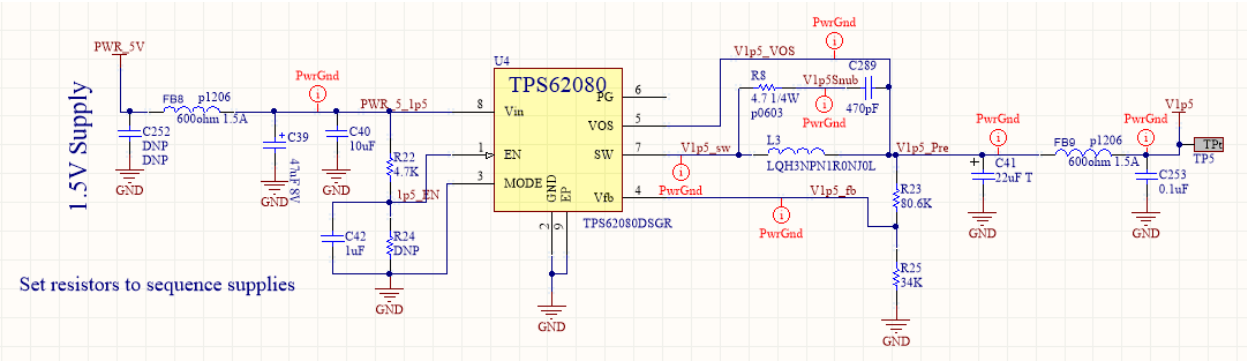
Debug Notes for REX200C 1.5V supply

May 16, 2017

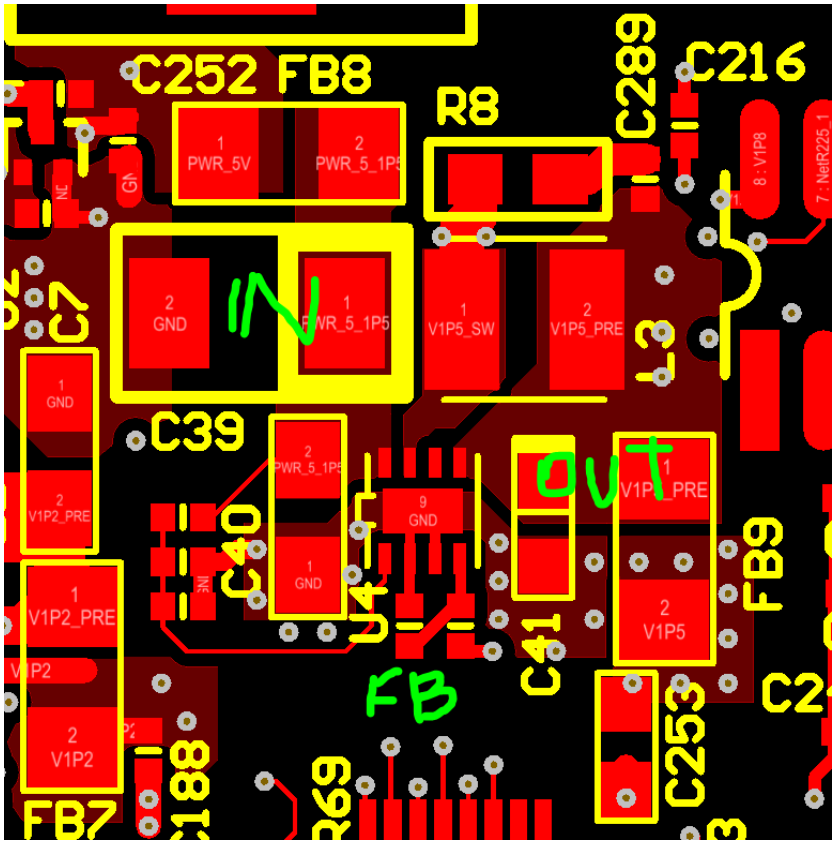
Vivek Sikri

The 1.5V supply on the REX200C is made with a TPS62080 switcher at its core. When powered on some of the boards measure 2.5-3V on what is supposed to be the 1.5V supply rail. As a result the DDR memory and other components on this rail get very hot. So far there has been no damaged parts but this is likely to happen.



The ferrite beads FB8 and FB9 are Digikey 1276-6364-1-ND. Output capacitor is Digikey 718-1718-1-ND

Here is a screen capture showing the layout for the supply.



There is about 50uF of capacitance on the rail that is not shown in the above schematic. The power is used by a DDR memory running at about 500MHz and its associated processor's DDR interface.

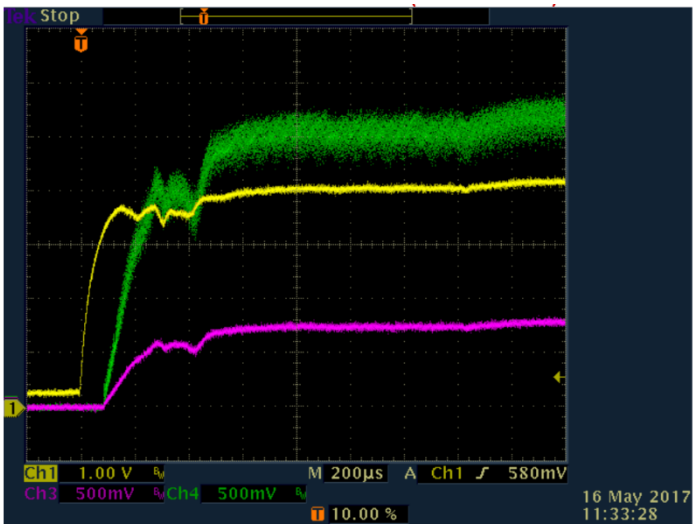
Here is a screenshot of the startup of the supply:

Ch 1 = Input voltage, normally 5V but only goes to 4V as it is current limiting upstream. Note the vertical axis is set to 1V/div for this and 0.5V/div for the rest.

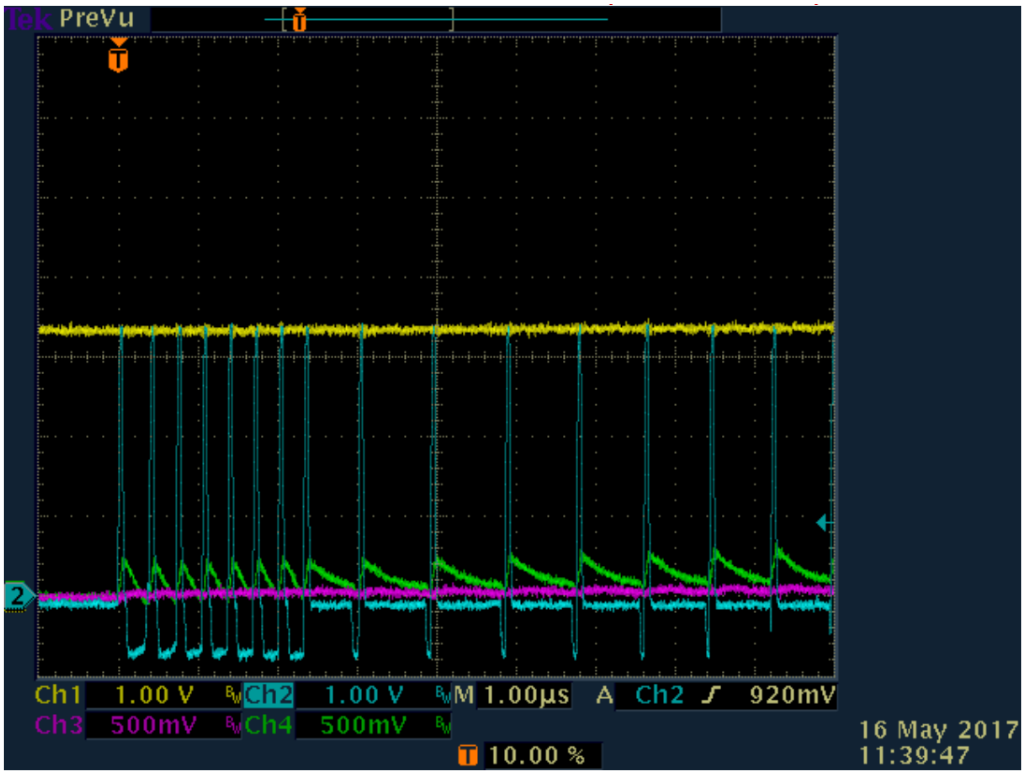
Ch 2 = switching node but not shown in this screenshot as the horizontal scale is very different from the others. A separate image will be captured.

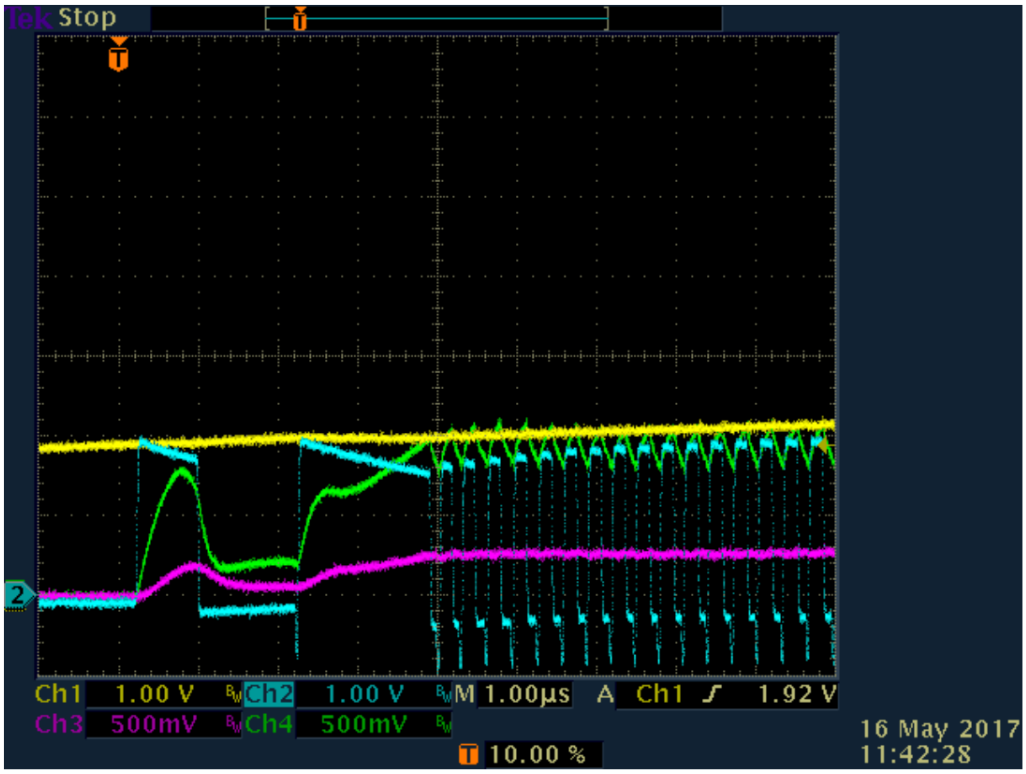
Ch 3 = Feedback voltage. This should settle at 0.45V but is significantly higher than that.

Ch 4 = Output voltage, this should be 1.5V but is more like 2.5V on this board. Also it is very noisy.

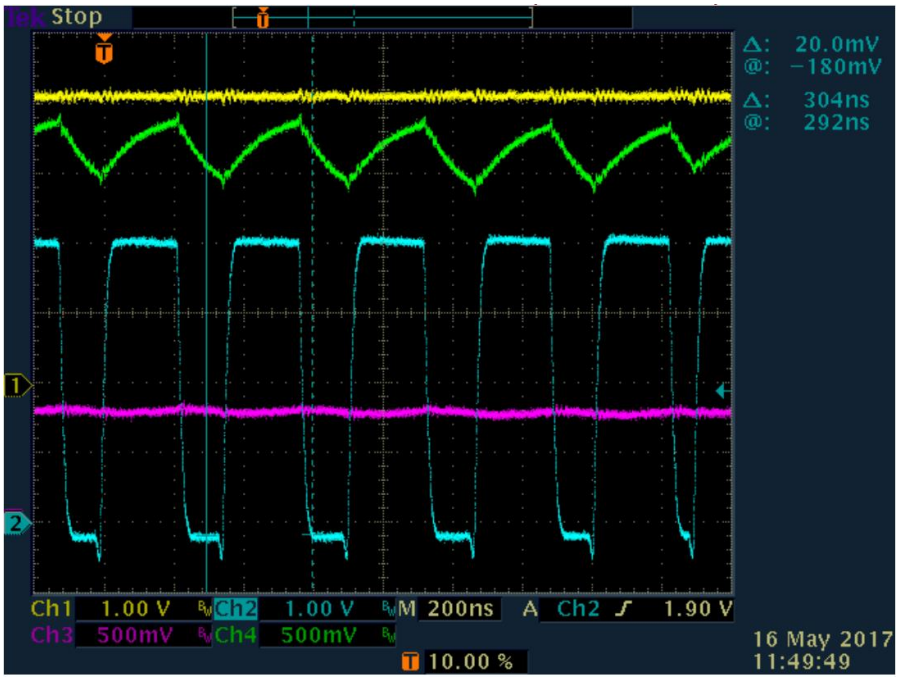


Here are several screen shots at a smaller timebase showing the switching waveform. These two are images taken at startup with various trigger settings to capture different parts of the startup sequence.

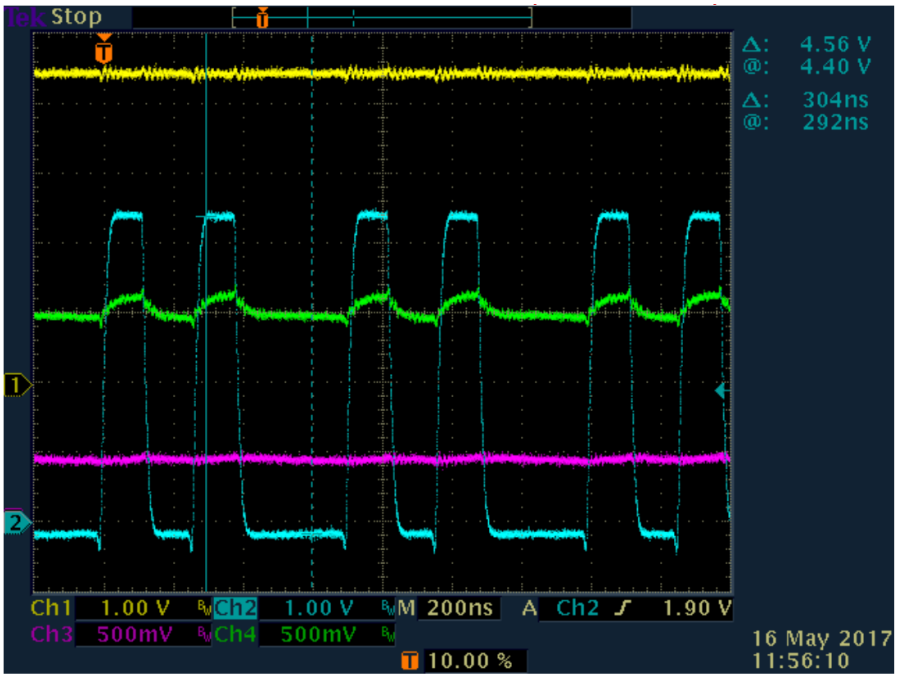




This image shows the Vin sitting at about 4V. There is a lot of noise on the output (Ch4). The feedback voltage has settled to about 800mV whereas it should be 450mV. This is after the supply has settled to steady state. The Vout is measured at the output capacitor, before the ferrite bead.



This image is with the output side ferrite bead FB9 shorted with a pair of tweezers. Note that the voltage output is at 1.5V, though still very noisy.



Since the part seems to work fine when the Ferrite bead on the output is shorted it seems that the bead is part of the problem. However even with the bead shorted there is a lot more noise on the output voltage than expected.

There is another TI E2E case that seems to be similar, but doesn't have a verified solution attached to it: http://e2e.ti.com/support/power_management/non-isolated_dcdc/f/196/t/397441?tisearch=e2e-sitesearch&keymatch=tps62080%20output%20inductance

Debug ideas to follow up on:

1. Add a 0.1uF or similar to one or the other feedback resistor to see if that helps the stability.
2. Replace or augment the tantalum output cap with a ceramic instead. The additional noise on the output could be due to ESR of the tantalum cap.
3. Replace the Ferrite bead FB9 with a 0 ohm resistor to see if that helps the noise levels vs the screenshot above where the bead is shorted with tweezers.