At the Repair Bench – MFJ-407D Keyer – October 2024

Last month, I wrote about an Astron power supply unit that had come in for repair. The ham who owns the Astron brought an MFJ-407D Electronic Keyer (Figure 1) to me at the same time, with the complaint that the keyer had no keying output.

Figure 1 - MFJ-407D Electronic Keyer

The customer suspected the output transistor, which did in fact turn out to have been in a failed condition. However, what the customer did not suspect is why the transistor had failed, nor were intermittent operation and power drop-outs mentioned at all. These two last conditions were conditions that I noted during test and repair operations. Of course, the unit would not be repaired until those problems were cured as well.

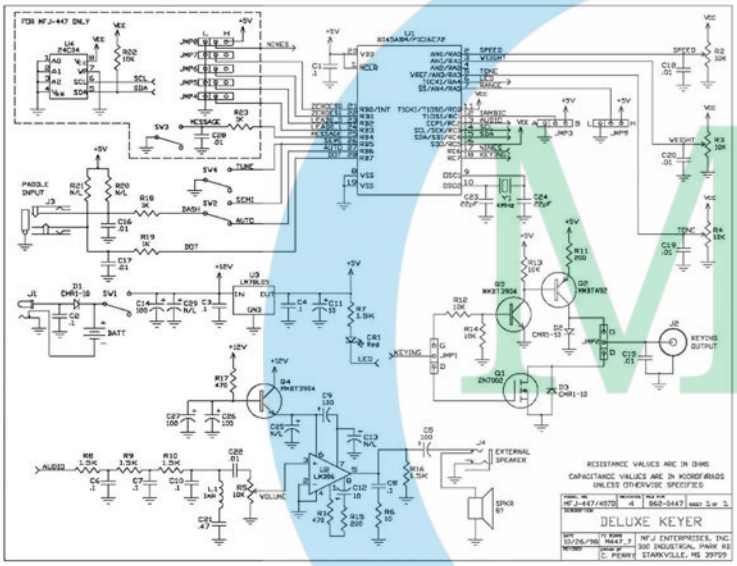

Figure 2 - MFJ-407D schematic diagram

Replacement of the failed output transistor, Q1 in the schematic (Figure 2), an enhancement-mode MOSFET, was straight-forward. The transistor in question is a 2N7002 surface-mount device in an SOT-23-3 package. This transistor is one of the few components in the direct output path for the keyer. There is a selectable parallel path designed for use in grid-block or tube-type systems rather than in solid-state systems. The grid-block path has considerably more components, but they are all moot because this keyer was configured for use in the ***Direct*** mode of operation.

Selection of the output mode is made through a pair of three-pin headers with a shunt cap on each header (Figure 4). Selection of the ***Direct*** mode requires placement of both shunt caps on the center and ***D*** pins of each of the respective pin headers. It is at these pin headers that the problem arose which apparently led to the failure of the 2N7002 transistor. Specifically, the problem was on the foil side of the PCB, where the pin headers are soldered through the board.

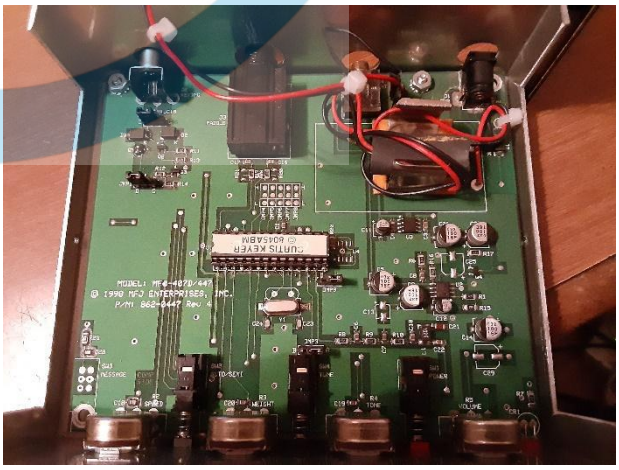

Figure 3 - MFJ-407D interior view

A short-circuit path had been formed at each of the pin headers between the D pin and the ground plane. The green corrosion formed there was conductive and led to a condition wherein both the gate and the drain of the MOSFET were shorted to ground. It is unclear exactly what the failure mechanism of the MOSFET was, but there is no doubt that it showed itself to be failed

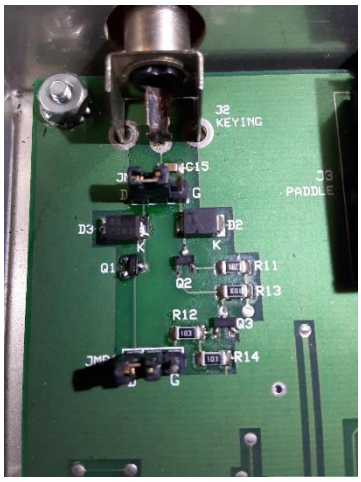

Figure 4 - Output component area

when the transistor was tested under both in-circuit and out of circuit conditions. The corrosion was completely removed from the board and the cleaned areas were sealed with clear enamel.

I set out next to cure the intermittent problems that this unit exhibited. I noted that I could affect the intermittency by putting pressure on the board in various spots, which led me to look closely at all of the solder joints on the board. As this is largely a surface-mount construction, most of these joints were on the component side of the board. Ultimately, I found and repaired cold solder joints at the IC socket pin rows for the microcontroller (µC or µController), a PIC16C72 device (Figure 5). Reflowing the joints along this IC socket cured the intermittency problems that had existed. As it turned out, one of the indications of power drop-out that I mentioned earlier was the fact that the front panel LED would intermittently go out. It happens that the LED ground is made through the µC, and that the LED's behavior was part of the larger cold solder joint intermittency issue.

Figure 5 - µController area of PCB

Although I do whatever I can to keep my repair pricing reasonable and affordable to most hams, this particular customer made the statement that I was too expensive and I could no longer be afforded. While I know that I keep the costs as low as I can, I have to admit that sometimes, repairing a unit is not economically feasible. Take this repair as an example. The repair bill for this job came in at about $120. A brand new MFJ-407E is available for about ten dollars more, plus tax and shipping. It is very easy to have a repair cost more than a replacement, as parts prices are higher than ever before, without even considering any labor costs. Of course, with MFJ now having gone defunct, that keyer option is no longer available.

This repair was interesting, and locating the intermittent was a challenge that was necessary for a complete repair. I hope that this keyer lasts a good long while and that the customer gets a lot of future use out of it.

See you next month!

