# Fixing The Sparkfun Pro Micro Design Defect, Version 1.0

By R. G. Sparber

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Don't get me wrong, Sparkfun's 5 volt, 16 MHz Pro Micro[2] is a terrific product. I use them in almost every one of my Arduino compatible applications. Most of the time, I have a simple system with just one Pro Micro and a few external parts. But once in a while it can get a bit more complicated. This is where I often run into the Pro Micro's design defect.
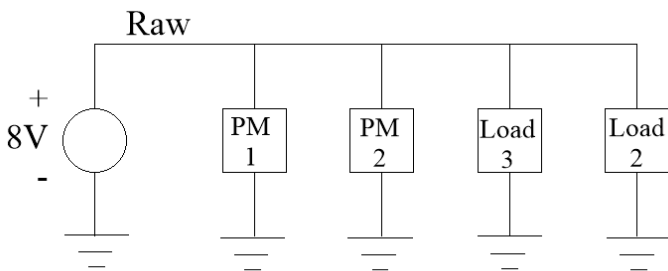

Consider this system. I have an 8V power source that feeds two Pro Micros plus two other loads. Works fine. Well, until I want to program one of the Pro Micros.
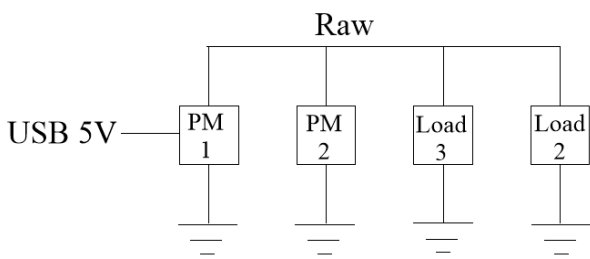
I plug a USB cable into the first Pro Micro. Funny things start to happen with the second Pro Micro and the two loads. They sort of turn on but not fully. I might even find that the first Pro Micro is not acting correctly. It may not be getting a supply voltage above the minimum limit. What is going on?

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[2] https://www.sparkfun.com/products/12640
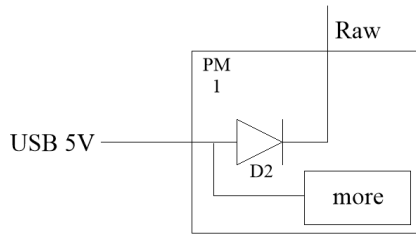
Look inside a 5V/16 MHz Pro Micro and you will find this diode, D2. When you plug in a USB cable, 5 volts from the cable is applied to the anode of this diode. The cathode connects to the Raw input but now Raw is an output.

Here is part of the full schematic which can be found at
https://cdn.sparkfun.com/datasheets/Dev/Arduino/Boards/Pro_Micro_v13b.pdf
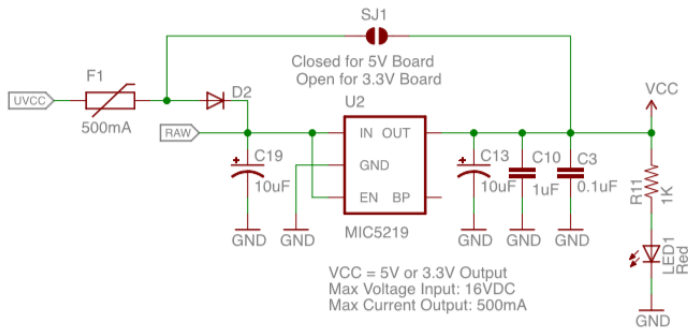
UVCC is the voltage from the USB. Since this is a 5V board, jumper SJ1 is closed. This lets us power the board directly from the USB[3].

Given that I am using 5V Pro Micros, 5V from the USB cannot power the 5 volt regulator[4]. Yes, it is vital that RAW not back power the USB, but this can be accomplished by not having D2 installed in the first place.

With D2 not in the circuit, I still power the board via the USB and can also power the voltage regulator from RAW. So nothing is gained (by the user[5]) when D2 is present.

The challenge is – how do I remove D2 without special tools?

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[3] Had it been a 3.3V board, the jumper is left open. Then current from UVCC passes through diode D2 and into the RAW node. This node powers our voltage regulator to generate 3.3V for our Vcc. Now, if a voltage greater than about 4.3V is present at RAW, diode D2 will turn off. This is essential in order to prevent back powering the USB.

[4] The input voltage must be larger than the output voltage for this kind of voltage regulator.

[5] I suspect that there is a manufacturing advantage to leaving D2 in place for the 5V Pro Micro. Sparkfun can have one program for placing components on the board. If they want a 3.3V Pro Micro, they load one version of voltage regulator and do not solder across SJ1. If they want a 5V Pro Micro, they load a different version of voltage regulator and do solder across SJ1. The savings in having one program is far more than the cost of diode D2.
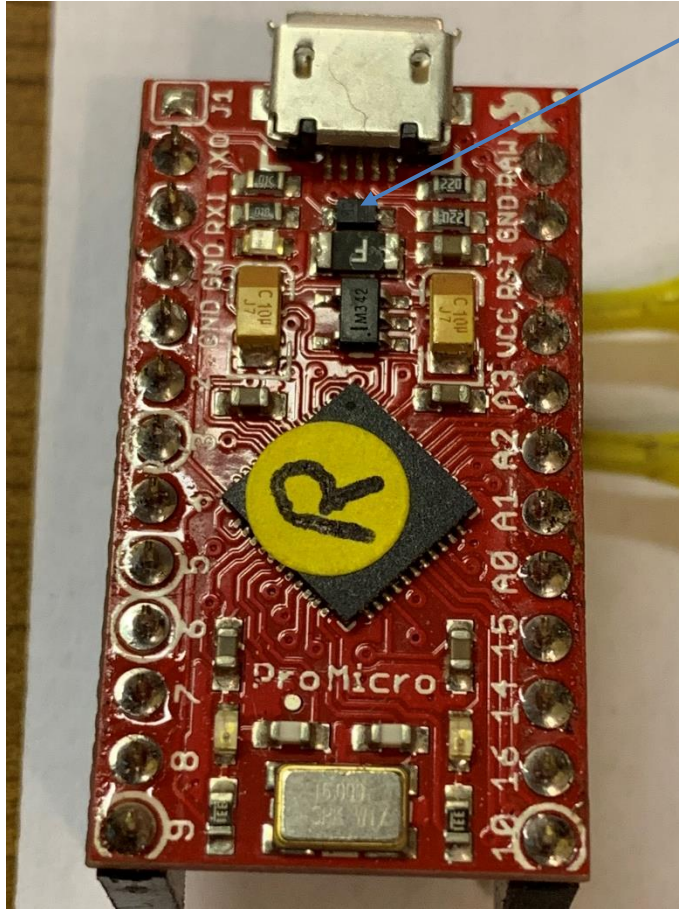
First, let's look at the culprit. As with most surface mount components, it is crazy small. Given a steady enough hand and a fine enough point on my soldering iron, I might be able to de-solder it.
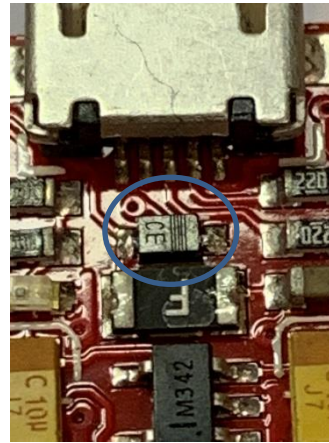
Thankfully, there is an easier way.

You will need a power supply able to source up to 2 amps[6] at about 2 volts. It should not put out more current. Alternately, you can use a 3.7V battery plus a power resistor. The resistor must be around 1.5 ohms and have a power rating of at least 10 watts. You will also need a wooden toothpick.

The trick is that we are going to let the diode un-solder itself.

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[6] We must limit the current to prevent damage to those tiny conductors on the board.
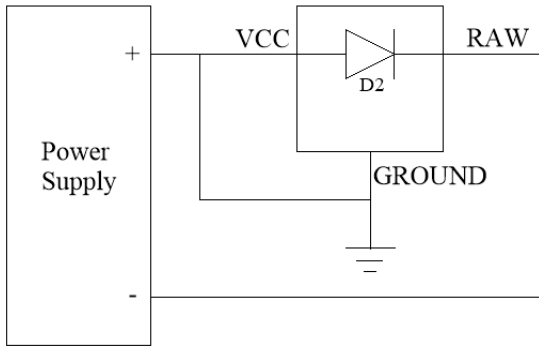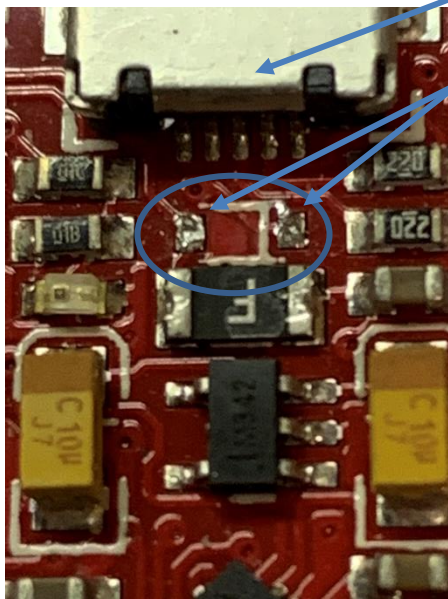
If you are using a power supply that will limit the current to under 2 amps, connect the positive lead to the Vcc pin on the Pro Micro. Also connect a ground pin on the Pro Micro to Vcc[7]. The negative lead connects to the pin marked RAW.
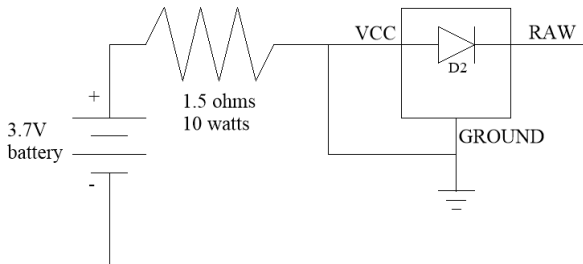
If you are using a 3.7V battery and a 1.5 ohm resistor, connect the positive lead of the battery to one end of the resistor. Connect the other end of the resistor to both Vcc and ground pins. Connect the negative lead of the battery to RAW.

Once connected, current will flow through the diode and it will start to get hot. After about 30 seconds you will be able to push the diode towards the USB connector with the toothpick. The instant you push either end of the diode off of its contacts, current will stop flowing and the solder will start to cool. It is likely that one end of the diode will remain soldered while the other end is free. You can leave it this way or pry it up with the toothpick to remove it.

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[7] This will protect the voltage regulator from seeing a negative voltage.

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