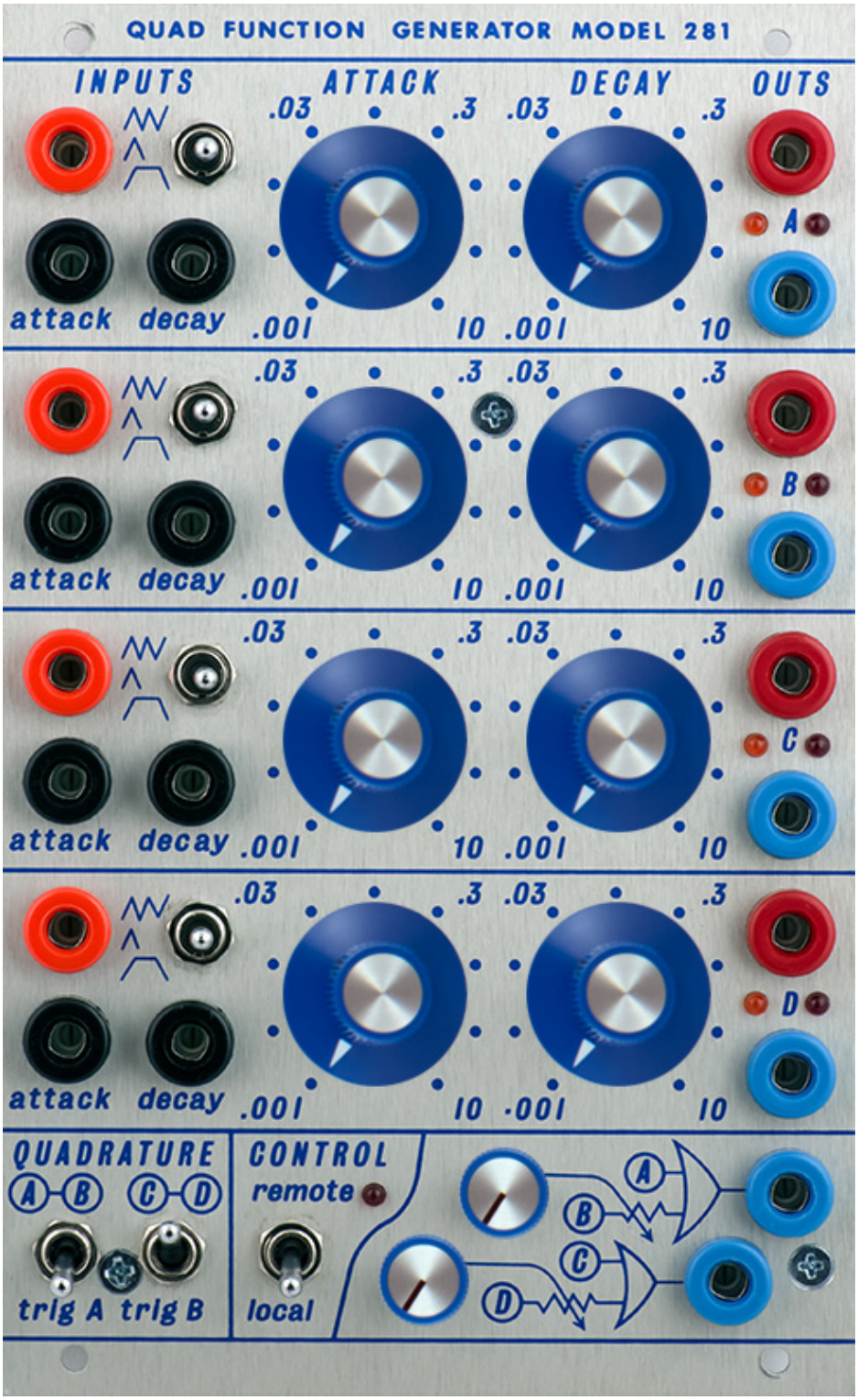
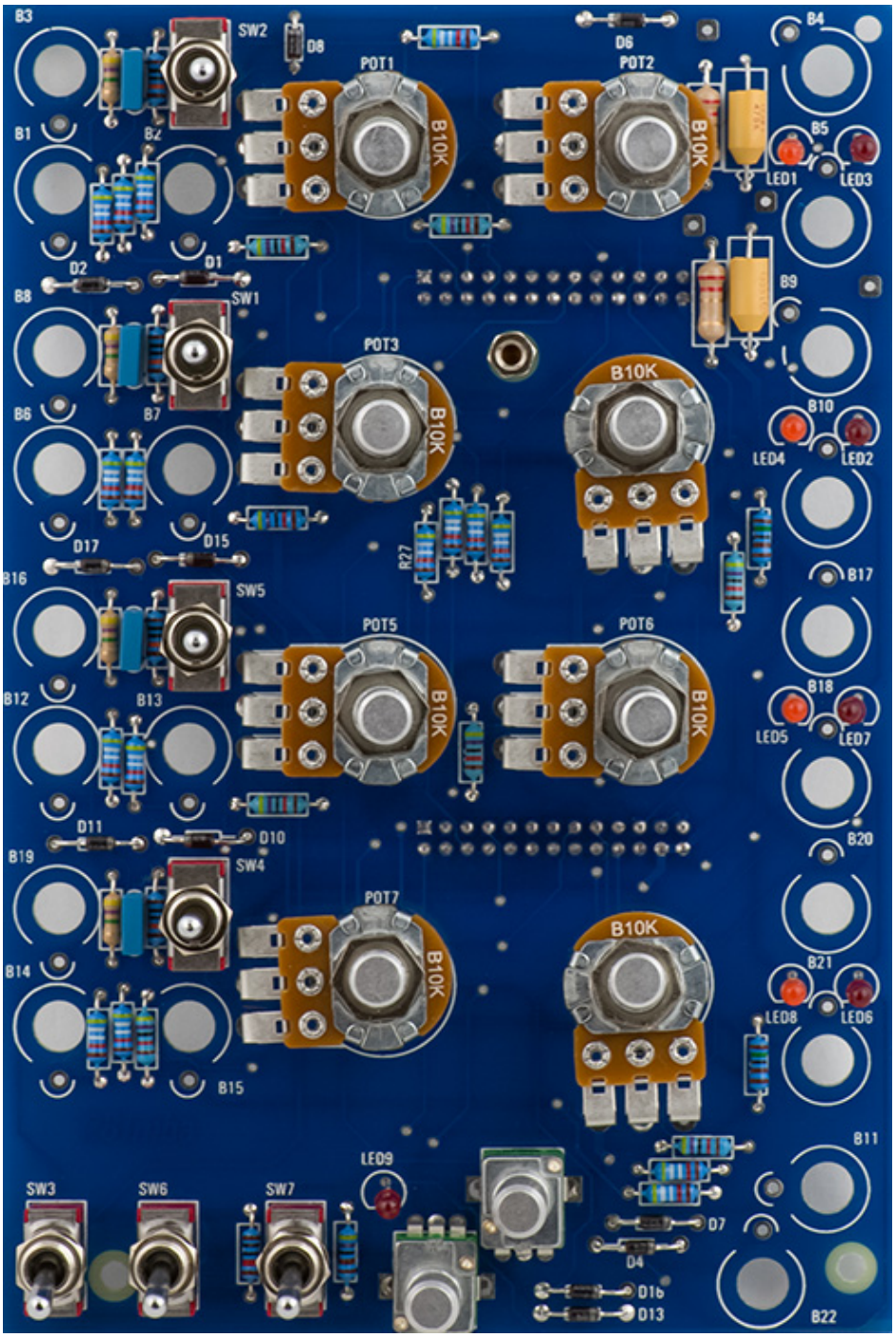
Buchla 281 Quad Function Generator Module

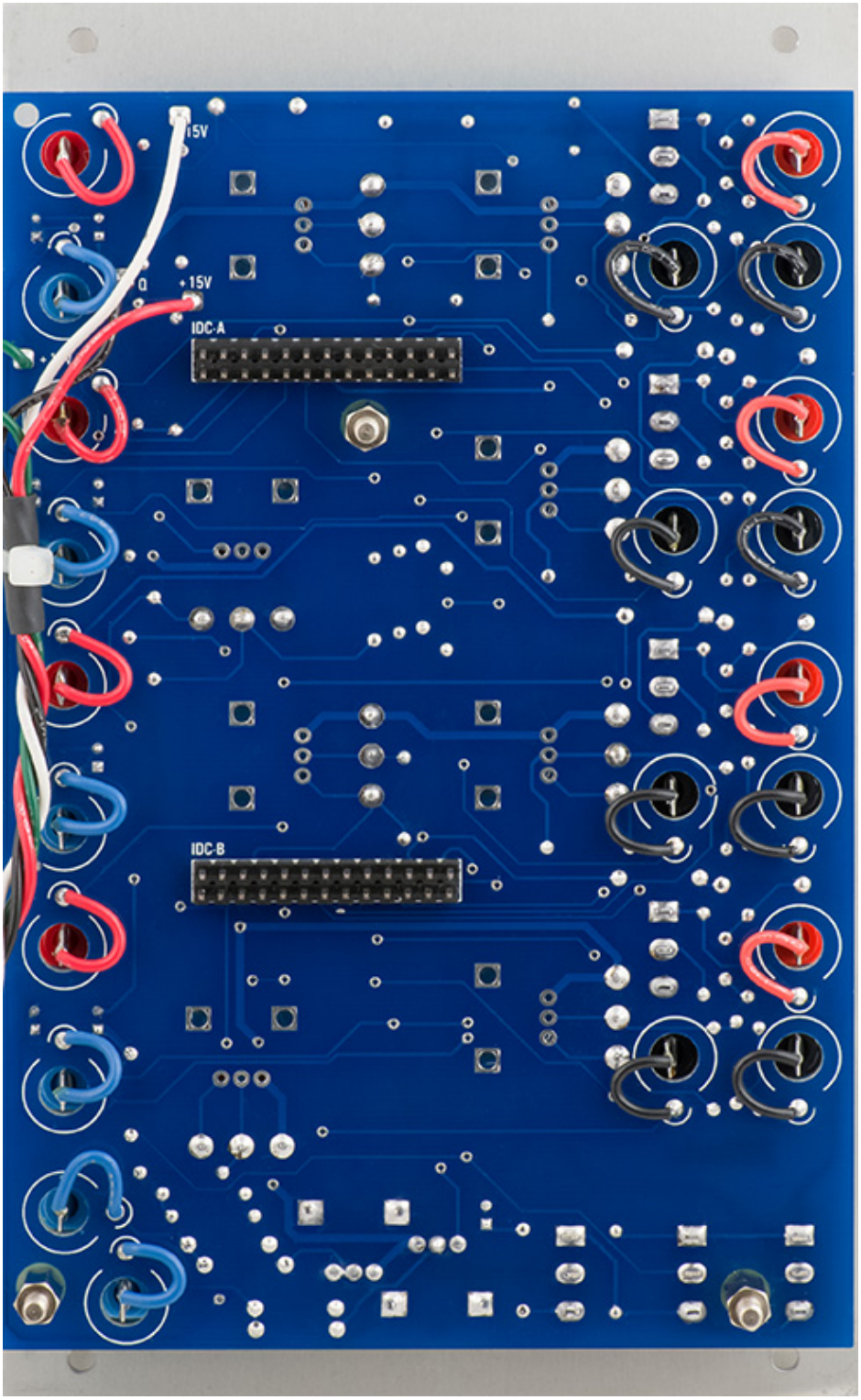
I built a V2 Buchla 281 Quad Function Generator module for someone else. They sent me a mostly complete kit of parts and I assembled and tested the module. Many of the components are sourced through Mouser but specialized parts, panel, and knobs have specific sourcing and I do not know the details.



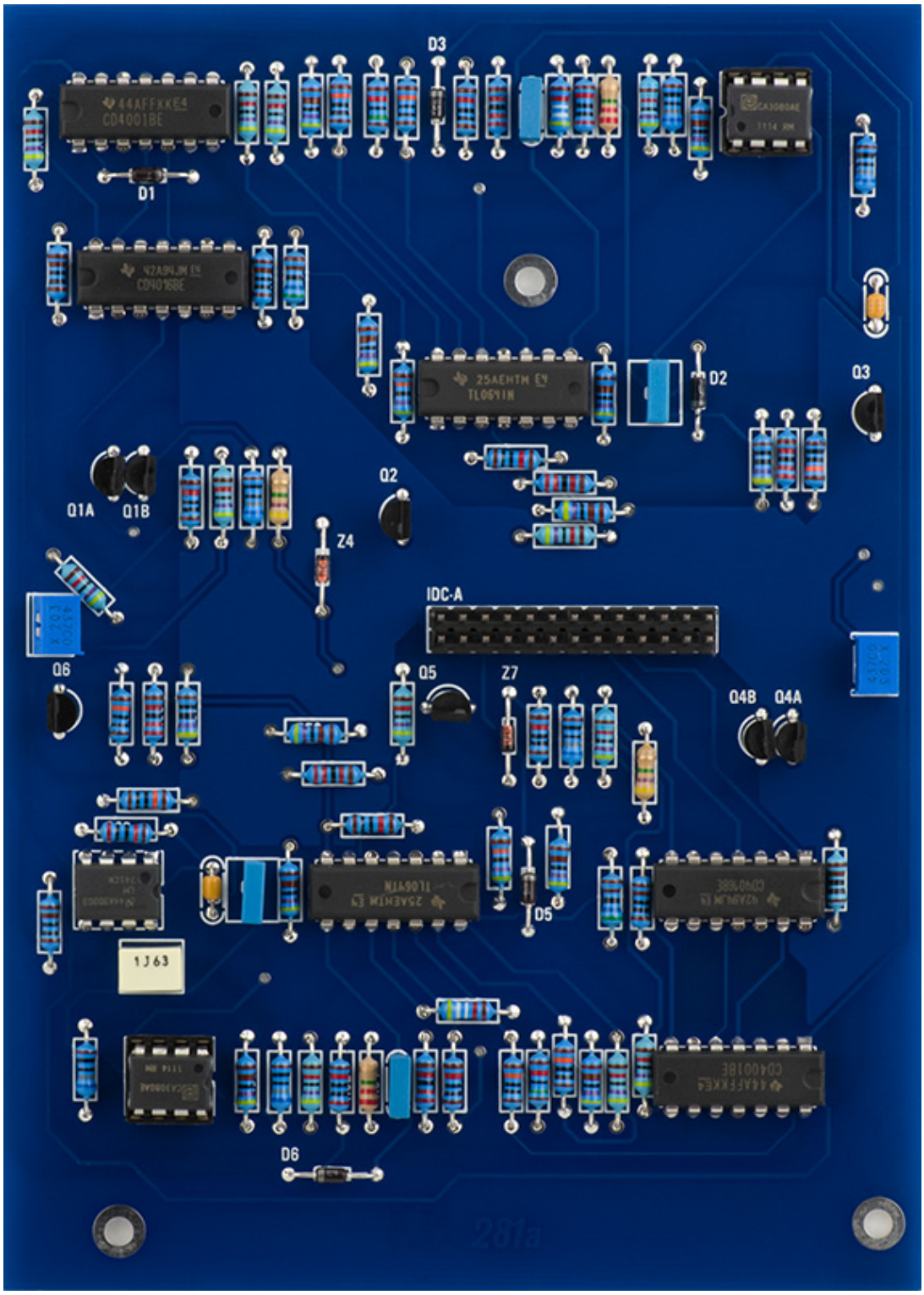
Assembly of PCB1 is straight forward.



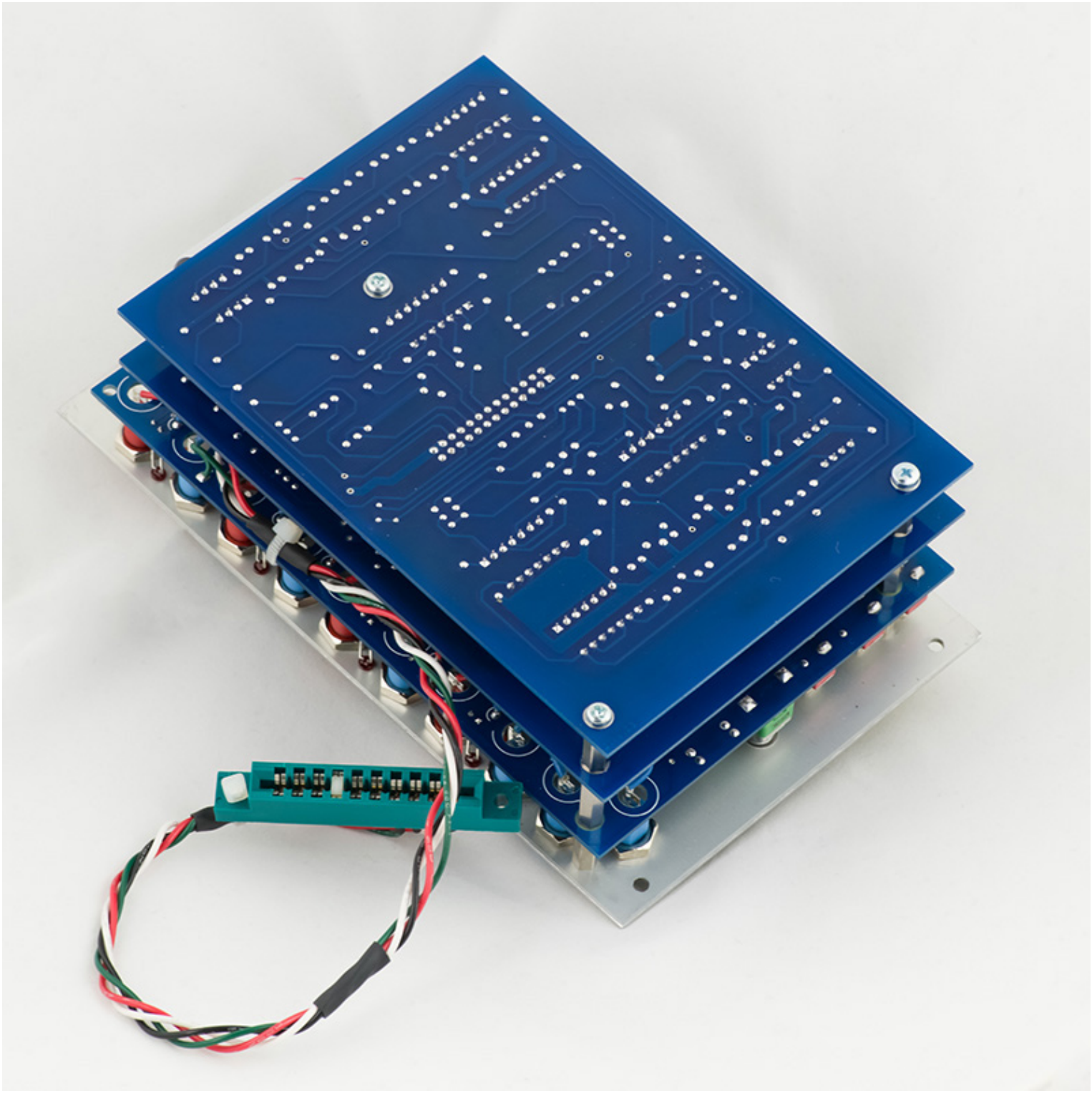
The power cable wires into discrete pads on the rear and I wire tied it to one of the connector holes.



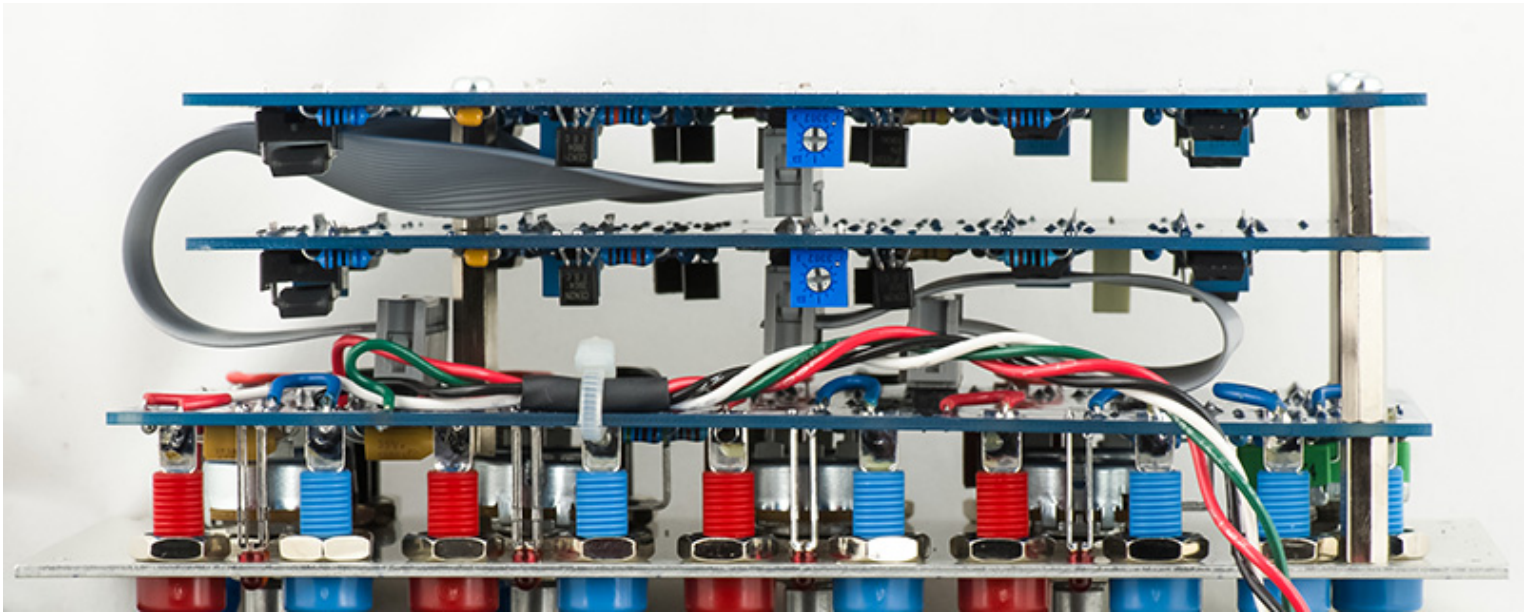
I used sockets for the CA3080 OTAs as they are both rare and fragile.



This photo shows the completed three PCB module.



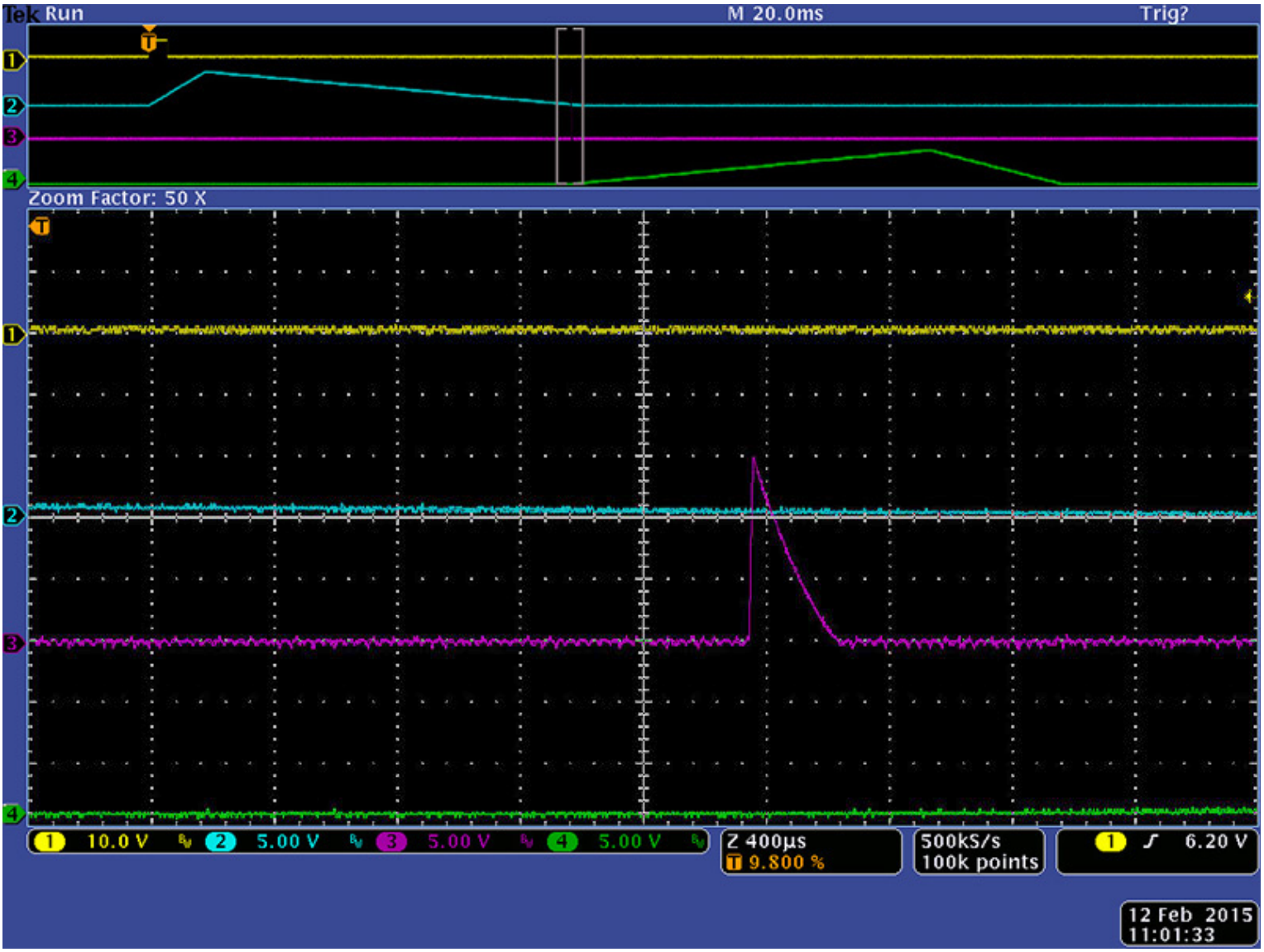
I routed the flat cables a bit different than other photos I have seen. I routed the cable that goes around the middle PCB on the side that had additional clearance. This cable needs to be split to fit around the center standoff. I made the other cable long enough that I could extend the PCB out for service. I used 20mm spacers between the panel PCB and the center PCB and 15mm spacers for the rear PCB.



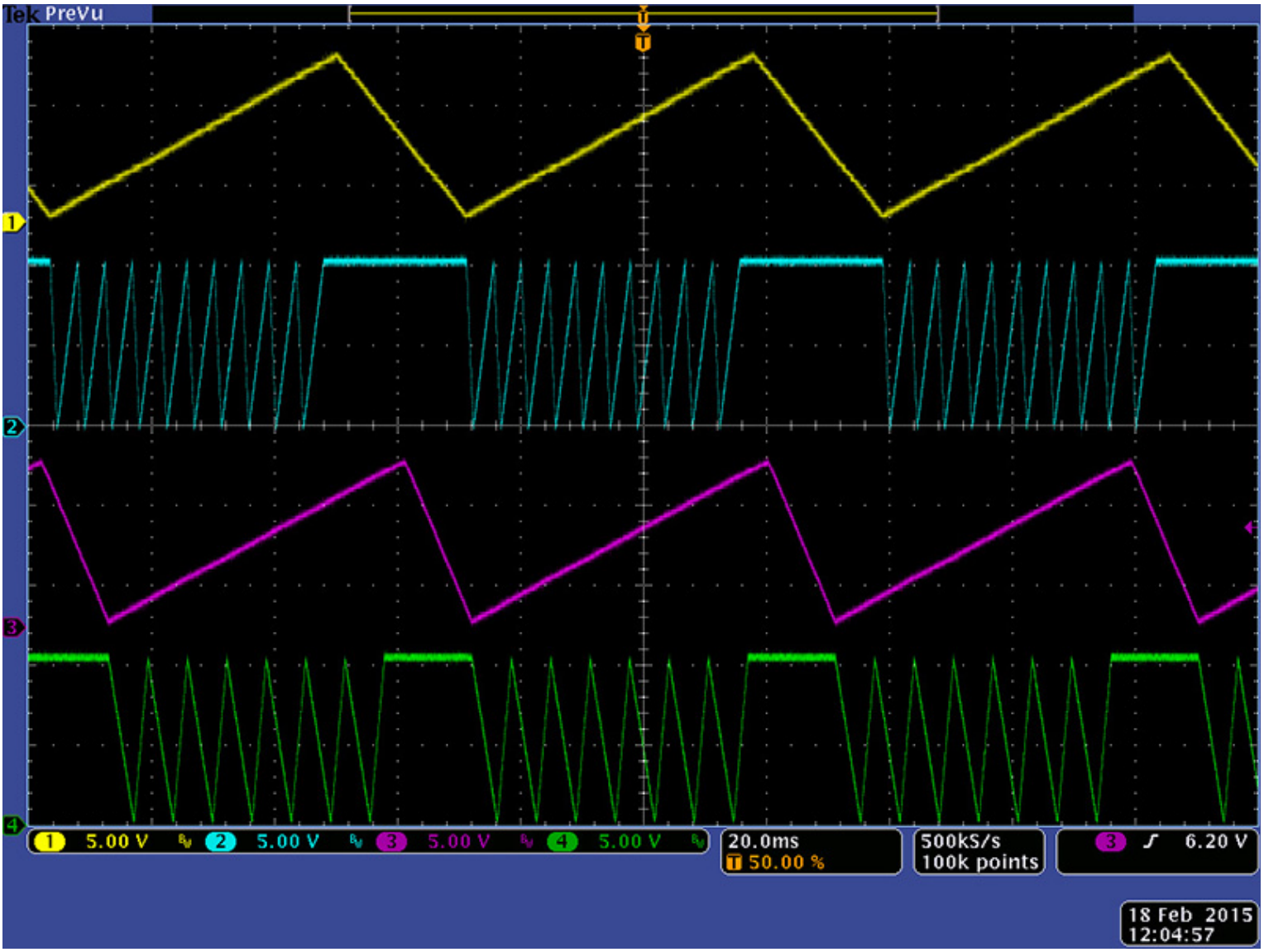
Operation

This image shows A triggering B. You can just barely see the magenta trigger pulse on this scope image.

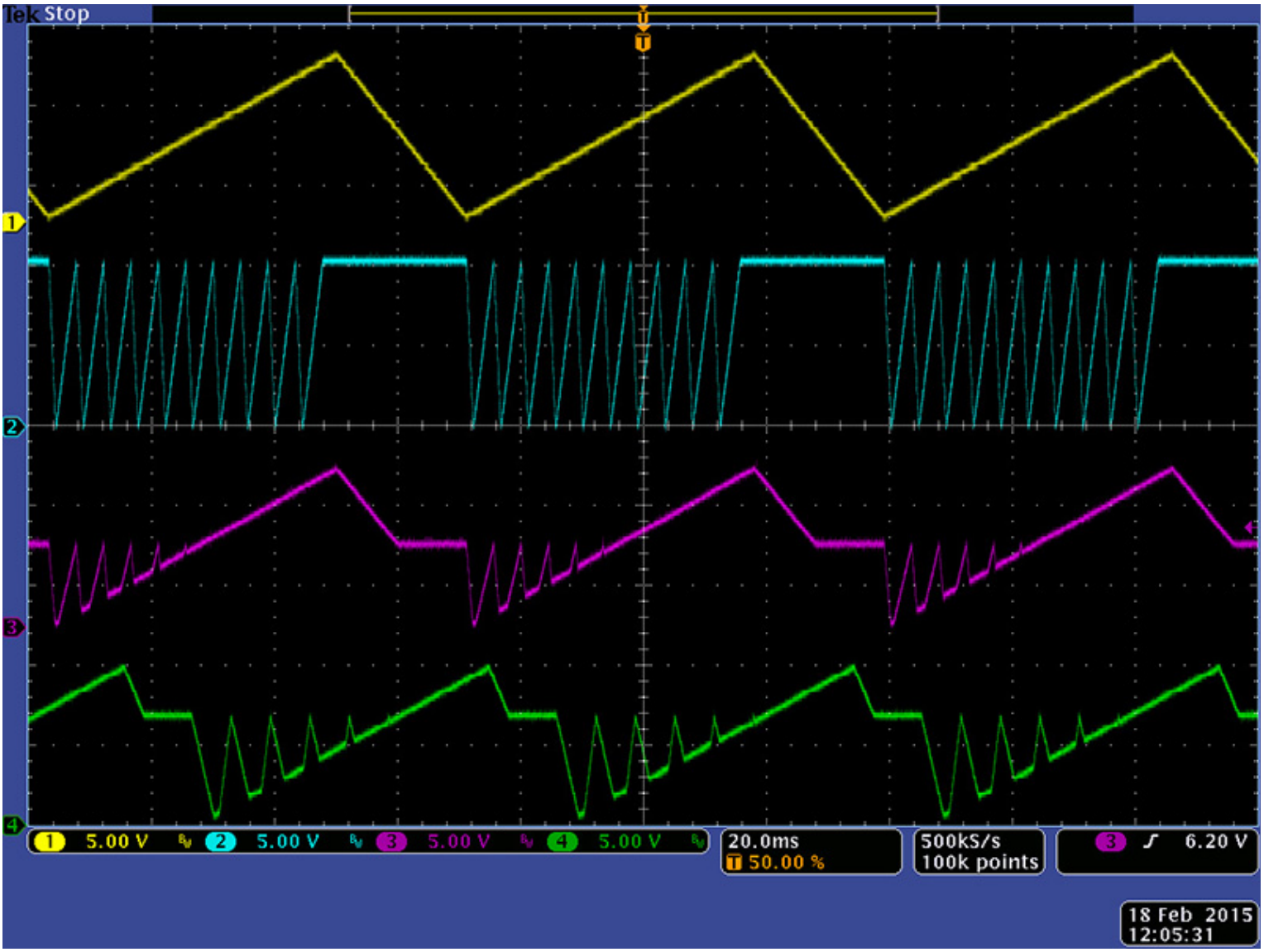
The red banana jack output is a trigger at the end of a cycle. Zooming in you can see it is a +15V pulse about 150 µS wide at mid-voltage.



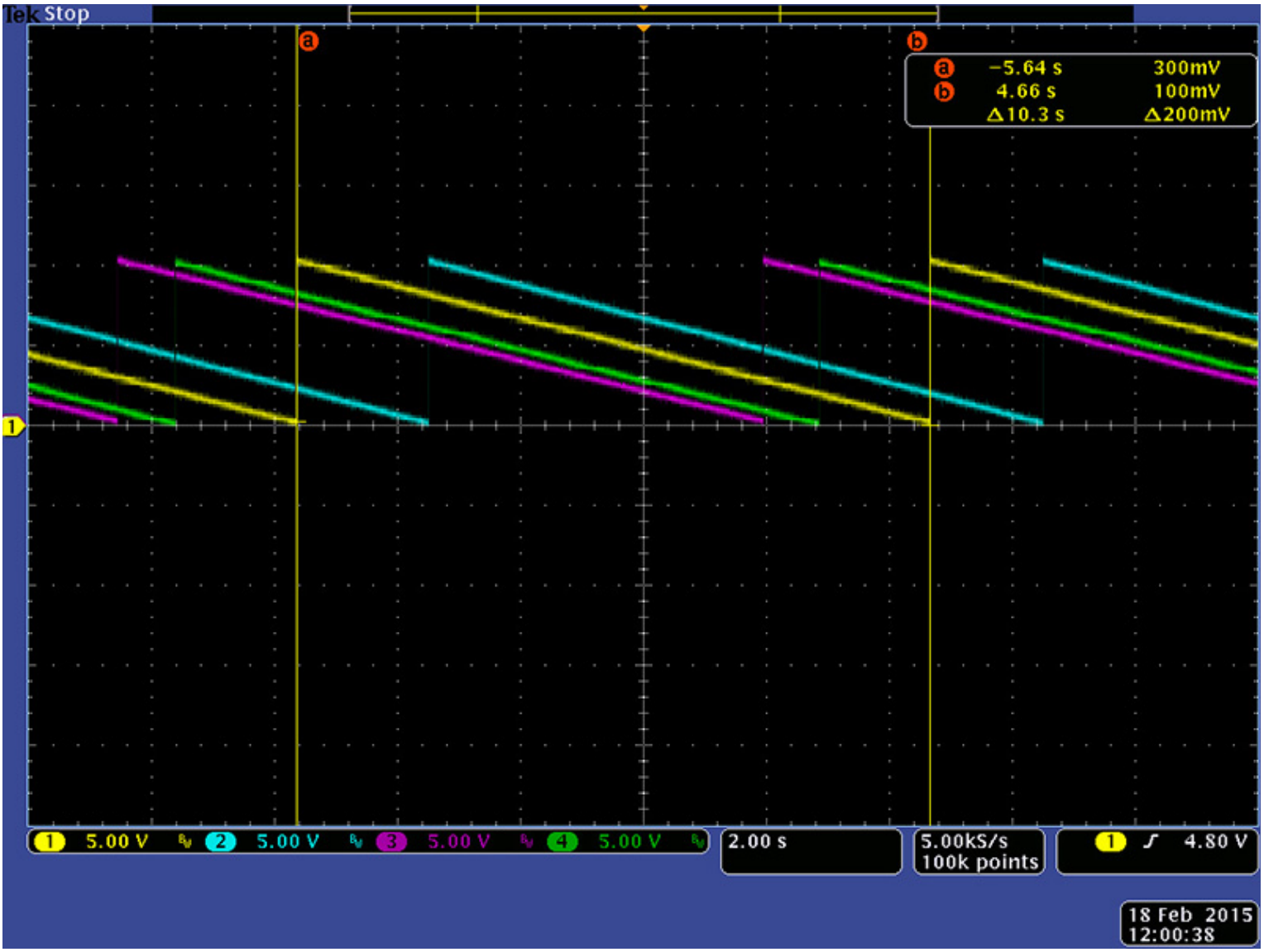
This scope image shows Out A - D in quadrature mode.



This scope image shows the same Out A and B as above and the Sum outputs.

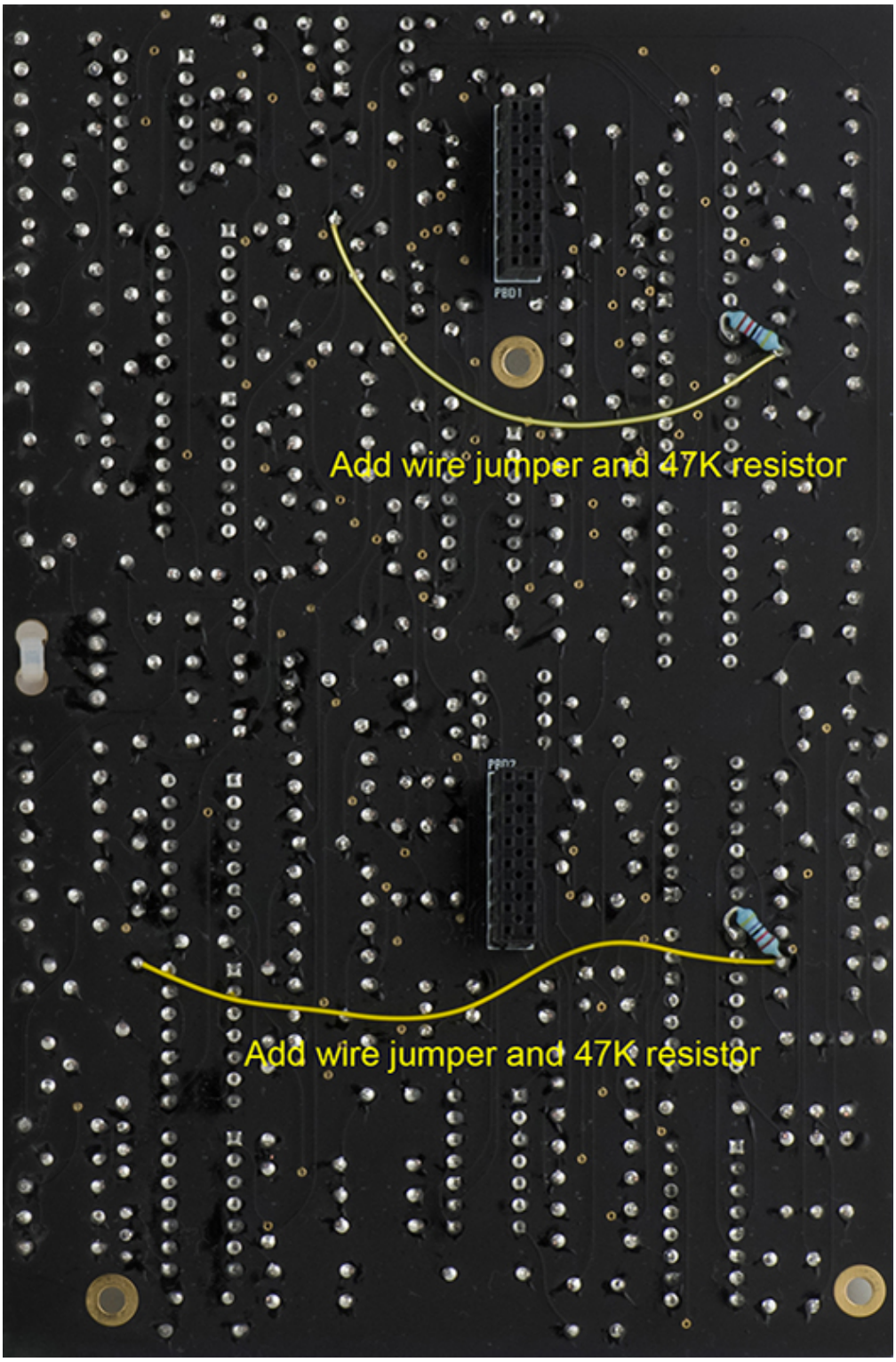


I calibrated Section A to 10 seconds and then adjusted the slope of Sections B - D to be parallel.

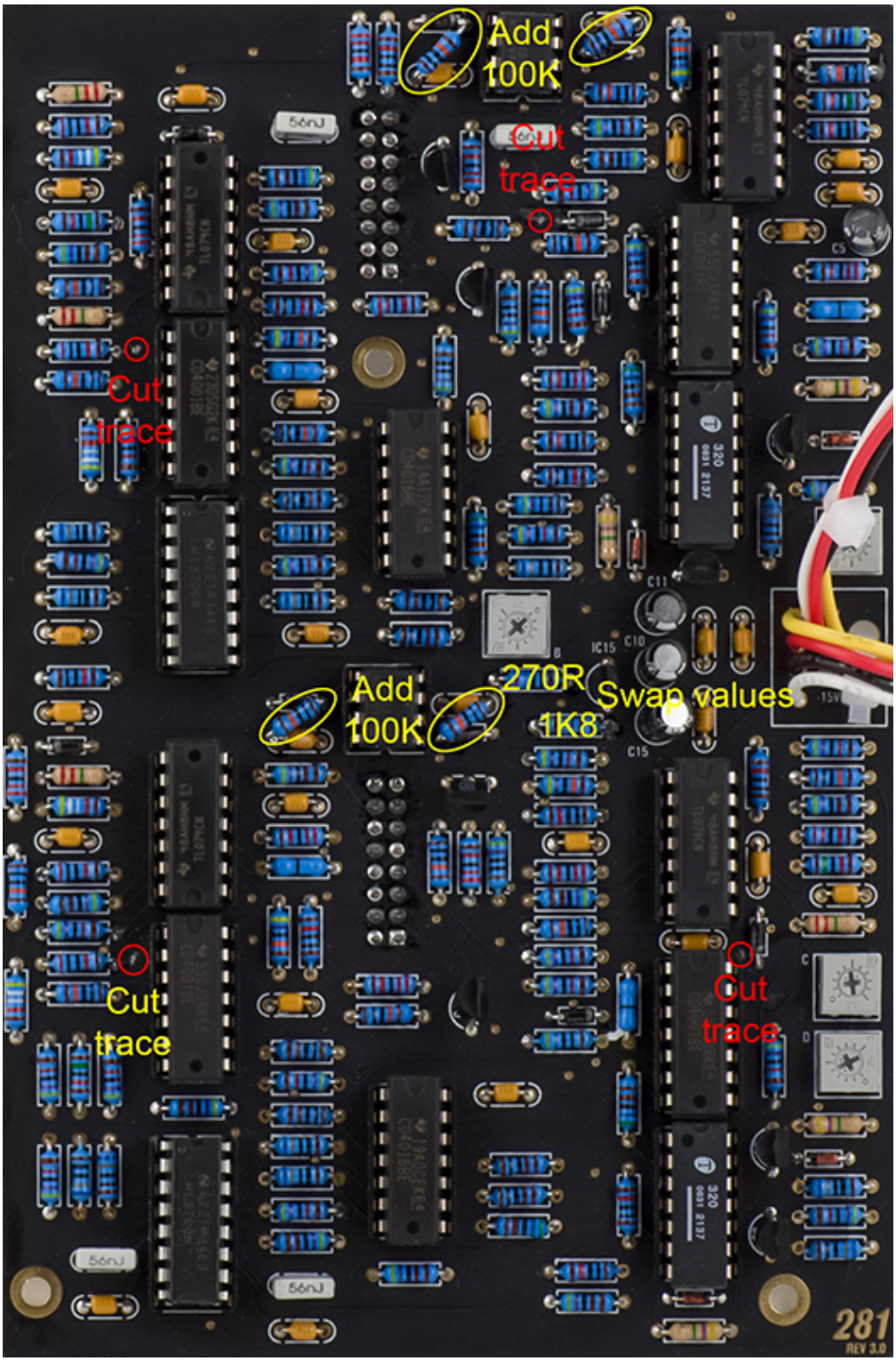


V3 PCBs

The V3 PCBs have a few issues that are easily corrected. The BOM for the 10V regulation resistors are swapped. R169 should be 270R and R270 should be 1K8. Pin 1 of IC7 and IC14 are driven from a saturated op-amp output through a diode. IC7 and IC14 are powered from 10V so you need a 47K resistor in series with pin 1 to limit the current. You can lift the pin and add the resistor but since the parts were in sockets, I chose to cut traces and add the resistor on the rear. All cuts are on the front of the PCB. Cut the trace to cathode of D2, to cathode of D7, right side (towards center) of R43, right side (towards center) of R109. On the rear of PCB2 add wires to connect the cathode of D2 to the left side (towards center) of R43, and the cathode of D7 to the left side (towards center) of R109 (the *left* side because you are working on the rear of the PCB).. Then add 47K resistor from the left side (towards center) of R43 to pin 1 of IC7, and the left side (towards center) of R109 to pin 1 of IC14.

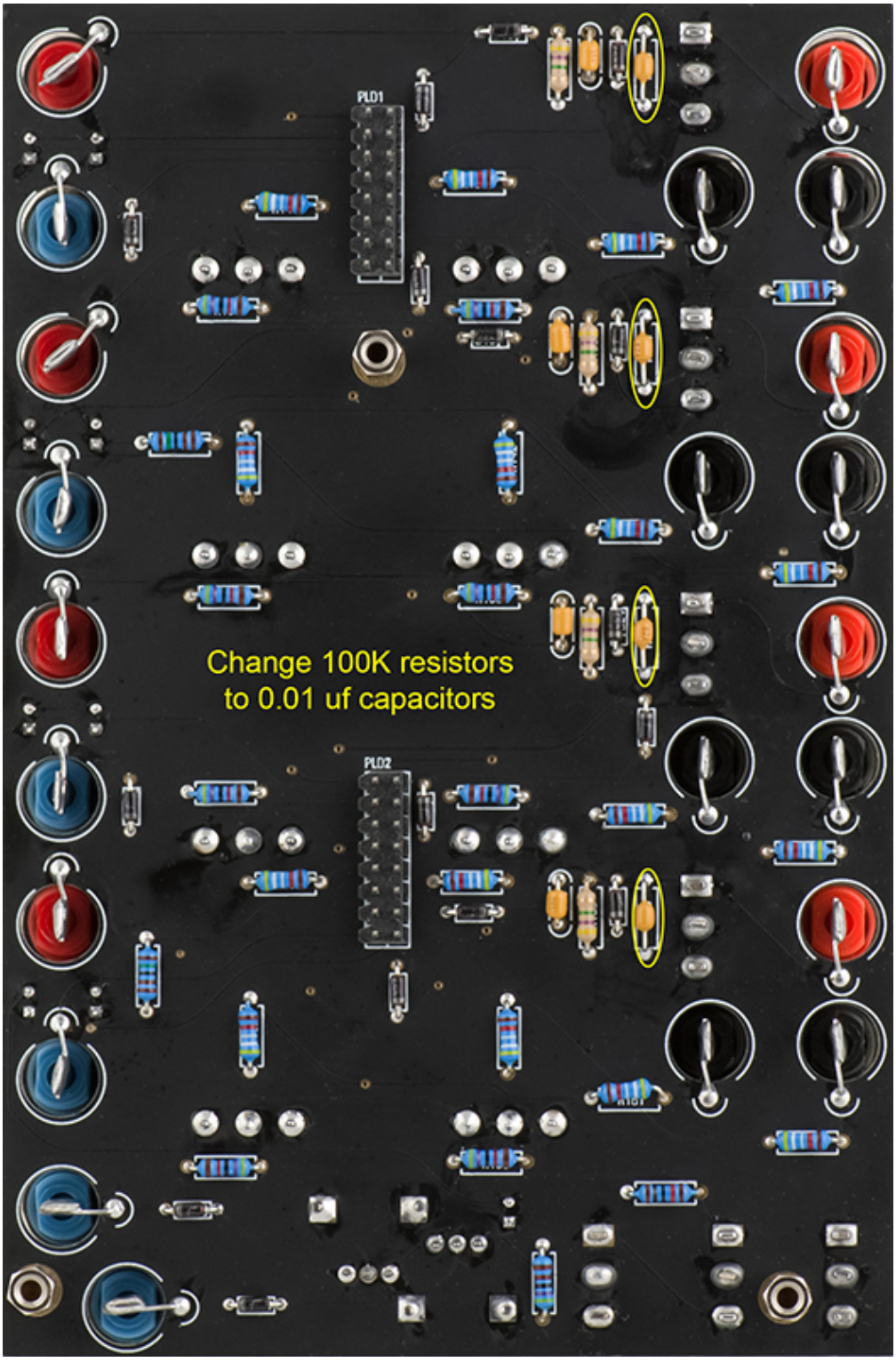


There are four op-amp inputs that are driven by diodes so they float when the diode is cutoff and noise will affect the outputs. Simply add four pulldown resistors to ground. Add 100K resistors to ground to IC6 pin 3, IC6 pin 5, IC12 pin 3, and IC12 pin 5. Nearby decoupling capacitors provide ground pads.



On this version I could not get the Transient vs. Sustain to work at all regardless of the trigger levels. While the input is true the RS flip-flop is held in the Attack state so it sustains until the input goes false. I assumed the circuit was designed for the "stepped" Buchla trigger-gate but the comparator level is set at 0.7V. When the switch bypasses the 100K, the level does change, but it is always greater than 0.7V. I tried changing the threshold but could not get the circuit to operate properly at all. I simply changed the input 100K resistors to

capacitors to provide a narrow trigger in transient mode and the full width in sustain mode. Change R146, R148, R163 and R165 to 0.01 µF capacitors.



Transient mode is shown in this scope image.

This scope image shows the sustain mode where the attack is held at 10V until the input goes false.

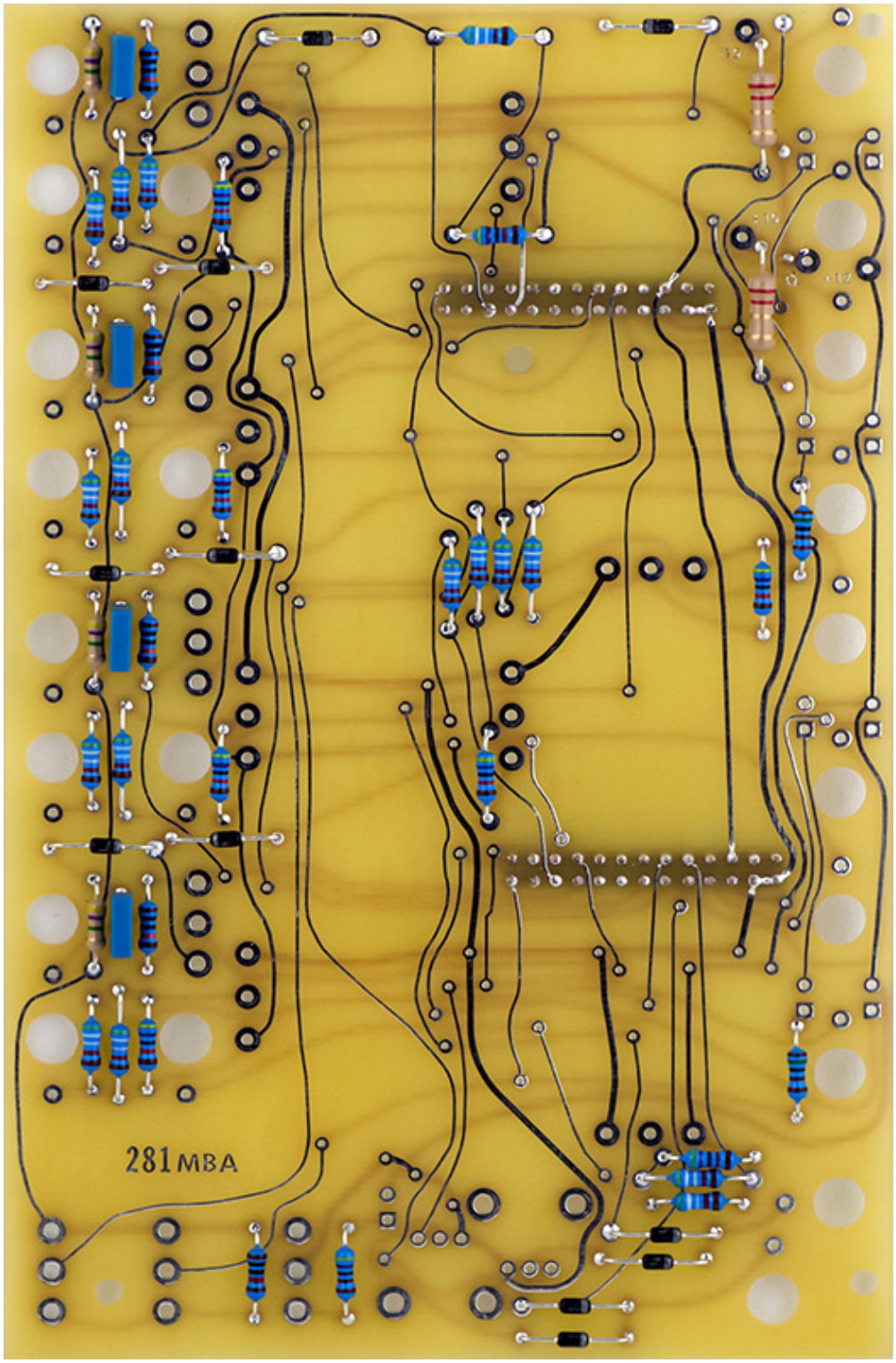
Additional V3 Modifications

I've been sent a couple of modules that wouldn't cycle continuously. They might cycle for seconds or minutes but eventually would stop.. What was strange is that different AC/DC adapters would work or wouldn't work. The LM317L has a different voltage differential specification than the LM317. The "L" version requires 2.5V of headroom which cannot be met using the +12V supply. I lifted the input leg of IC15 and wired it over to a +15V decoupling capacitor and the module cycled correctly.

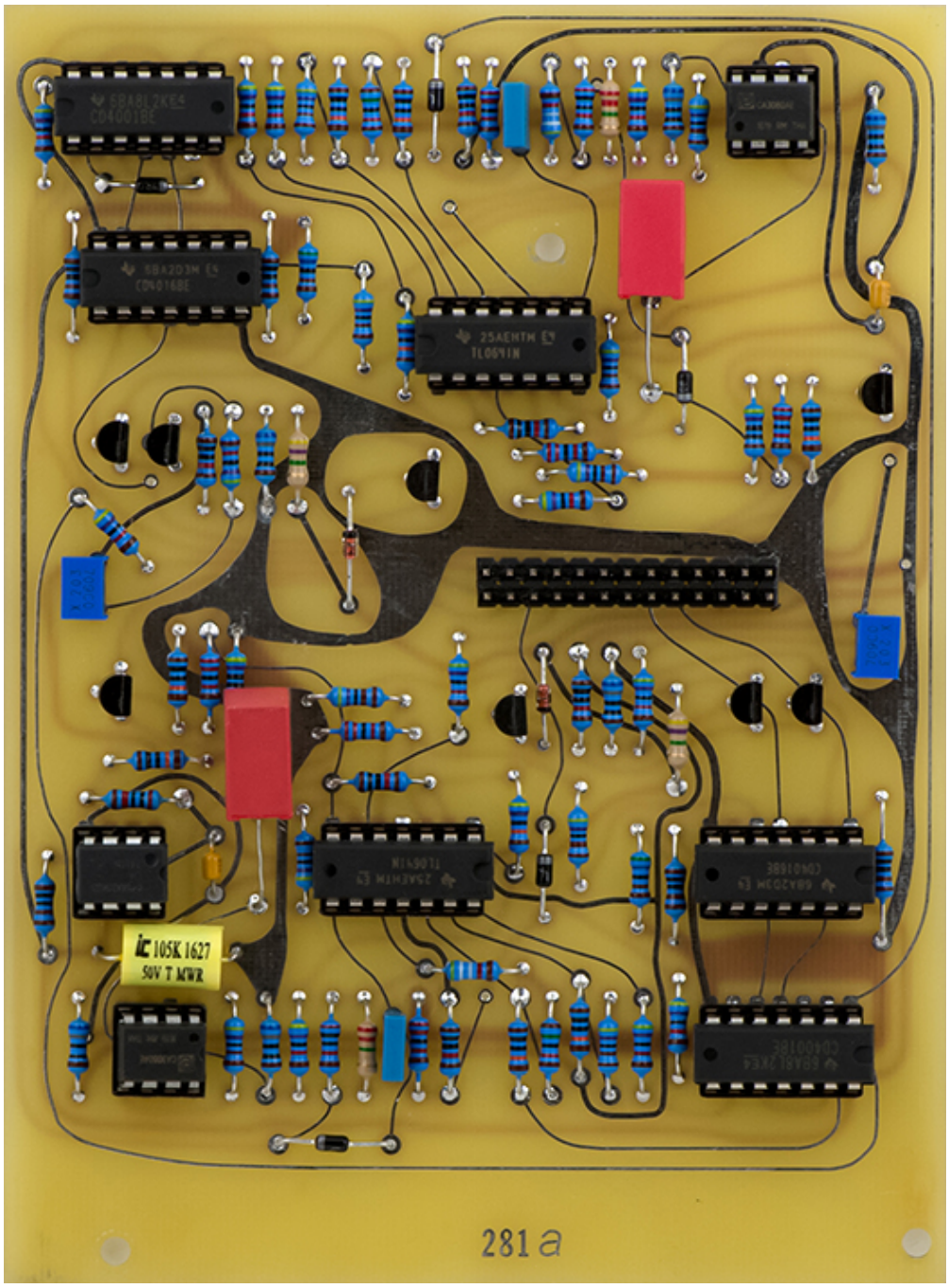
There is also an issue with continuous cycling if the pulse output is patched back to the trigger input. The pulse output has a diode in series so it can drive the signal high but requires a load to return to ground. With my modifications the trigger input connects directly to the 0.01 capacitor so there is no DC path to ground at the jack to discharge the capacitor. When you loop the pulse output back to the trigger input the capacitor is not discharged between cycles. You can add a 100K resistor from the trigger input jack to ground to correct this.

Vintage Version PCBs

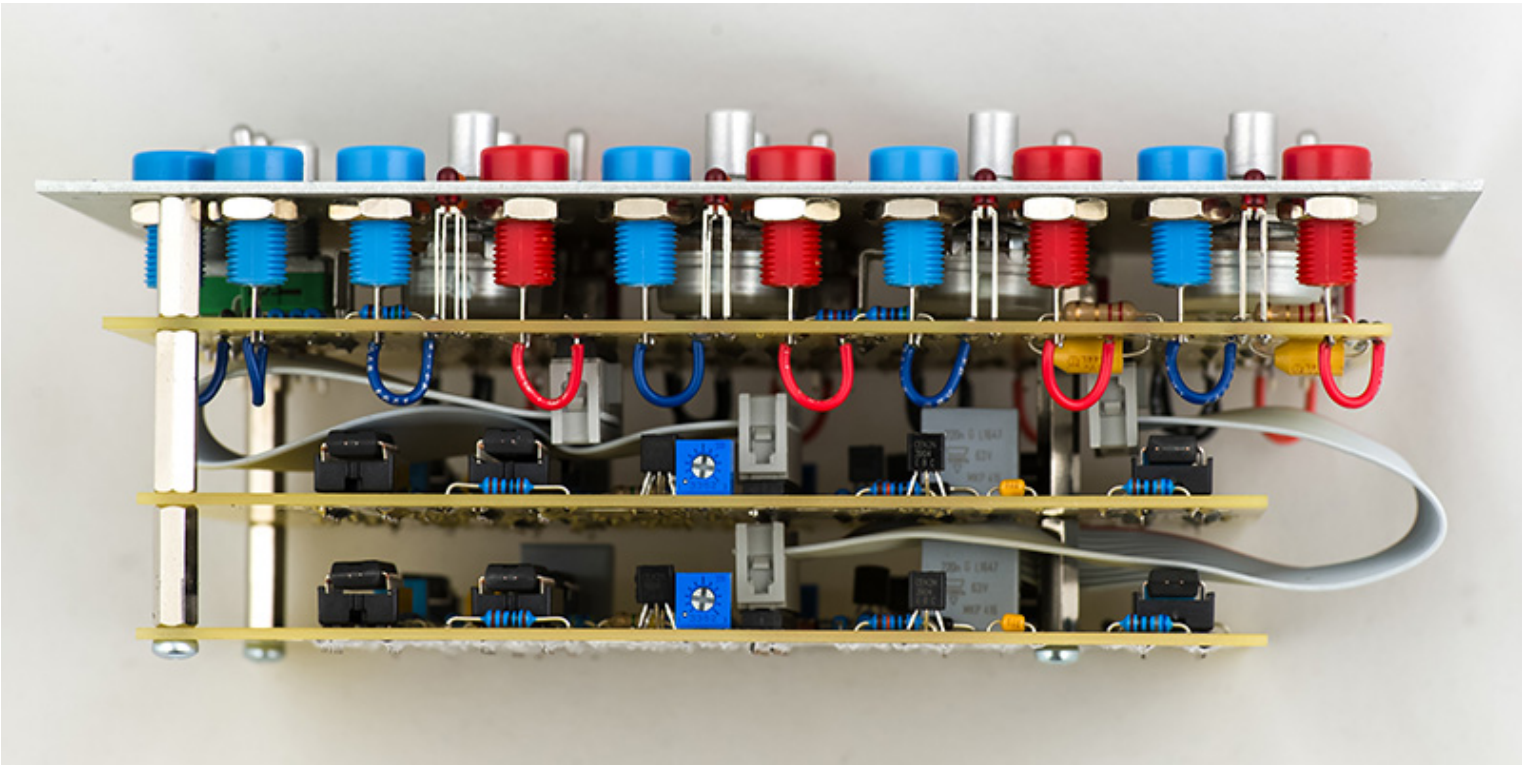
There is a hand routed version of the PCBs that is built the same as V2. It took me a while to find the reference diagrams for these PCBs which are important because there is no silk screen. I soldered the two tantalum capacitors on the rear of the PCB for additional clearance.

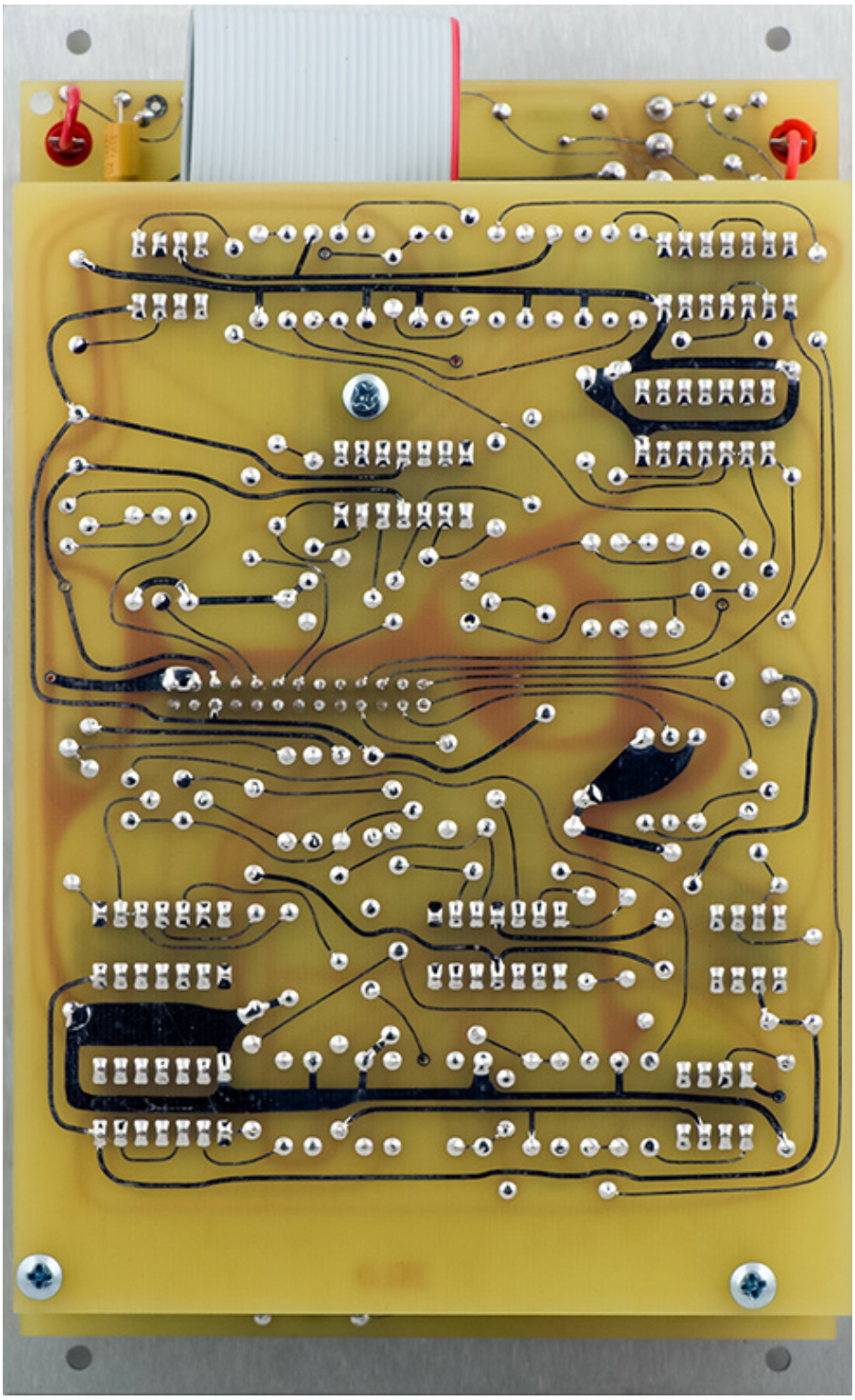


Transistor Q6 is rotated 180° on PCB2/ 3 from V2 and the 220nF capacitors (large red) and 1µF capacitor (yellow axial) on PCB2 and 3 also have wider lead spacing so I used different parts from the V2 BOM.



The 20mm standoffs are a bit tight when sockets are used as the flat cable header overlaps the IC in the socket.





Vintage Version Operation

I had a heck of a time getting this version to operate. The design is very susceptible to leakage on the PCB so it has to be very clean. I had to try different timing capacitors to find ones that would work reliably. I ended up using Wima film capacitors and had to change three of them to 1 µF to get the full 10 seconds. It is strange that

the fourth channel would reach the 10 seconds with the 220nF timing capacitor. I had to mount the radial capacitors on their side because of their height. One channel it would stop functioning if the Attack was set to maximum and reducing R9 from 1K to 910R to correct this.

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