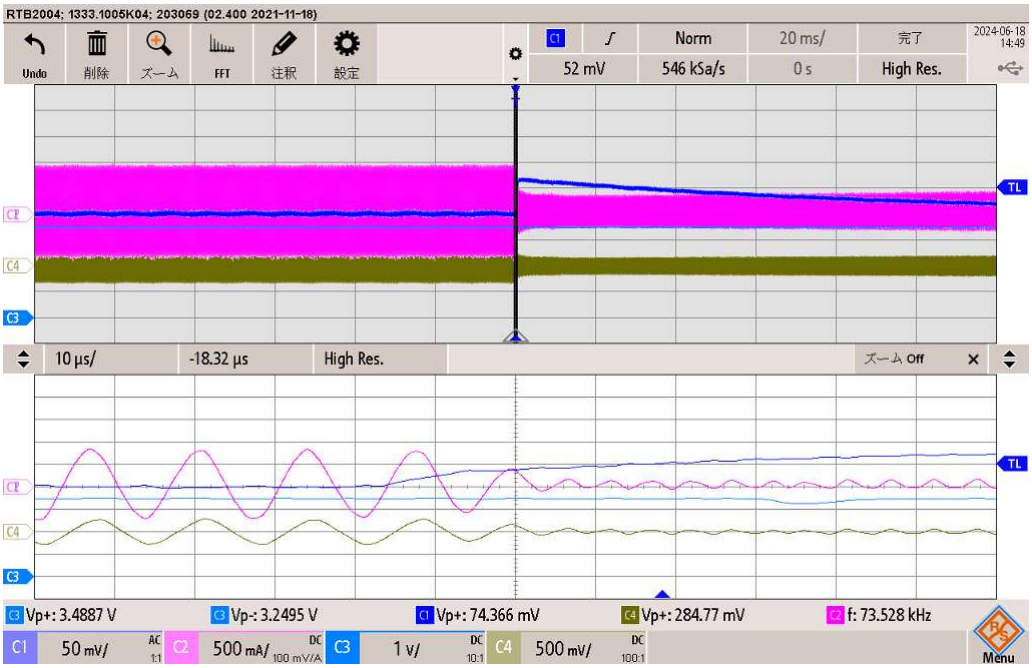
<UCC256403 5V10A output_Transient response waveform measurement during sudden load change 2>

2024.06.19

1. When the transient response is under control: Measurement conditions: Load 100% -> 0%
   (output switch ON -> OFF)

1.1_5V output (AC measurement)

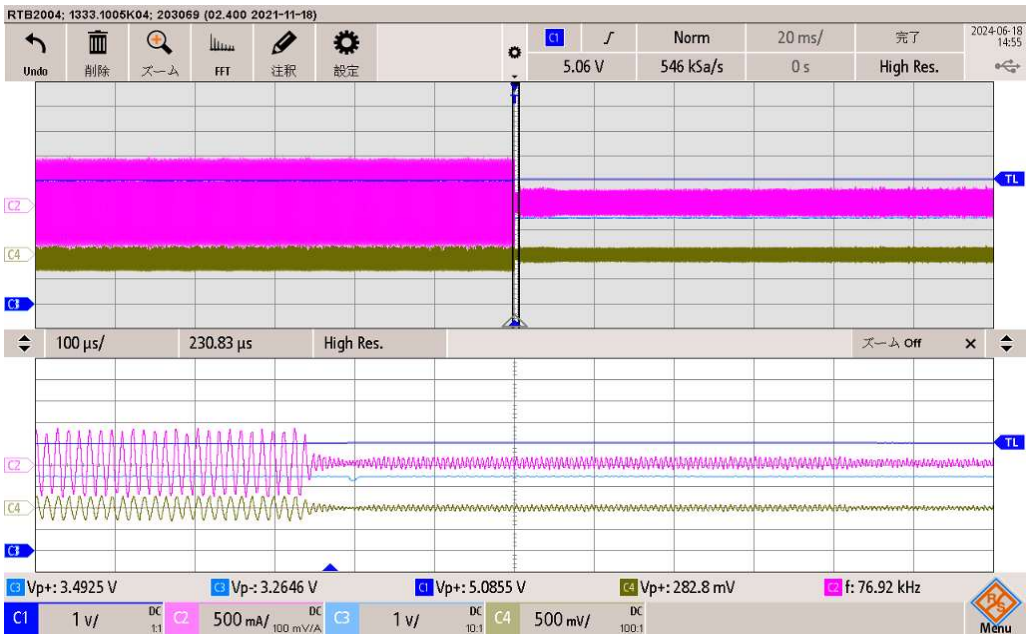


C1: 5V output voltage [AC50mV/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results):

①When there is a sudden change, an overshoot of about +80mV occurs, but it converges to a constant voltage.

1.2_5V output (DC measurement)

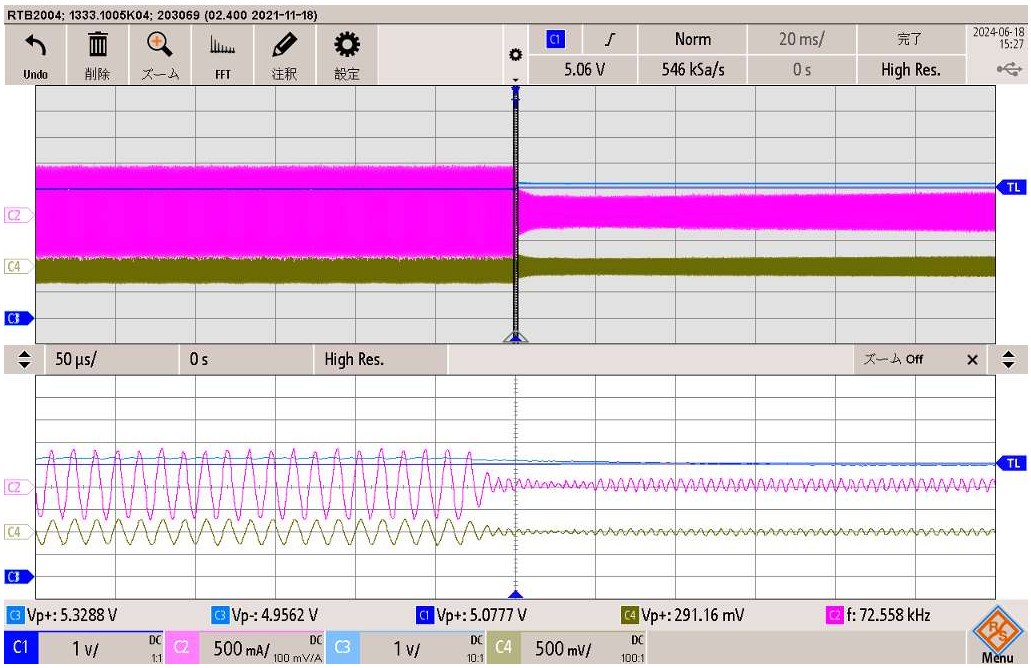


C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results):

①When there is a sudden change, an overshoot of about +80mV occurs, but it converges to a constant voltage.

1.3 _Simultaneous measurement of BW and FB terminals



C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: FB terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results):

① During a sudden change, the 5V output overshoots by approximately +80mV, but converges to a constant voltage.

② The FB terminal voltage drop remains at around 4.95V, and no extreme drop occurs.

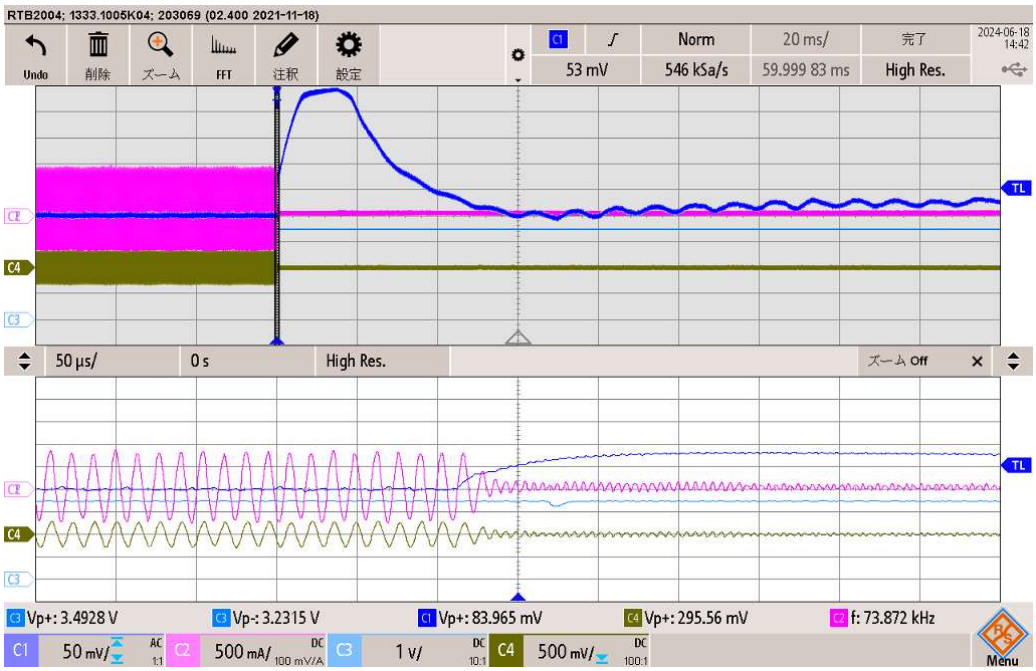
③ The FB terminal control voltage continues to function almost normally.

④ The BW terminal voltage has dropped below the rated voltage, and no signs of overvoltage are visible.

2. When control response is lost due to a sudden change in load

Measurement conditions: Load 100% → 0% (output switch ON → OFF)

2.1_5V output (AC measurement)



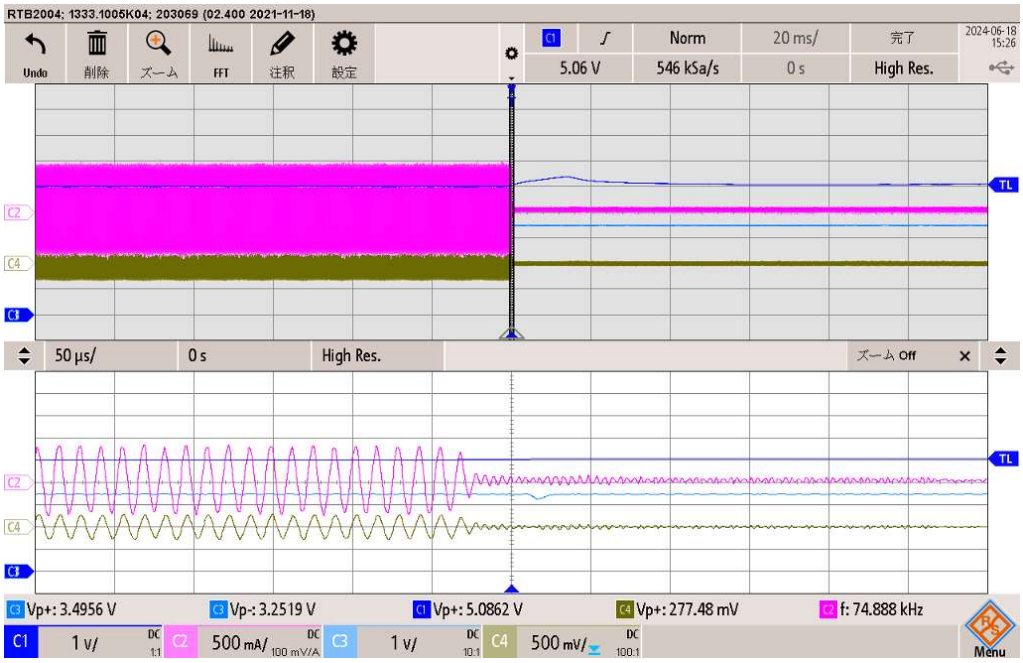
C1: 5V output voltage [AC50mV/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results):

① During a sudden change, after an overshoot occurs at the 5V output, the output voltage does not converge to a constant voltage but rises to approximately 5.3V.

② During a sudden change, no overvoltage occurs at the BW terminal voltage, it is attenuated compared to the rated load, and there are no signs of an overvoltage occurring.

2.2_5V output (DC measurement)



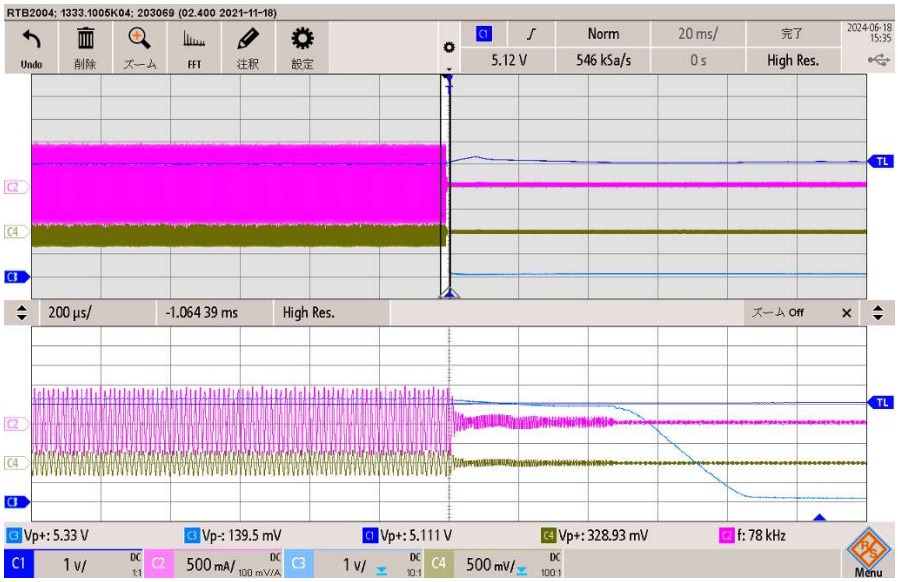
C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results):

① During a sudden change, after an overshoot occurs at the 5V output, the output voltage does not converge to a constant voltage but rises to approximately 5.3V.

② During a sudden change, no overvoltage occurs at the BW terminal voltage, it is attenuated compared to the rated load, and there is no sign of an overvoltage occurring.

2.3_Measure BW and FB terminals simultaneously



C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: FB terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

(Measurement results)

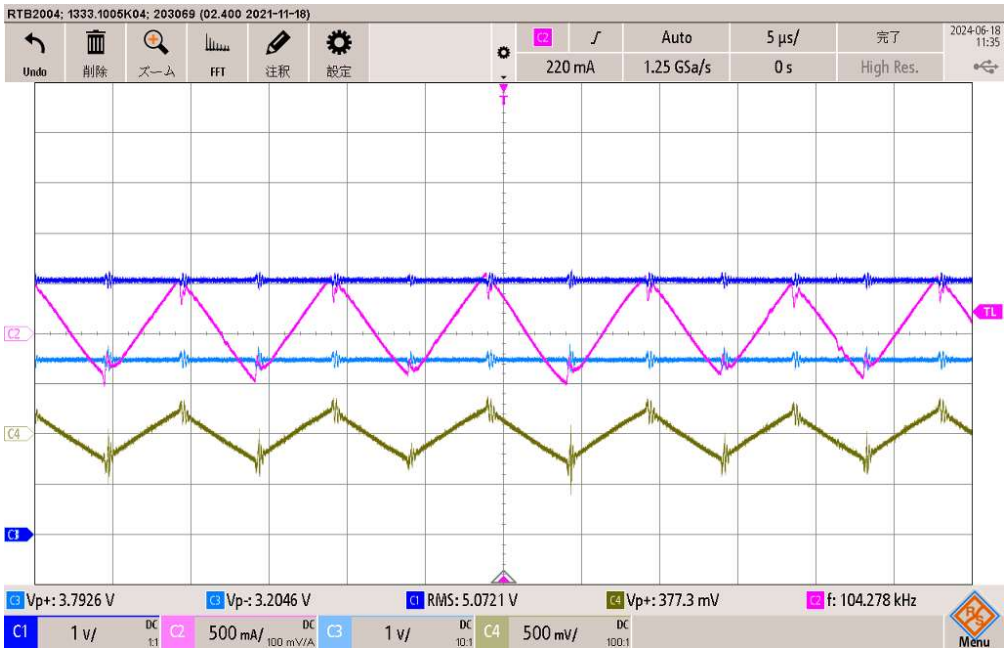
①After a sudden change from 100% to 0% 5V load, the FB terminal voltage is rapidly pulled from approximately 4.8V to 0V in about 250 μ sec.

②No overvoltage occurs in the FB terminal voltage.

3．Primary SW current waveform when control response converges and does not converge

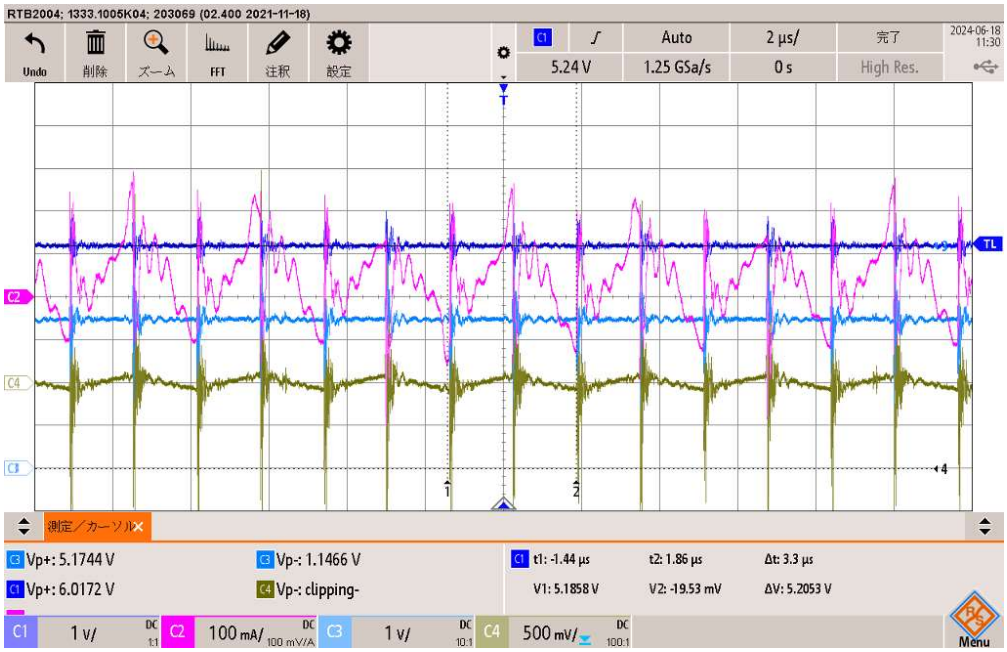
Condition: After a sudden change from 100% to 0% load

3.1_ Waveform when control is stable and converges with no load



C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

3.2_ Waveform when control does not stabilize with no load



C1: 5V output voltage [DC1V/div], C2: Primary resonant current [DC500mA/div], C3: LL/SS terminal voltage [DC1V/div], C4: BW terminal voltage [DC500mV/div]

<Overall findings from the measurement results>

The OV detection at the BW terminal as you pointed out did not occur, and the fact that the 5V output sometimes converges to a constant voltage when the load suddenly changes and sometimes does not converge is due to the nature of the control mechanism of the UCC256403, which I imagine is due to the response limit of the FB control, and the fact that it reaches one of these modes due to the nature of the control mechanism.

(In multiple tests, most of the results showed that it did not converge stably.)

Naturally, I think that this is related to the gain and response speed of the feedback loop, but since the evaluation is based on an application that was prototyped and modified by directly reusing a TI evaluation board, the control photocoupler is a general product and a high-speed type is not used.

Changing to a high-speed type may improve things a little. (Currently unconfirmed.)

The above is my current view, but if you have any knowledge based on these results that could improve the constant voltage accuracy stably when the load suddenly changes (100% to 0%), I would appreciate your advice. (However, the addition of the constant voltage diode proposed by your company is not permitted due to the specifications of the equipment.)