MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.622 Power Electronics	Issued: May 1, 2023
Problem Set 11	Due: May 8, 2023

Reading:	KPVS Chapter 6 through Section 6.4; KPVS Section 24.6
Note:	*Work on the design project!*

Problem 11.1 KPVS Problem 6.1

Problem 11.2 KPVS Problem 6.3

Problem 11.3

Figure 1 shows the topology, circuit states and operating waveforms of a ZVS resonant transition boost converter that is suitable for use at high- and very-high frequencies. For purposes of this problem, you may ignore device drops and component nonidealities. Please find the range of output voltages V_2 that will guarantee zero-voltage turn on of the MOSFET. That is, find the range of output voltages for which the MOSFET drain voltage ($v_{drain} = v_{C1}$) will ring down to zero in state 4, as illustrated. State your answer in terms of the input voltage V_1. *You must provide either a derivation or justification for your answer.*

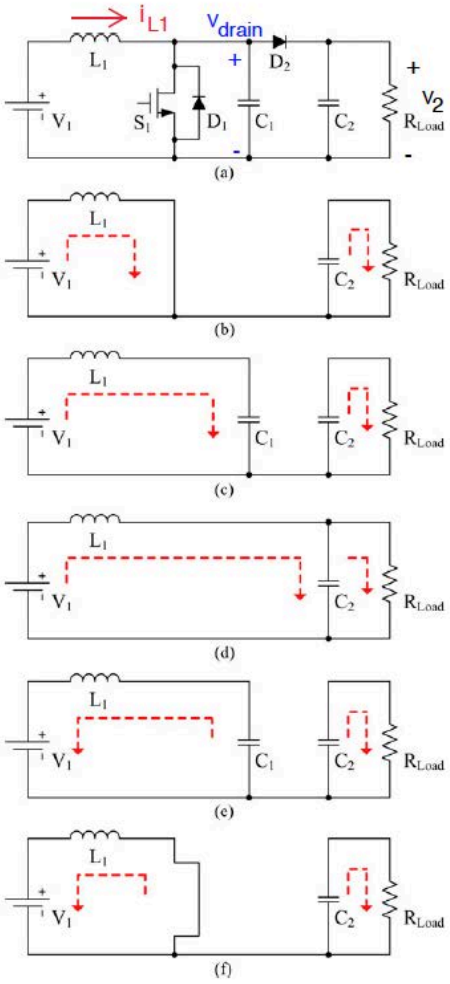

Fig. 2. Proposed VHF resonant boost converter: (a) circuit topology, (b) state 1, (c) state 2, (d) state 3, (e) state 4, and (f) state 5.

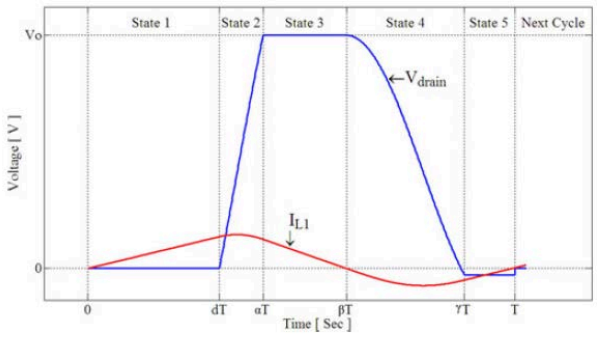

Fig. 3. Drain voltage and inductor current waveforms.

Figure 1 A ZVS resonant-transition boost converter and its operating waveforms. This converter topology is suitable for operation at very high frequencies. Figures adopted from Shamsi, et. al. "Design and Development of Very High Frequency Resonant Boost Converters," *IEEE Transactions on Power Electronics*, Vol. 27, No. 8, Aug. 2012.

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