

ECEN 405
Lab 3: Power converters
(Part 3 - Boost converter) Submission

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1 Calculations

Constants: $V_d = 20V$, $R_L = 500$, $D = 0.3$, $L = 4mH$, $C = 100\mu F$

Output Voltage

$$V_o = \frac{D}{1-D} V_d = 30V$$

Output Current

$$I_o = \frac{V_o}{R_L} = 0.06A$$

Inductor Current Ripple

$$I_{ripple} = 0.2 I_o \frac{V_o}{V_d} = 0.018A$$

Switching Frequency

$$f_{sw} = \frac{V_d(V_o - V_d)}{L I_{ripple} V_o} = 92592.5925926 \approx 92.59kHz$$

Output Voltage Ripple

$$V_{ripple} = \frac{I_{o max} D}{f_{sw} C}$$

$$I_{o max} = I_o + 0.5 I_{ripple} = 0.069A$$

$$V_{ripple} = 0.002484 \approx 2.5mV$$

2 Drain of MOSFET

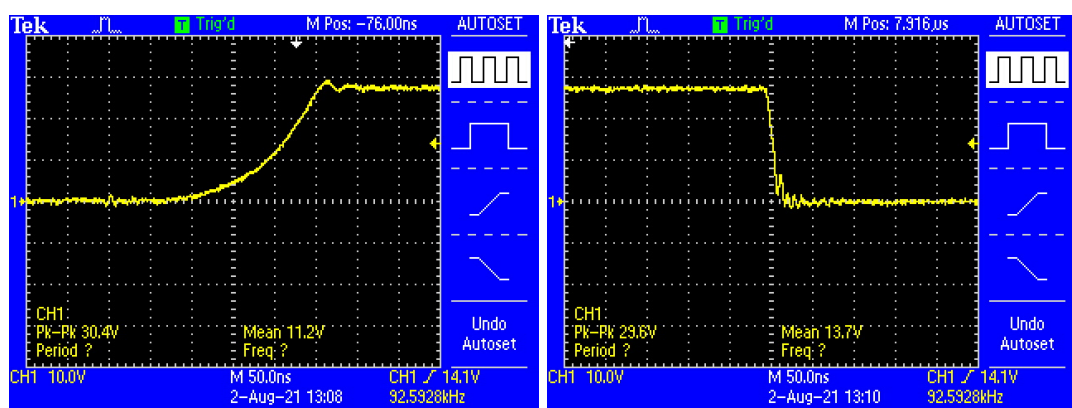


Fig 1. Rising Edge and Falling Edge

At the MOSFET the boosted 30V PWM waveform is seen, with a frequency of 92.59kHz. Worthy of note is the differences in edges, with a slow rise and slight ringing on fall.

3 Efficiency vs Output Current

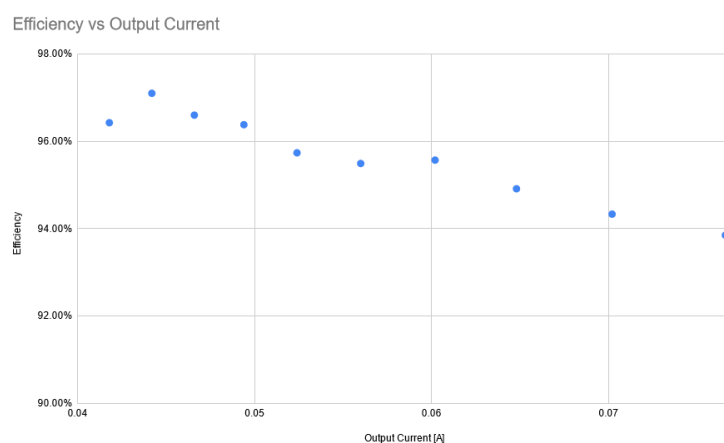


Fig 2. Efficiency vs Output Current