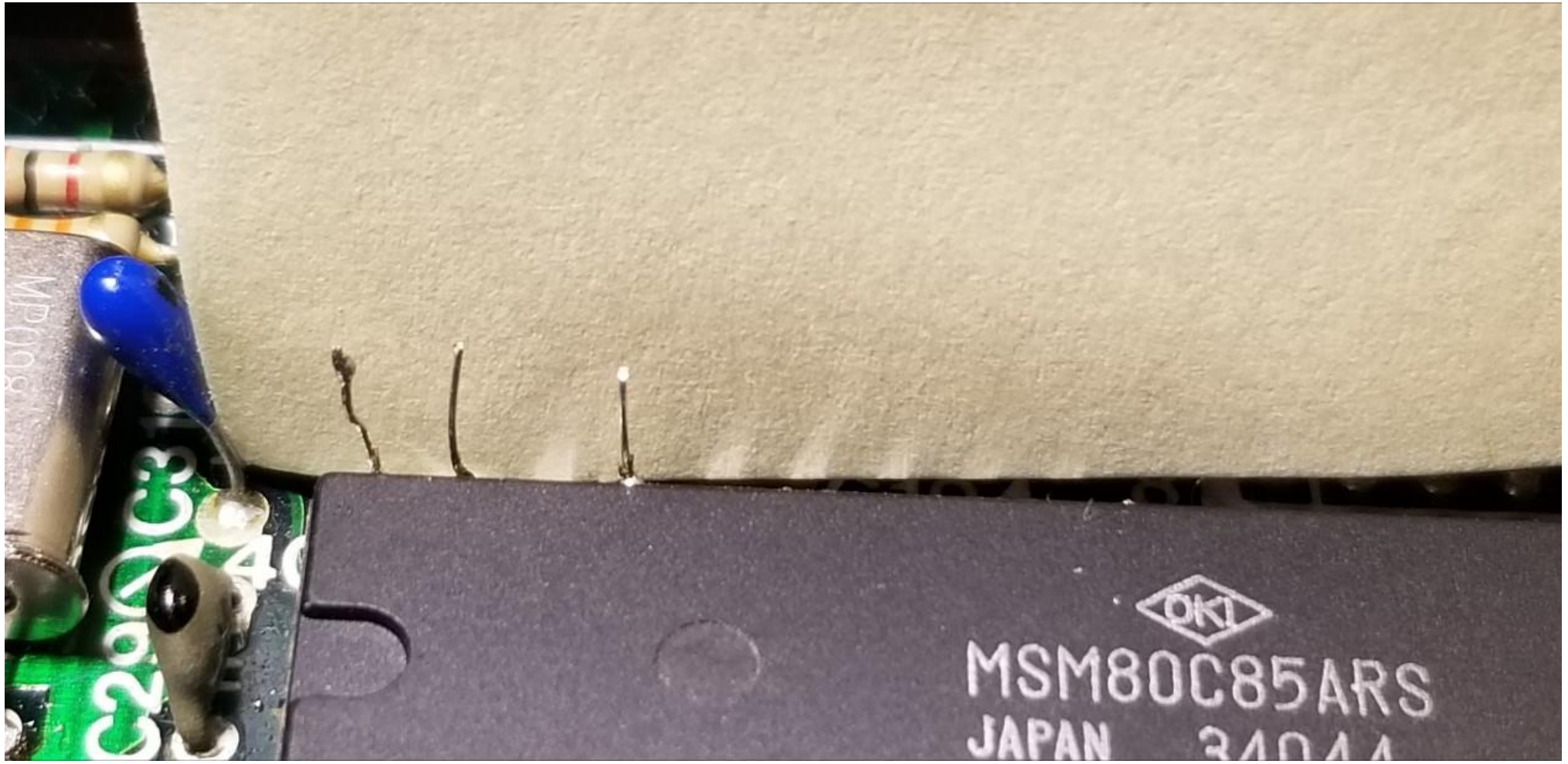
Insert, solder, trim the leads

Cut the clock track at location



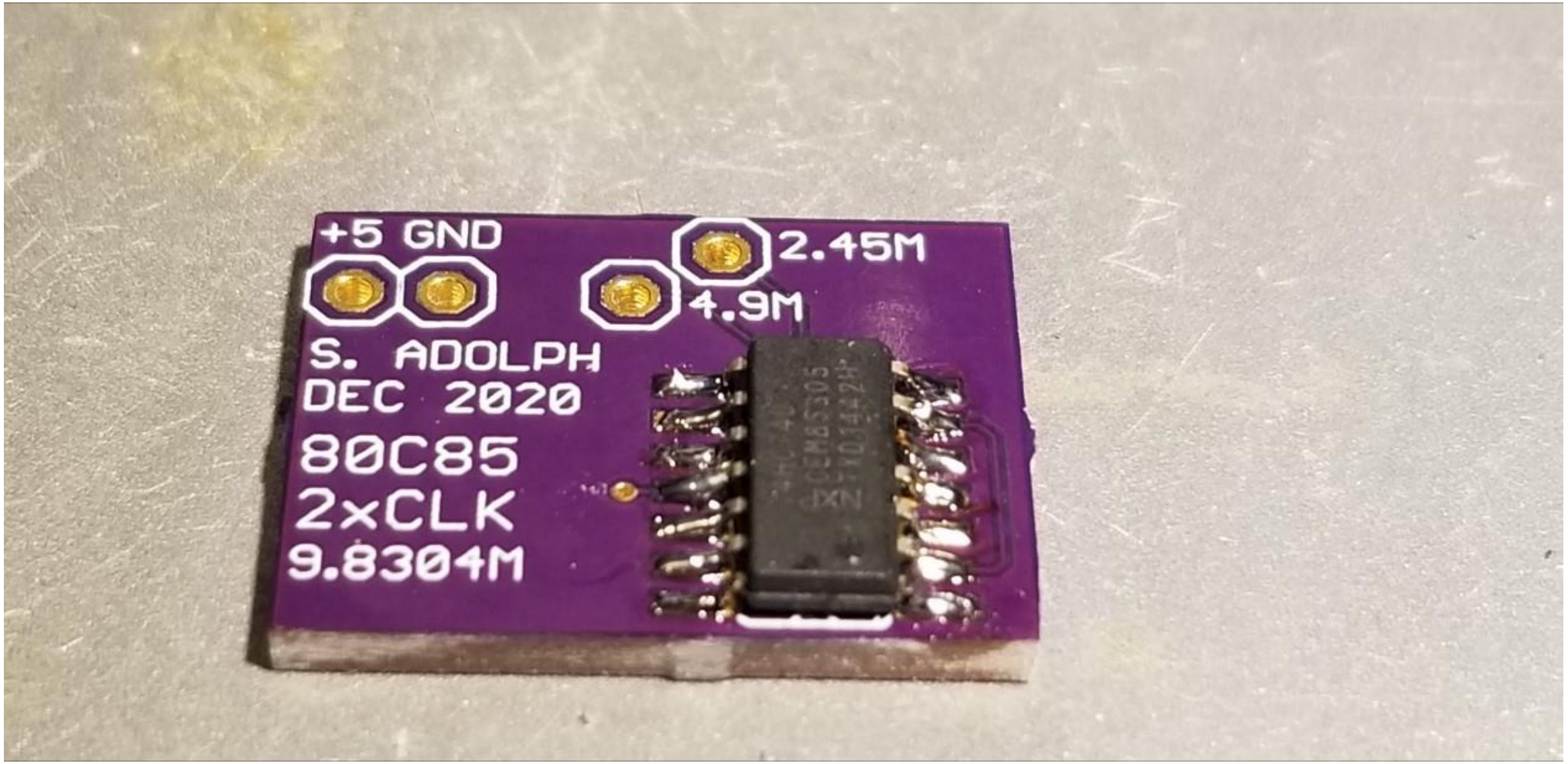
Cut track carefully as indicated, to isolate the clock fed from pin 37 of the CPU.
This is easily reversed with a single strap wire if needed.

Add 3 wires to the CPU



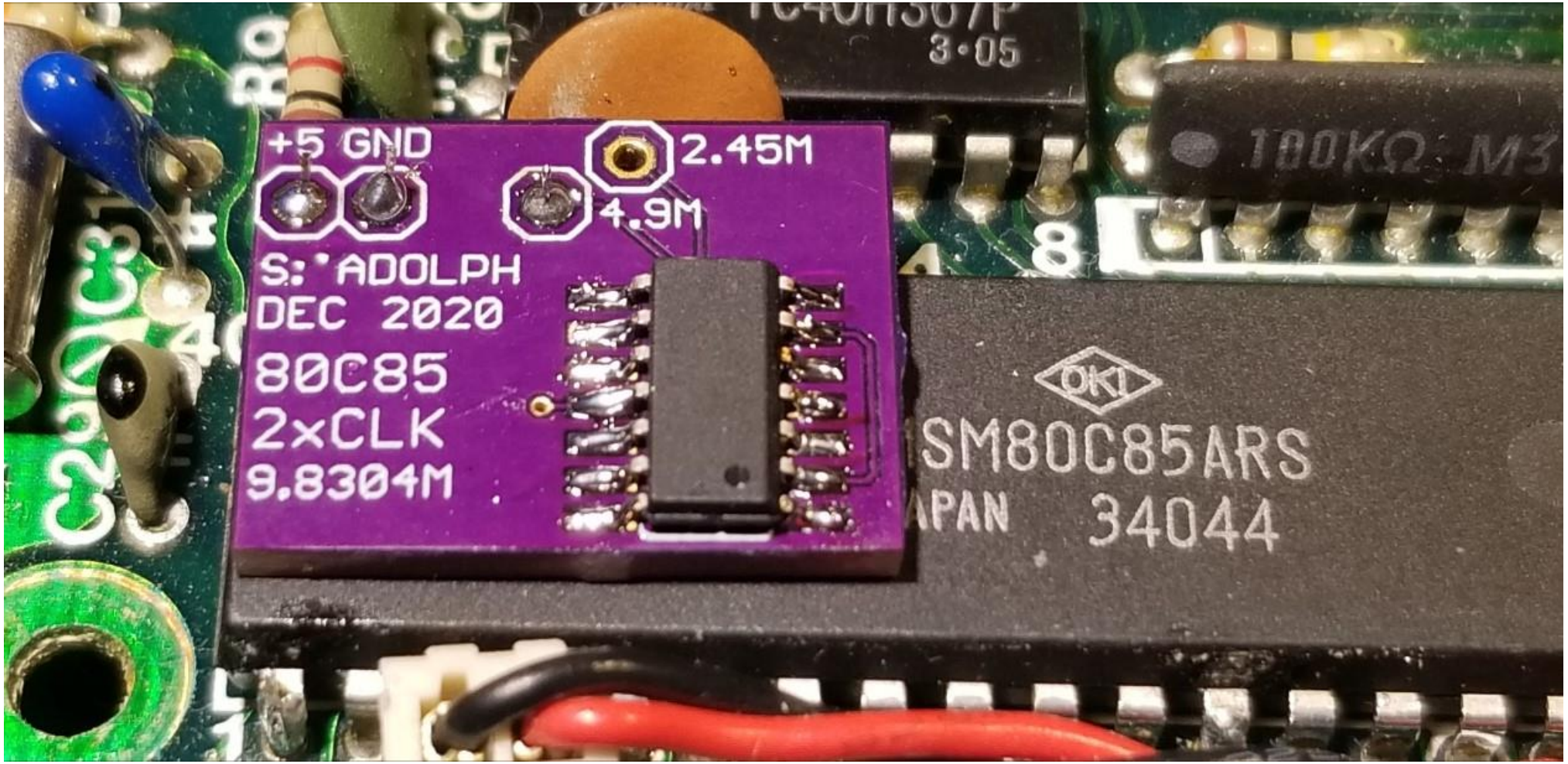
Solder 3 short wires vertically to pins 40, 39 and 37 on the CPU, as shown.

Assemble clock divider PCB



Solder the 74HC74D IC to the divider PCB.

Attach clock divider to CPU



Slide the divider PCB onto the three pins as indicated. Solder lightly as to not dislodge the wires from the CPU.

Connect new clock signal

Run a wire from the via right next to the clock track cut, to the 2.45M pin on the clock divider PCB.

Speeding up the memory

With the clock circuitry in place, you can now try your M100 and see if it works at 5MHz. It may work with no further modifications.

If it does not run, you may have an issue with the speed of either or both of the following:

System Main ROM	System RAM
• Check your main ROM. • If you have an old USA M100, that has the main ROM from SHARP labeled **LH535618**, chances are your ROM is too slow for 5MHz operation **(but some work!!)** • You can address this by swapping your original main ROM for a faster 27C256 or equivalent EPROM (using an adapter board). • There are several solutions available for this.	• Check your SRAM. • The original M100 SRAM modules were built with SRAMs rated for 250 nsec. “TC5518BF-25” • These modules are too slow, **but the motherboard circuits can be modified to improve for speed up.** • Newer modules with SRAMs rated at 200nsec or faster likely work.

Install faster Main ROM

Install new Main ROM using adapter. Use an EPROM that is 150nsec or faster.

Image can be stock, or modified to suit. I'm using the hardware scroll patch.

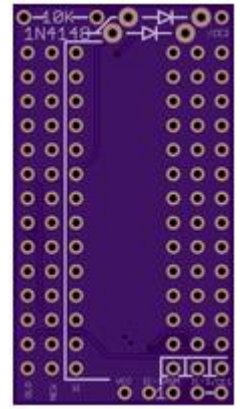
Adapter for faster Main ROM

The SHARP LH535618 main ROM is rated at 600 nsec. I've tested several and about 30% of them can actually run at 5MHz. But most do not.

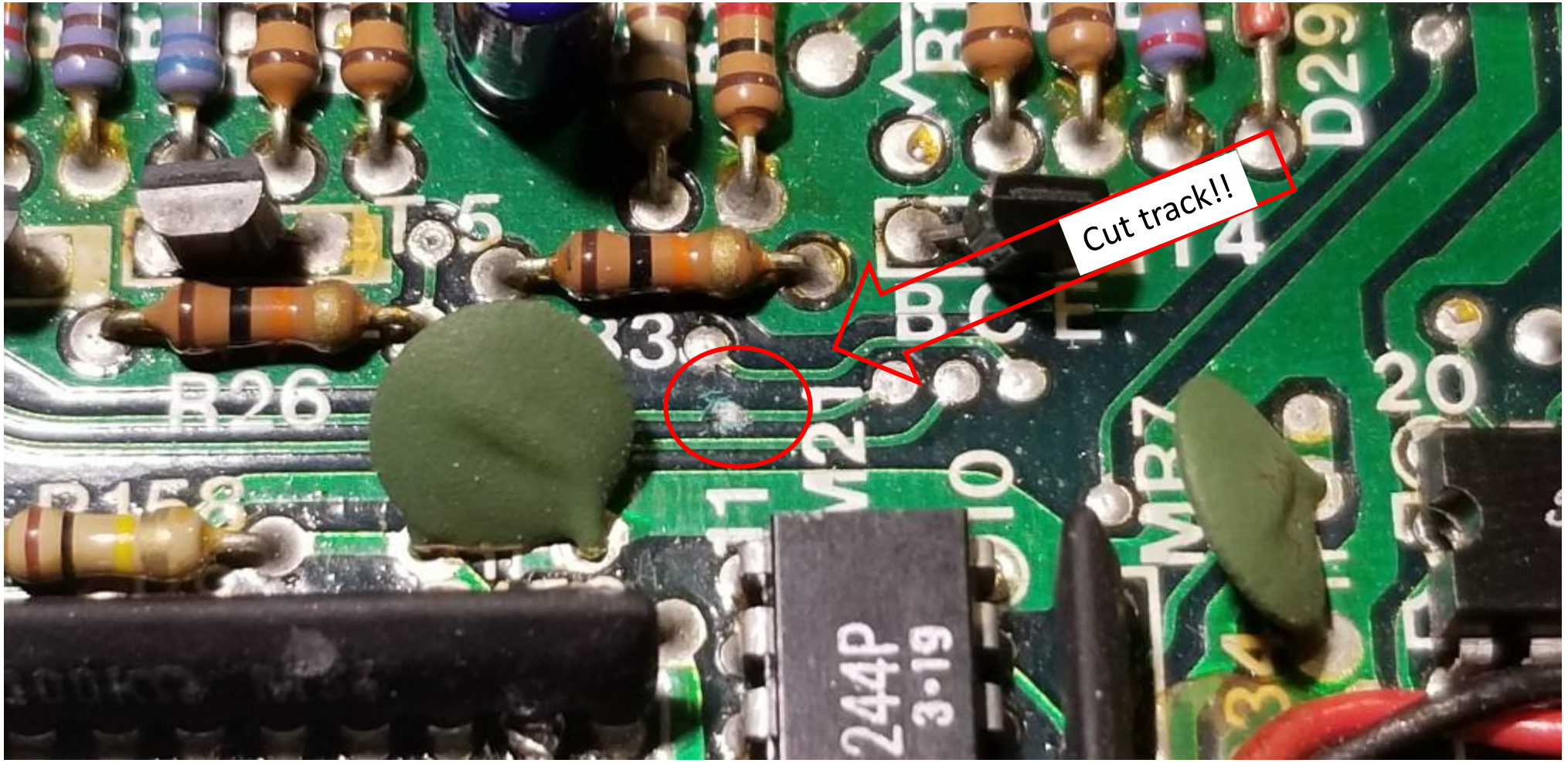
Mounting a modern, fast (<200nsec) EPROM requires an adapter board, which you will have to assemble or buy.

There are several ways to get a PCB and chip solution for upgrading the main ROM.

- This link has one PCB that works
- https://oshpark.com/shared_projects/Kil9S1ya



Faster SRAM: Disable A* input to M20 pin 14



Cut track as indicated. This disconnects the input to the M20 A* buffer at pin 14.

Faster SRAM: Pull A* buffer input high

Solder a short wire from pin 16 to pin 4 of M20. This drives A* high to the chip select circuits, which in turn speeds up the access to the SRAM.

Finishing comments

This modification permanently changes the clock rate. Switchable solutions are also available and tested.

The changes are reversible, to the extent that you can repair the cut traces.

I have modified 2 M100 to date with no issues observed. I also have 2 T102s similarly modified to run at 5 MHz.

If you have any questions, don’t hesitate to ask!

Steve Adolph

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