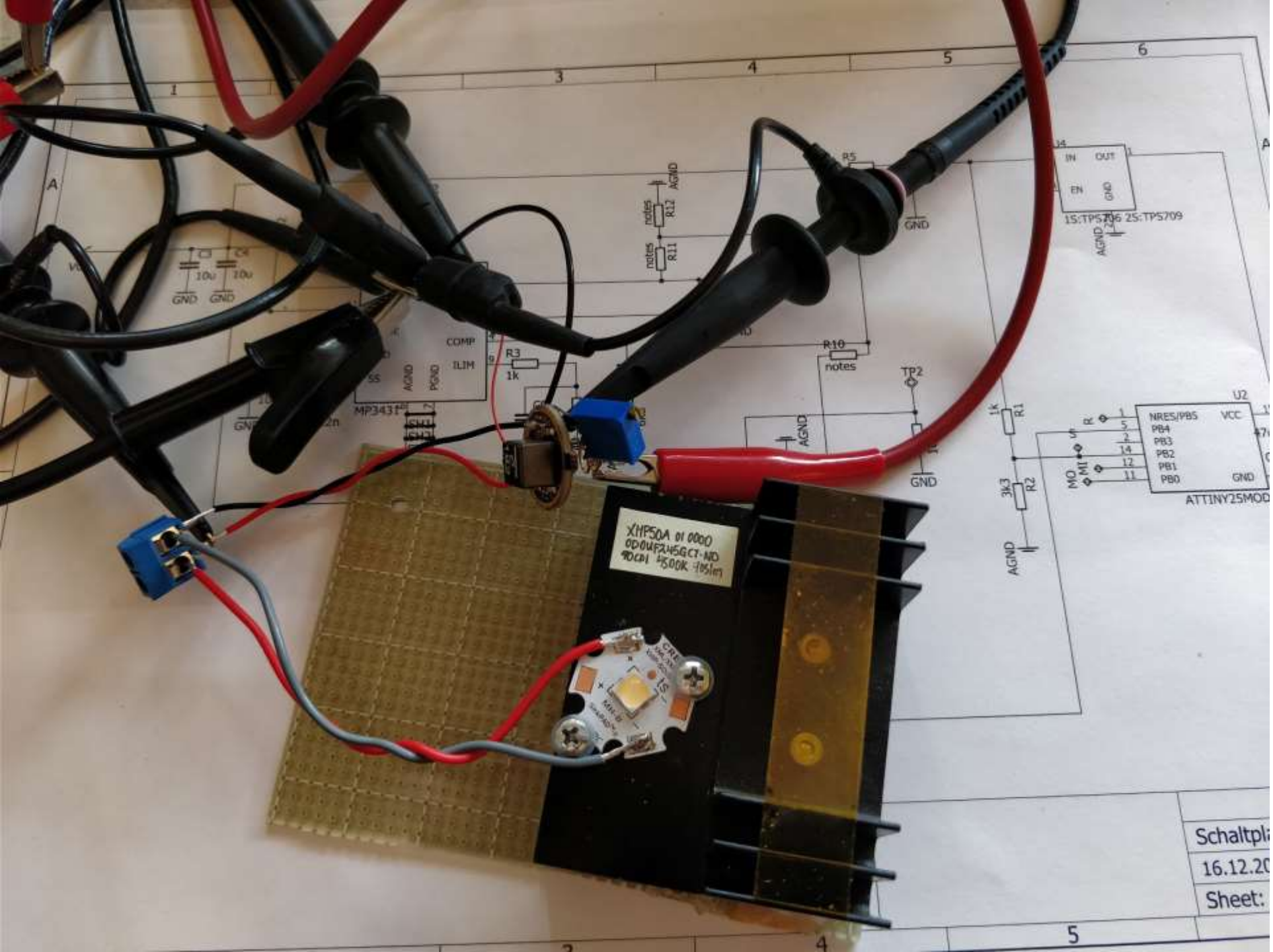
Boost Driver Debugging

Using Schoki's (v1) driver assembled by TA

13 Mar 2018



Debugging on bench

Probe colours

V_SW

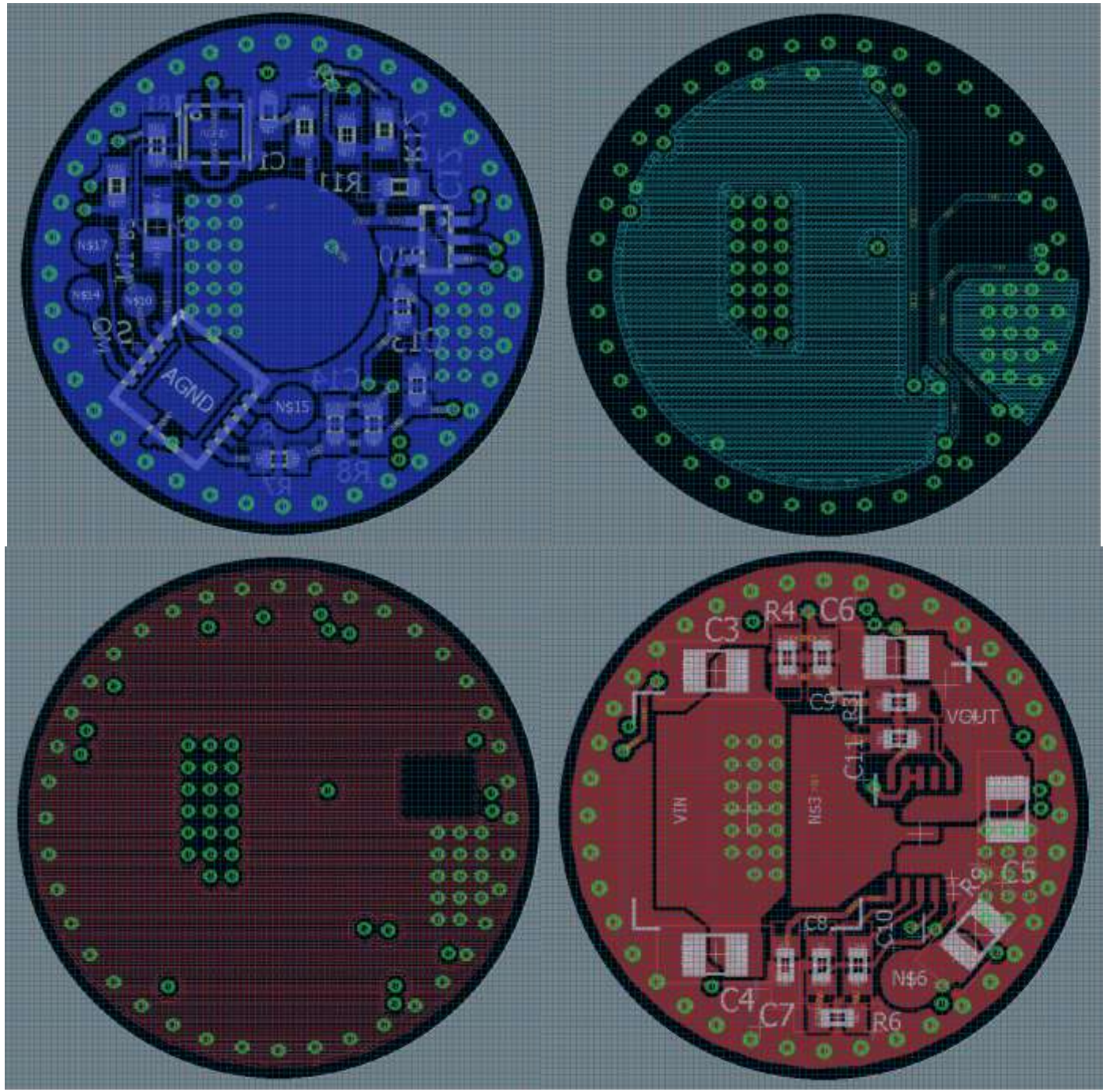
V_Out_LED

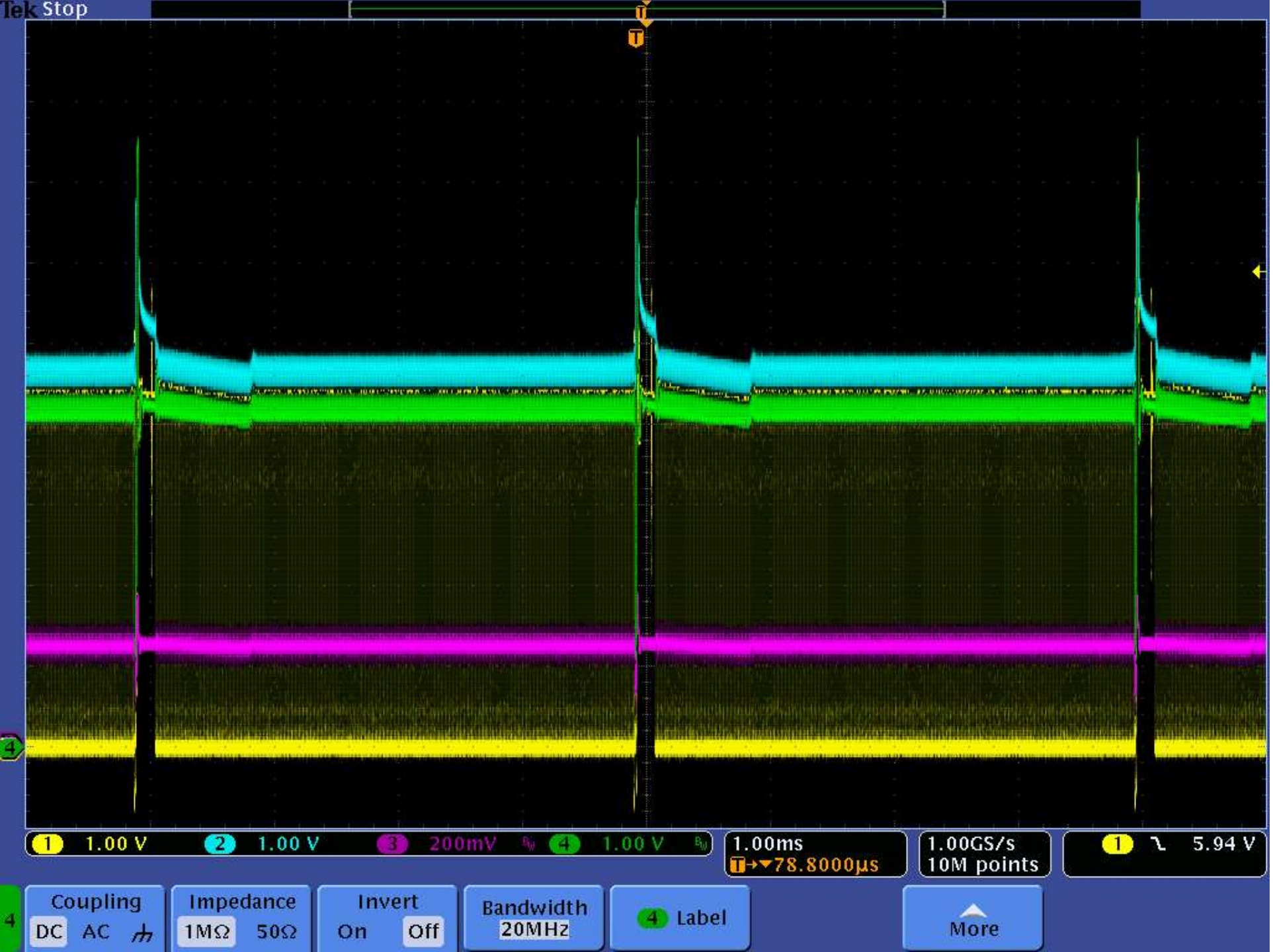
V_pot

V_Input_4.2

Board connected to a 6V XHP50A, input power is from a DC Power supply at 4.2V

Potentiometer is used to simulate the ‘current set’, sending a DC voltage into the inverting input of the OpAmp.


AGND
N$15
C3
R4
C6
C9
R3
C11
VOUT
VIN
C8
C5
C4
C7
R6
N$6



Original TA Driver

No modifications

Probe colours

V_SW

V_Out_LED

V_pot

V_Input_4.2

Low power input, notice that LED is ‘flickering’ as the MP34xx tries to generate a higher output voltage but quickly fails.

Original TA Driver

No modifications

Probe colours

V_SW

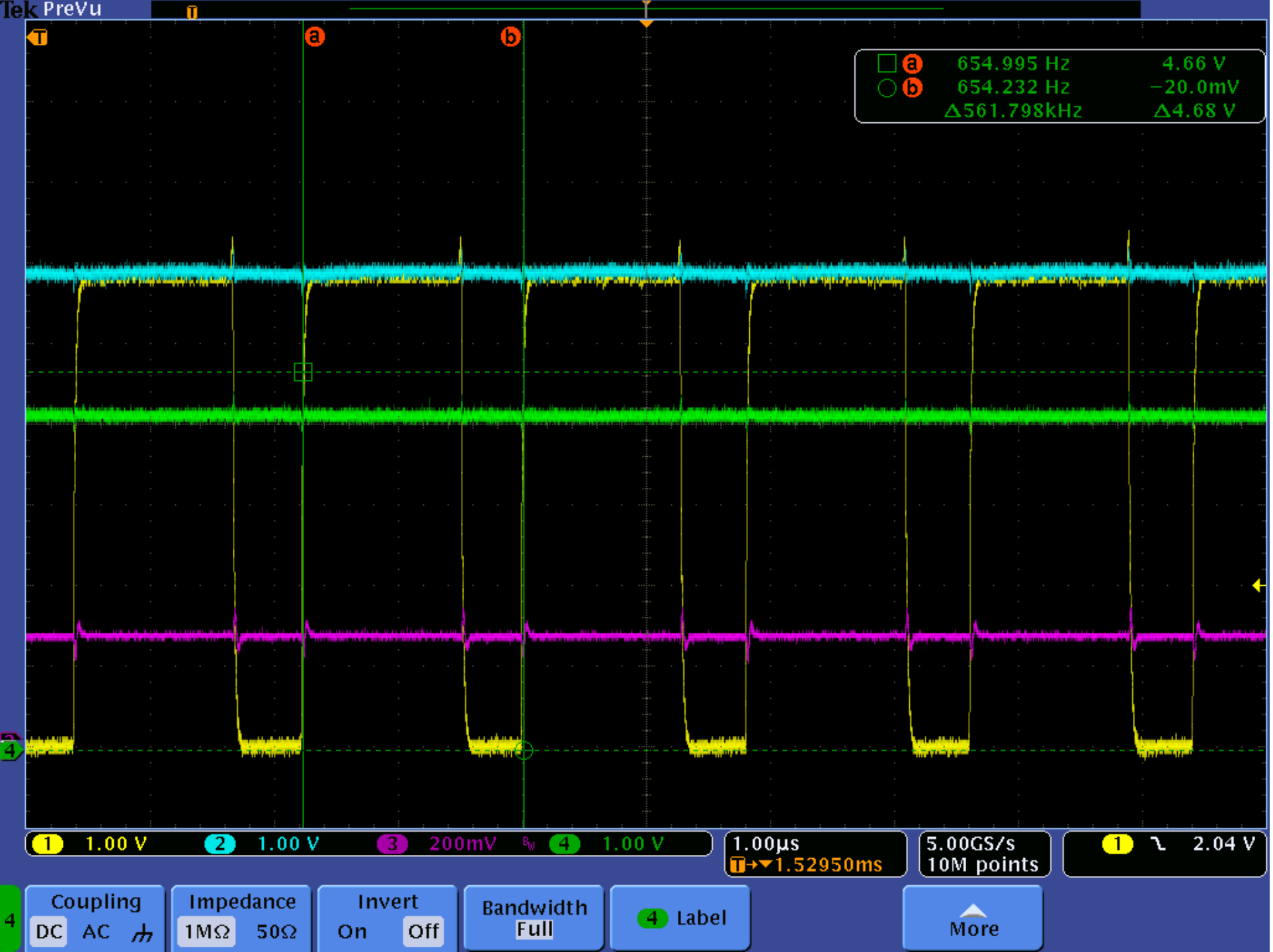
V_Out_LED

V_pot

V_Input_4.2

Zoom in from previous slide.

Note the green input voltage. When the lower switch in the MP3431 turns on for a long duration, Vin drops significantly, causing the MP3431 to turn off and restart.



Original TA Driver

Modified with extra 44uF of input capacitance

Probe colours

V_SW

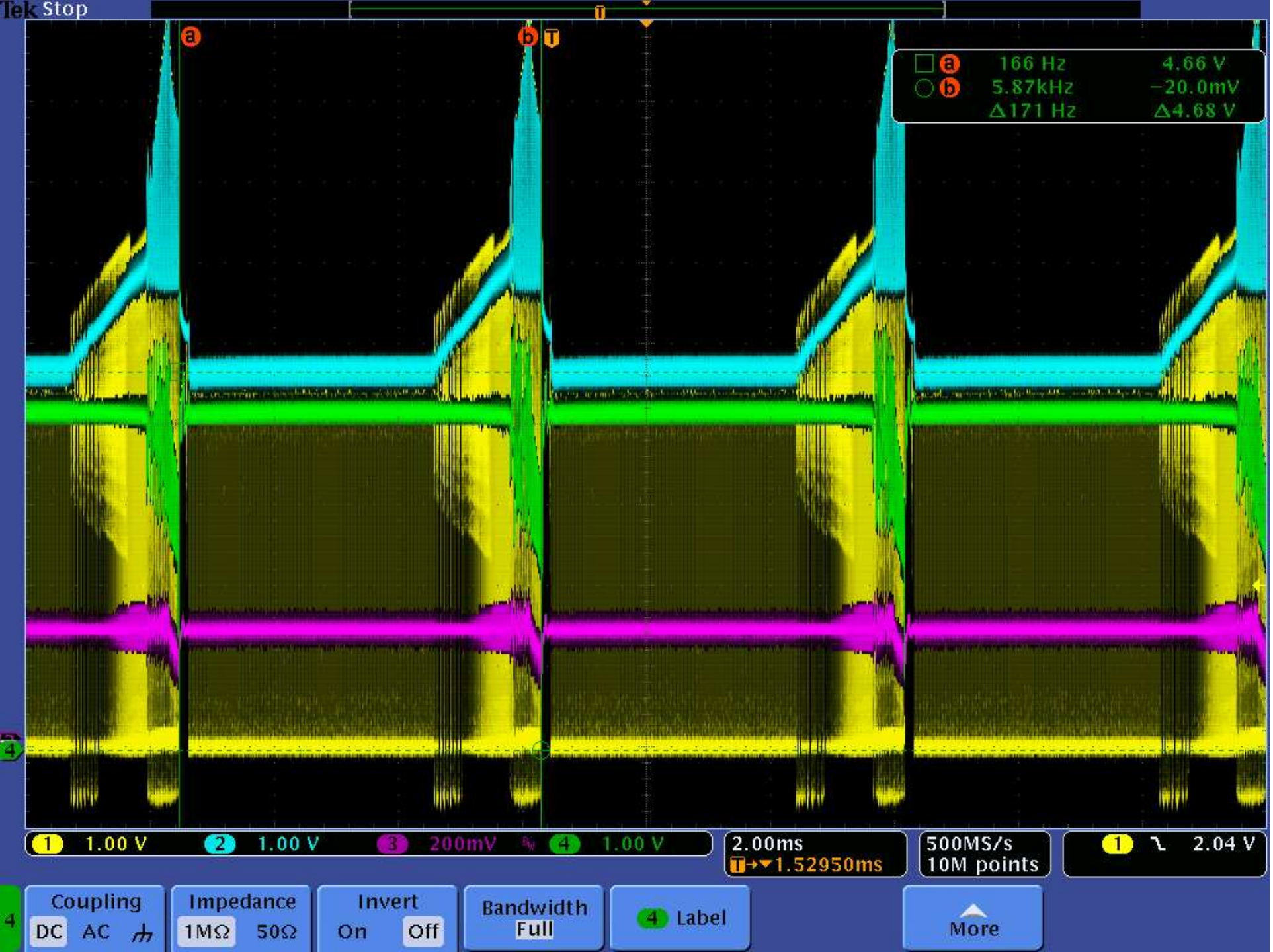
V_Out_LED

V_pot

V_Input_4.2

Now driver works pretty well up to about 1A 4.2V intput. Note the clean regulation and expected ~560kHz switching frequency.

However, a similar problem occurs when output current is turned up more.



Original TA Driver

Modified with extra 44uF of input capacitance

Probe colours

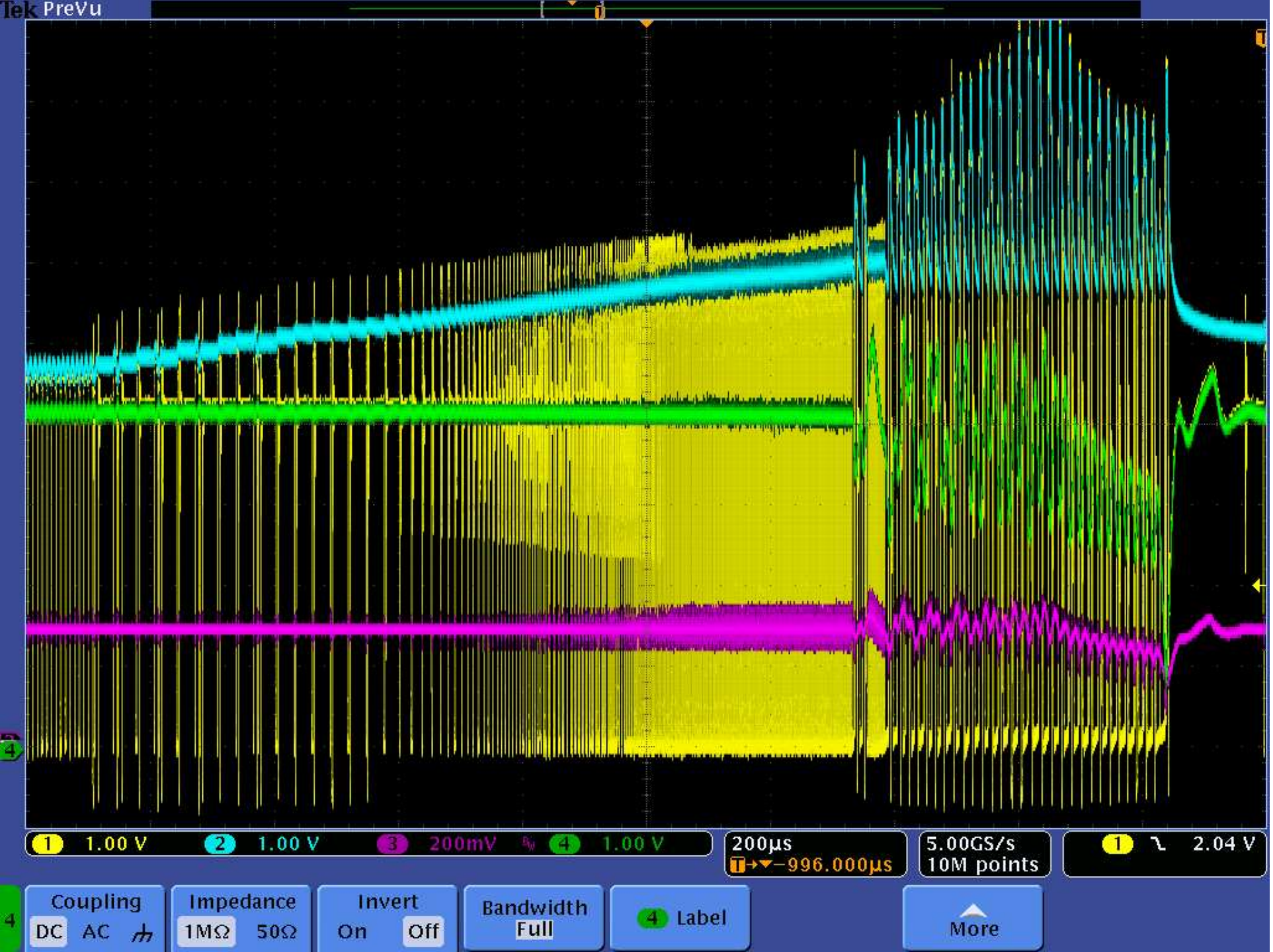
V_SW

V_Out_LED

V_pot

V_Input_4.2

In this problem configuration, LED begins flashing at ~170Hz. Let's see in more detail what's going on during each problem event.



Original TA Driver

Modified with extra 44uF of input capacitance

Probe colours

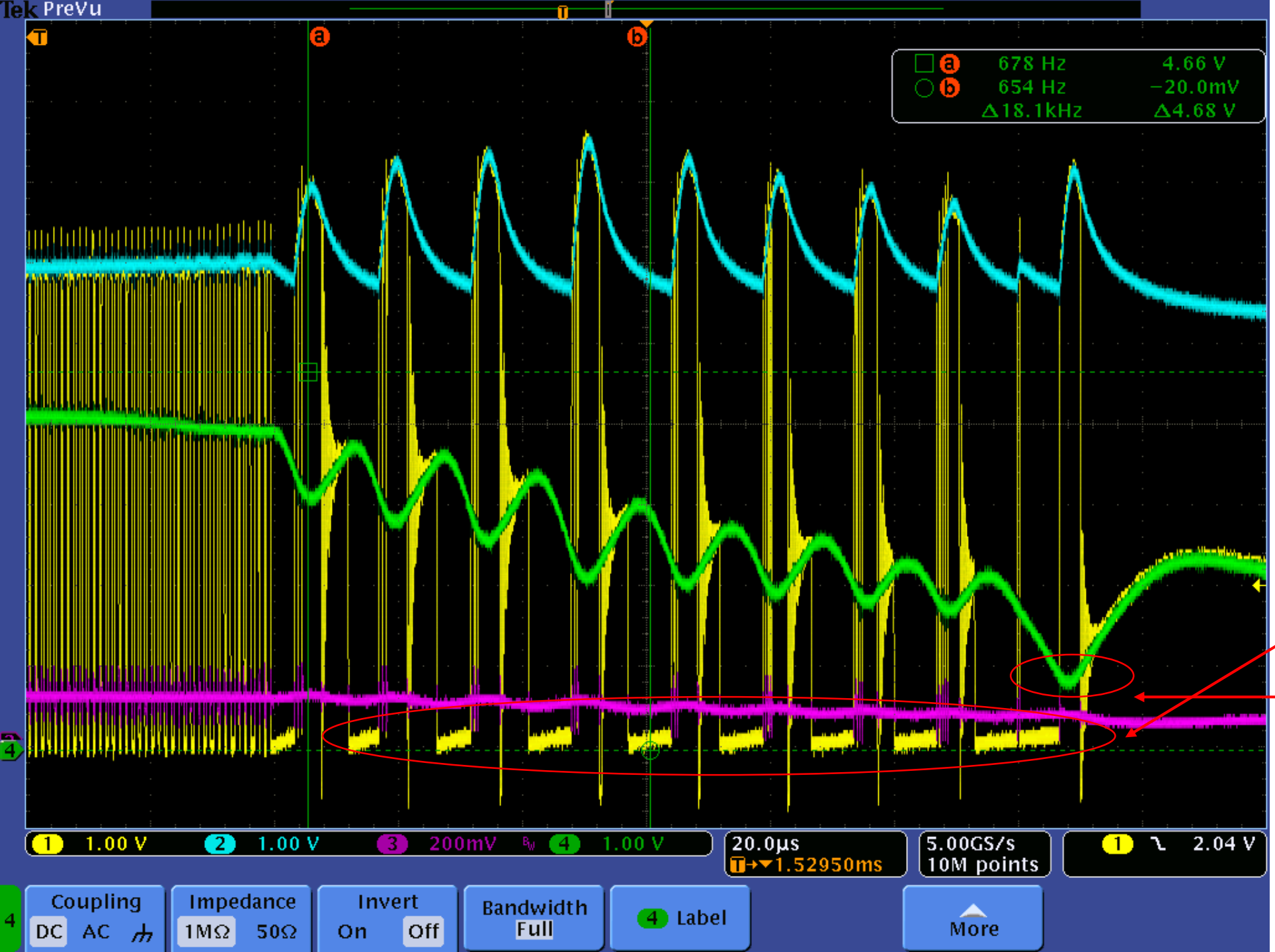
V_SW

V_Out_LED

V_pot

V_Input_4.2

Zoom in from previous chart. Note after startup phase, switching duty cycle increases based on SS, but at some point note how V_in starts to drop and messes up the switching.



Original TA Driver

Modified with extra 44uF of input capacitance

Probe colours

V_SW

V_Out_LED

V_pot

V_Input_4.2

Zoom in again from previous chart. More obvious here is how the first long-ish duty cycle starts to cause a significant voltage sag on Vin. Positive feedback exacerbates the problem until V_in is too low and the MP34xx switches off.