

FIGURE 2.1

Circuit schematic of a buck converter.

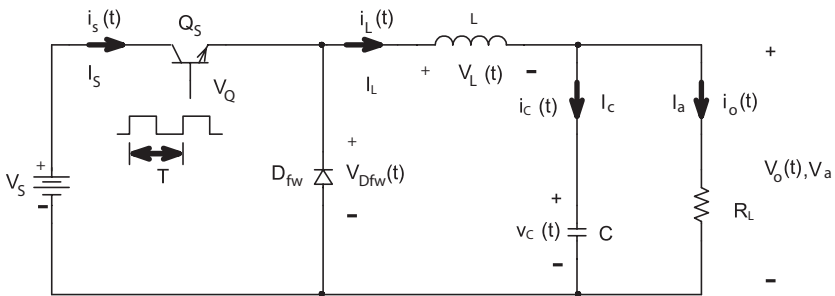


FIGURE 2.2

Mode 1 equivalent circuit for the buck converter ($0 < t \leq t_{on}$).

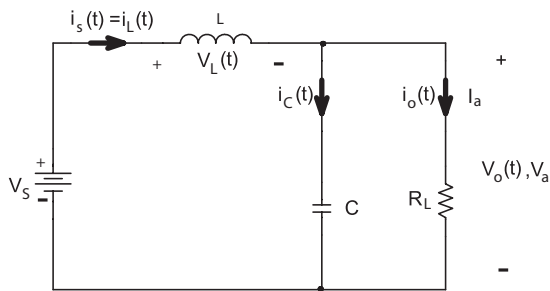


FIGURE 2.3

Mode 2 equivalent circuit for the buck converter ($t_{on} < t \leq T$).

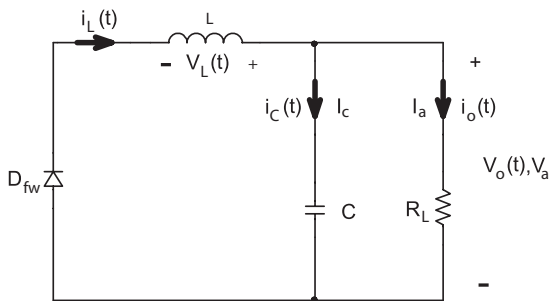


FIGURE 2.4

Buck converter switching waveforms.

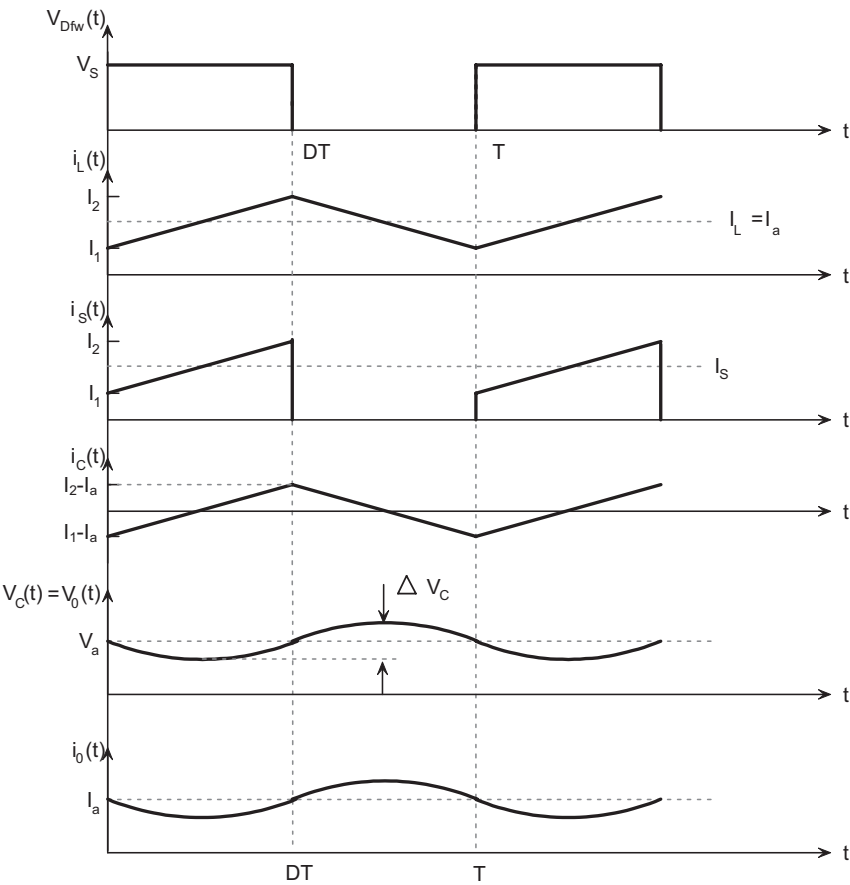


FIGURE 2.5

Discontinuous mode 2 equivalent circuits for the buck converter.

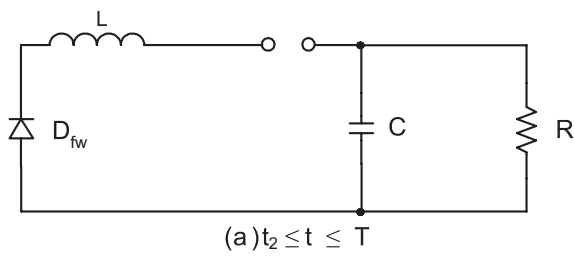
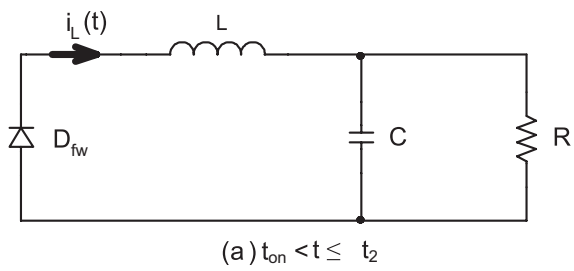


FIGURE 2.6

Discontinuous-mode inductor current waveform.

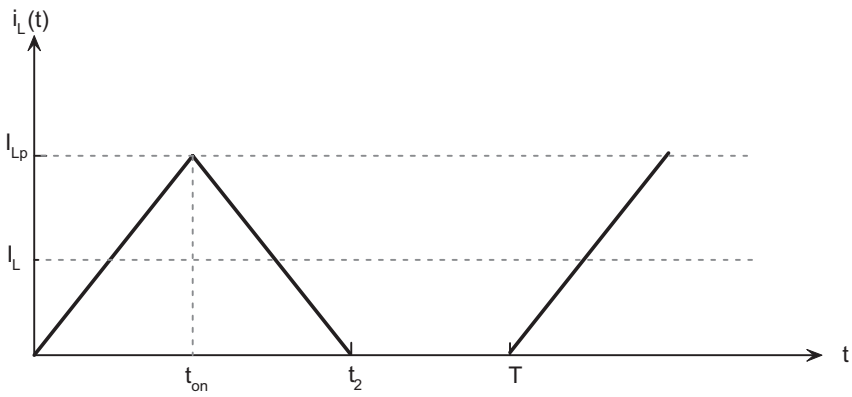


FIGURE 2.7

Open-loop voltage conversions ratio versus duty cycle of the buck converter operating in continuous and discontinuous modes.

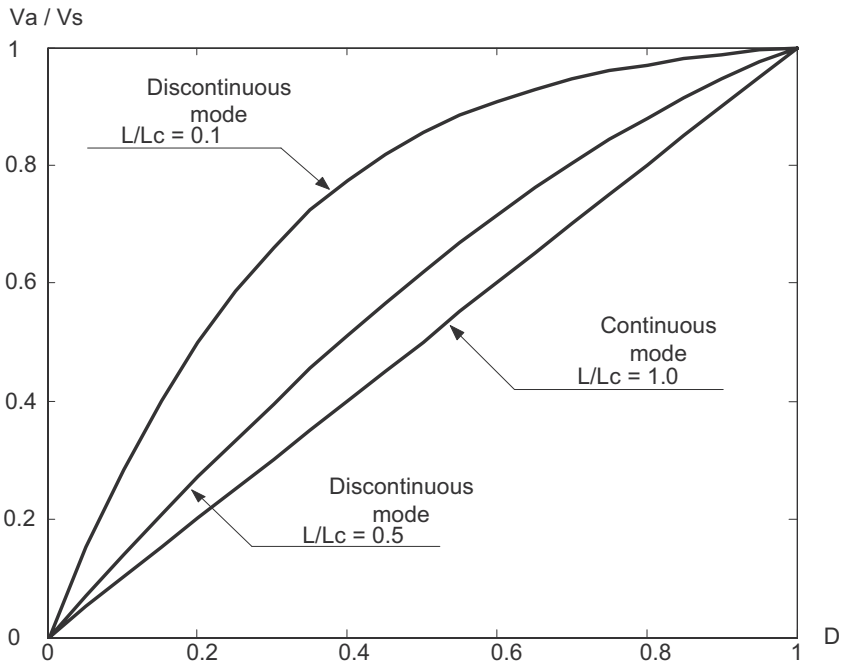


FIGURE 2.8

The t_2/T versus duty cycle of the buck converter in the discontinuous mode of operation.

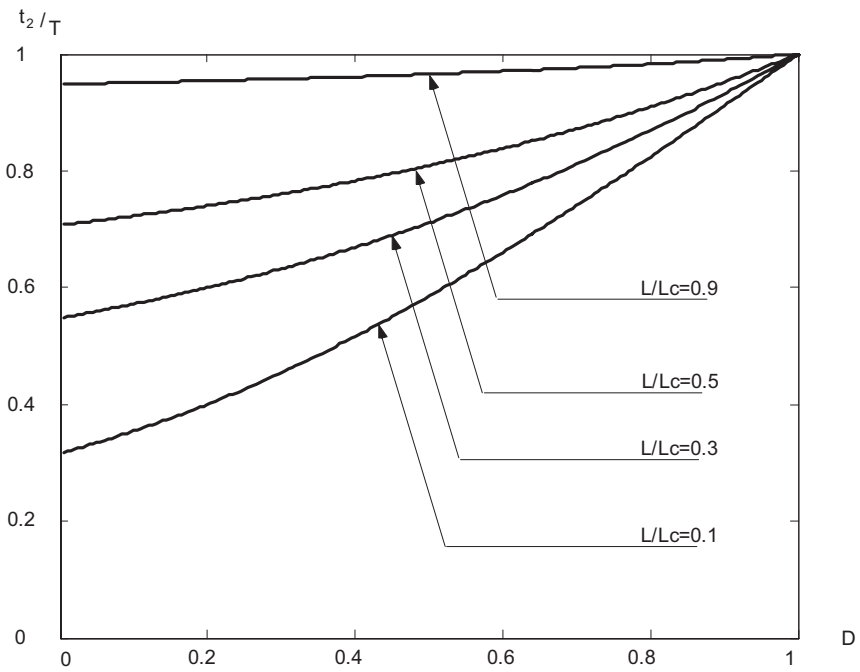


FIGURE 2.9

Buck converter waveforms for (a) $L > L_c$ and (b) $L < L_c$.

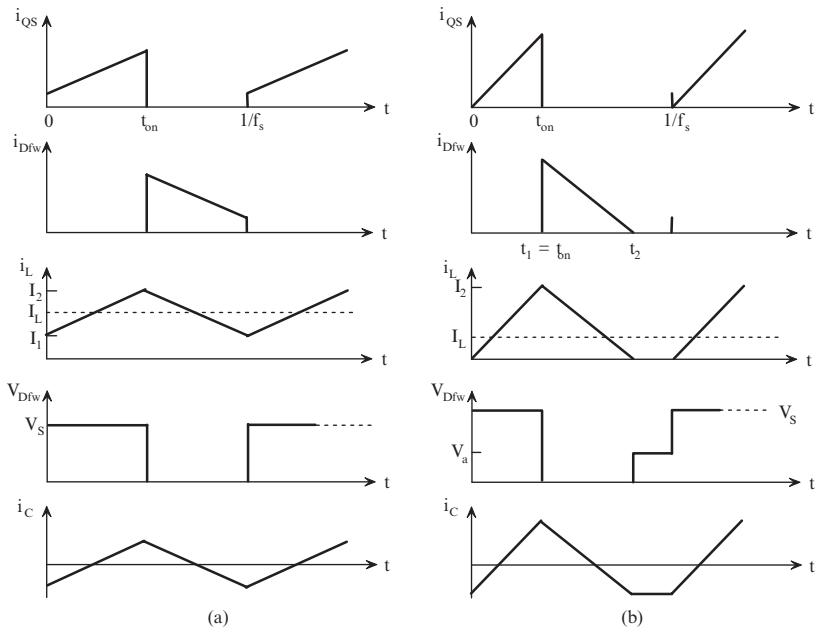


FIGURE 2.10

Synchronous rectifier.

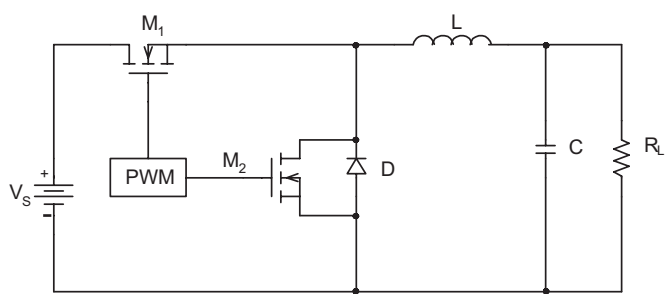


FIGURE 2.11

Two-port network for ripple steering.

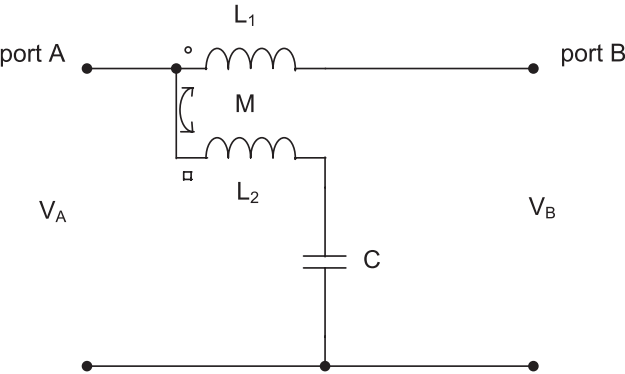


FIGURE 2.12

Conventional buck converter with an additional LC branch.

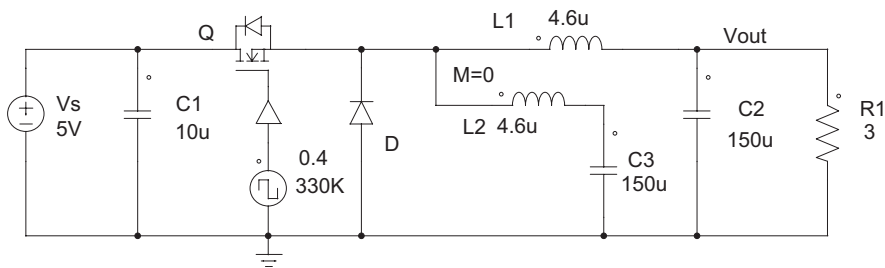


FIGURE 2.13

Output voltage and inductors current waveforms of the circuit of Figure 2.12.

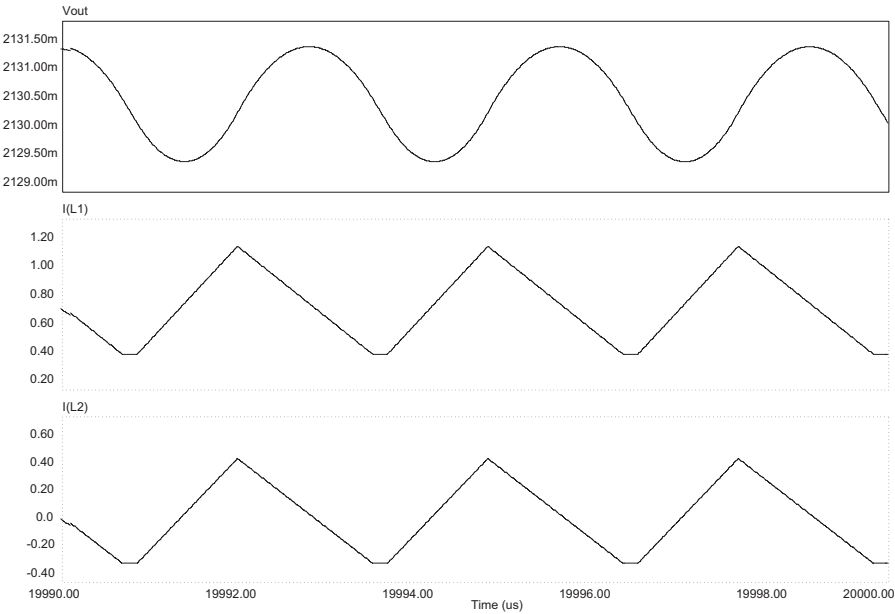


FIGURE 2.14

Buck converter with coupled inductors.

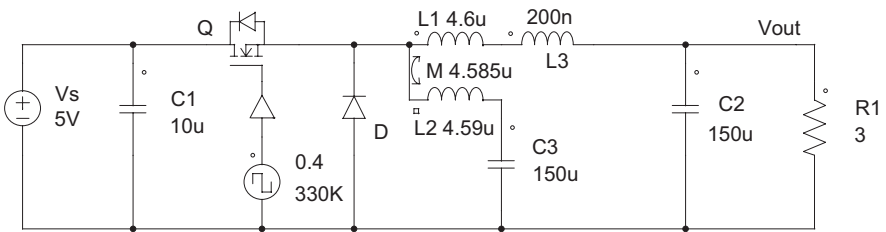


FIGURE 2.15

Voltage and inductor current waveforms of the buck converter with coupled inductors.

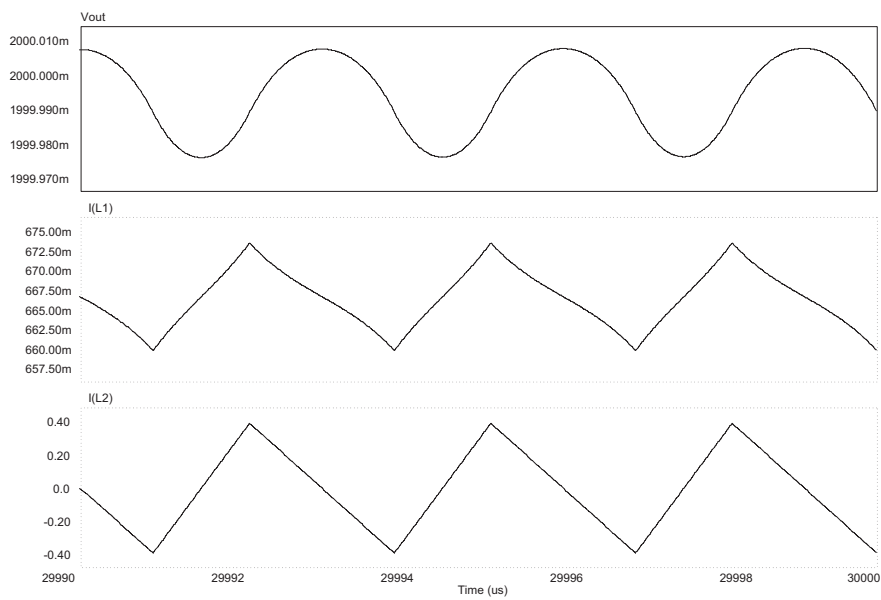


FIGURE 2.16

Circuit schematic of a boost converter.

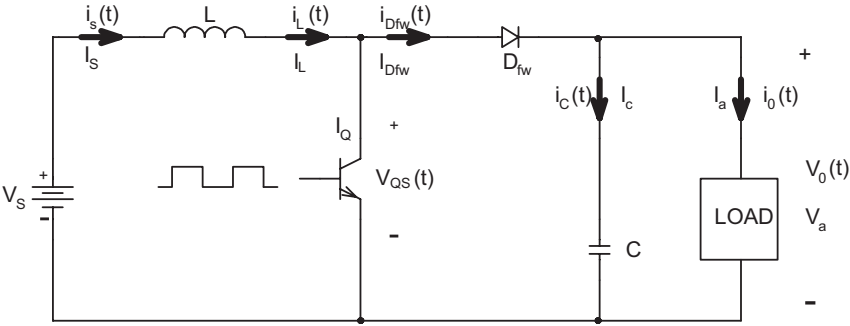


FIGURE 2.17

Waveforms for the boost converter.

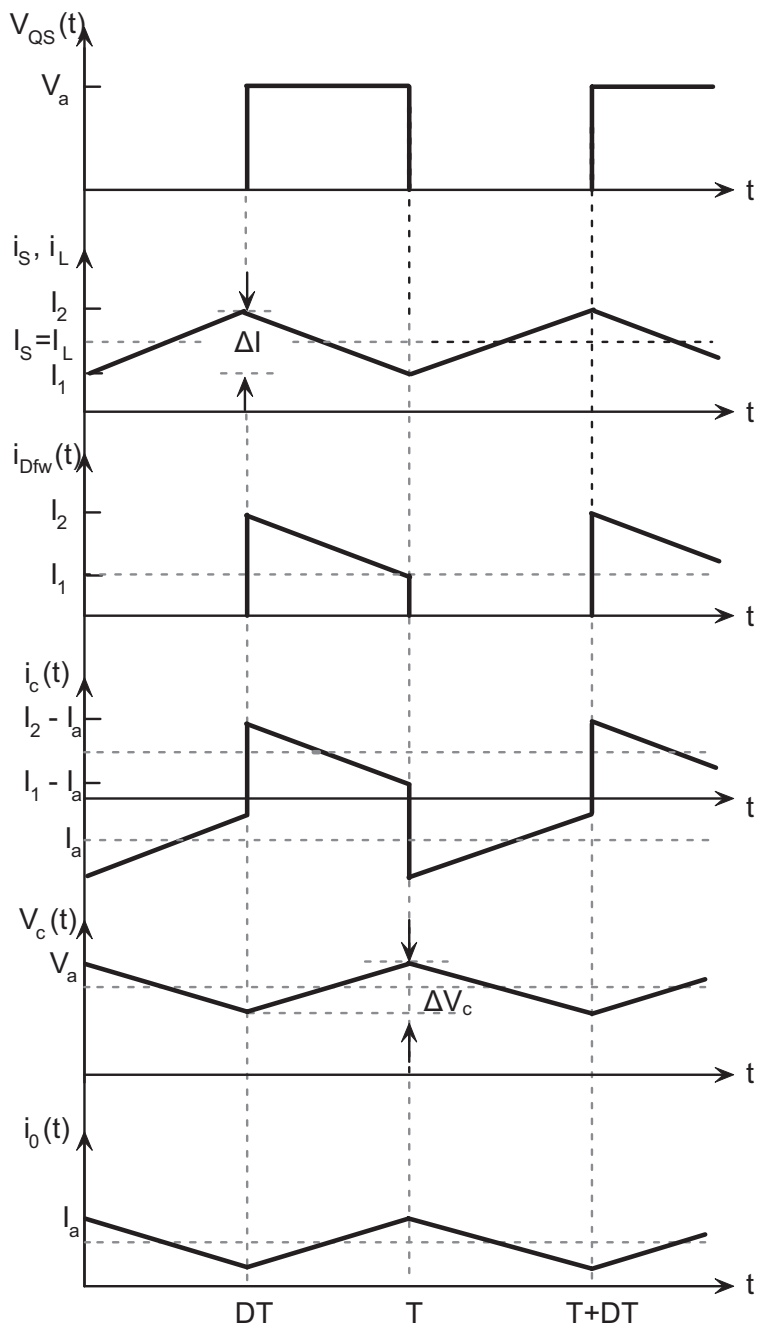


FIGURE 2.18

Mode 1 equivalent circuit for the boost converter ($0 < t \leq t_{on}$).

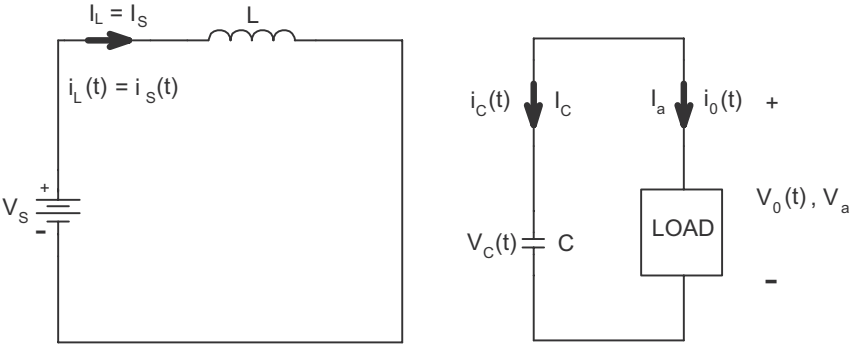


FIGURE 2.19

Mode 2 equivalent circuit for the boost converter ($t_{on} < t \leq T$).

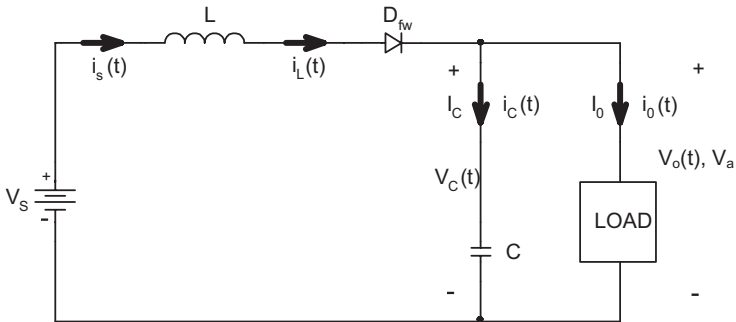


FIGURE 2.20

A comparison of the peak-to-peak inductor ripple current versus the duty cycle for the buck and boost converters at a constant $K = V_s/f_s L$.

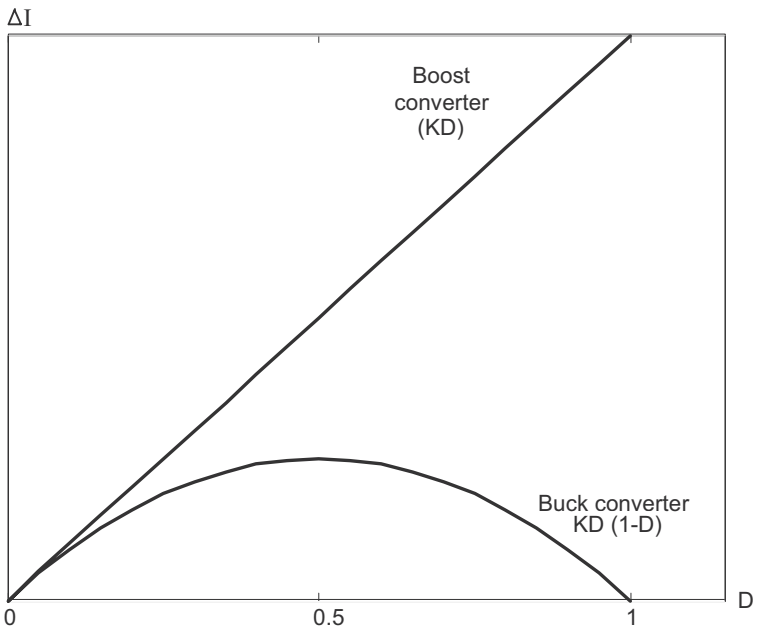


FIGURE 2.21

Discontinuous mode 2 equivalent circuits for the boost converter.

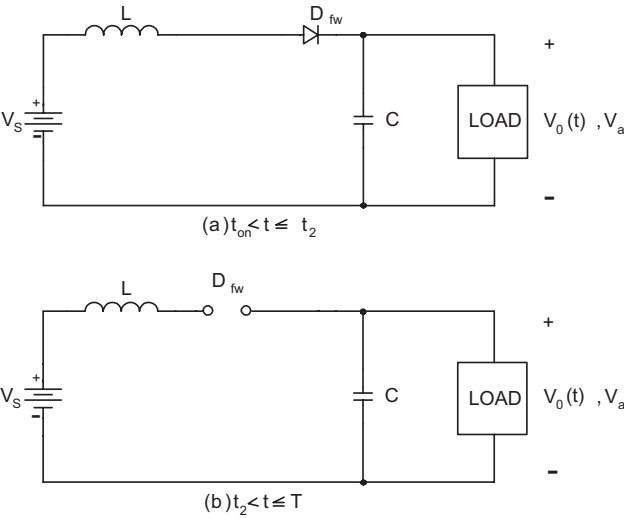


FIGURE 2.22

Waveforms for (a) voltage across and (b) current flowing through the inductor for a boost converter in the discontinuous mode of operation.

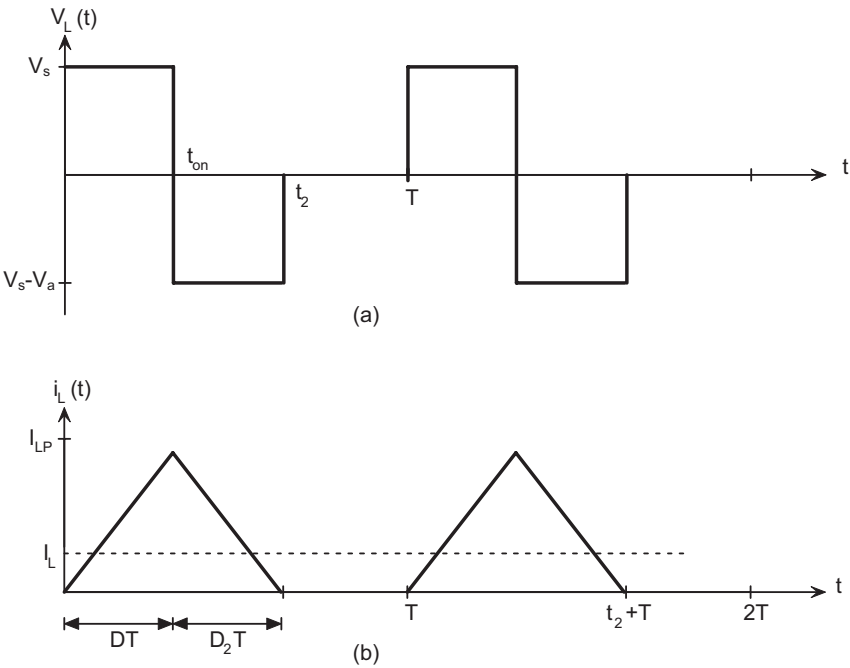


FIGURE 2.23

Open-loop voltage conversion ratio versus duty cycle of the boost converter operating in the continuous and discontinuous modes.

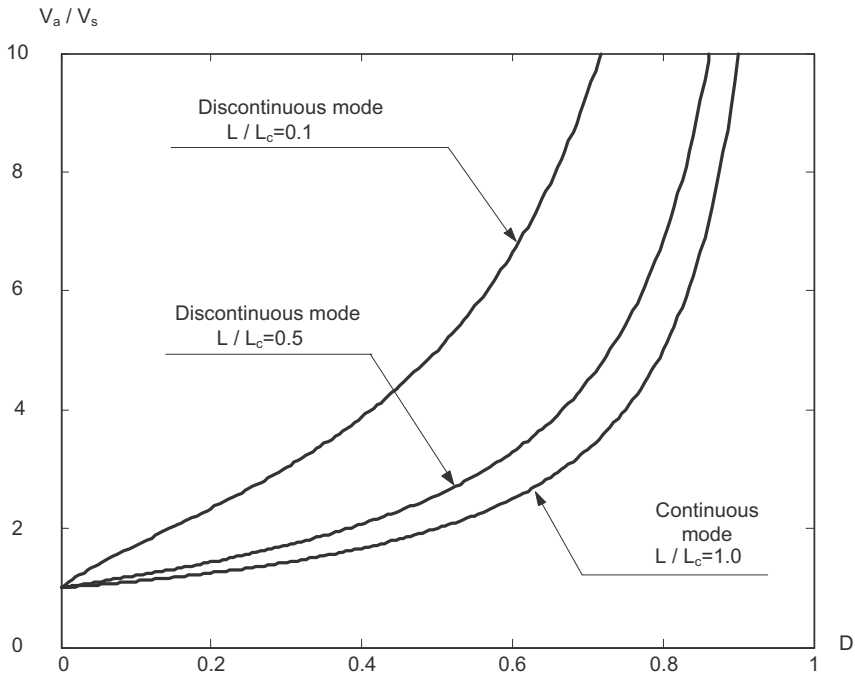


FIGURE 2.24

Waveforms for the discontinuous-mode boost converter.

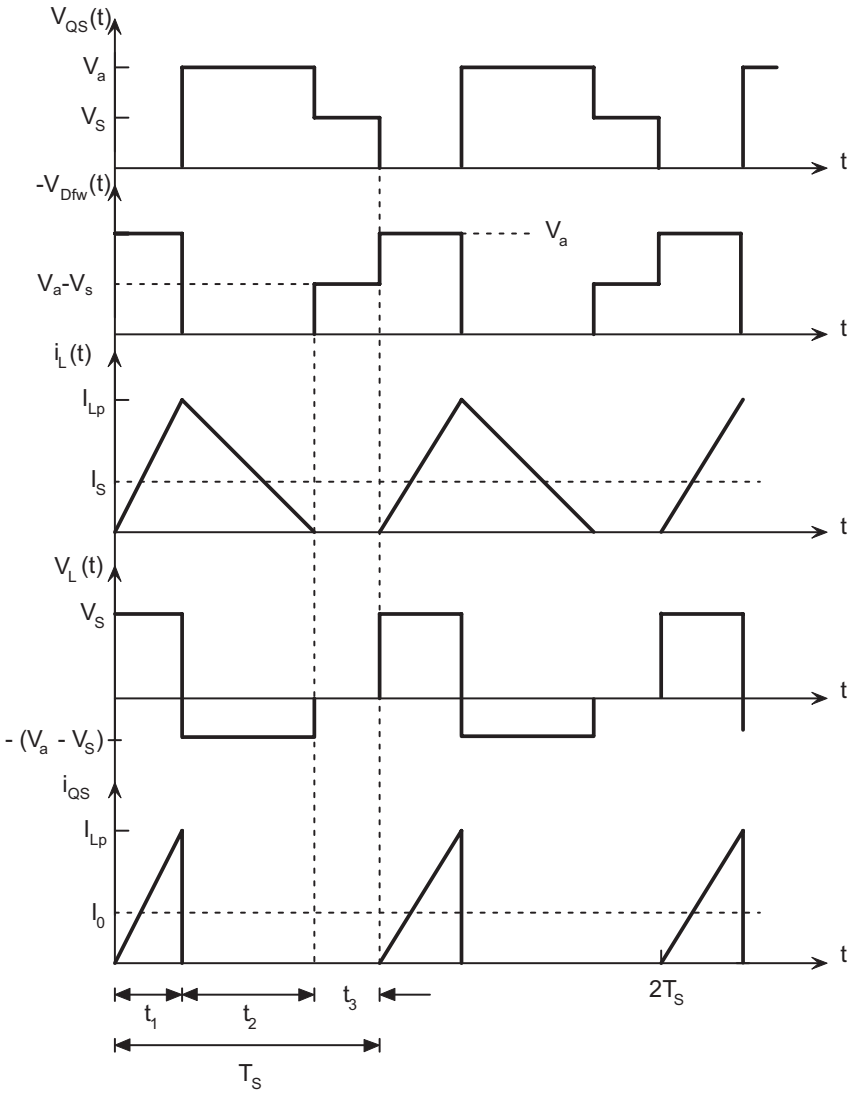


FIGURE 2.25

Circuit schematic of a buck-boost converter.

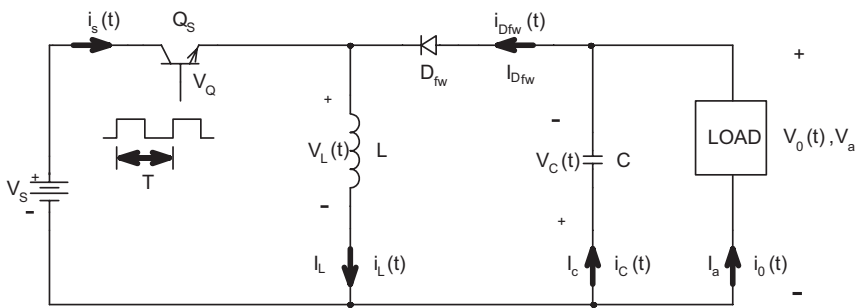


FIGURE 2.26

Buck-boost converter waveforms.

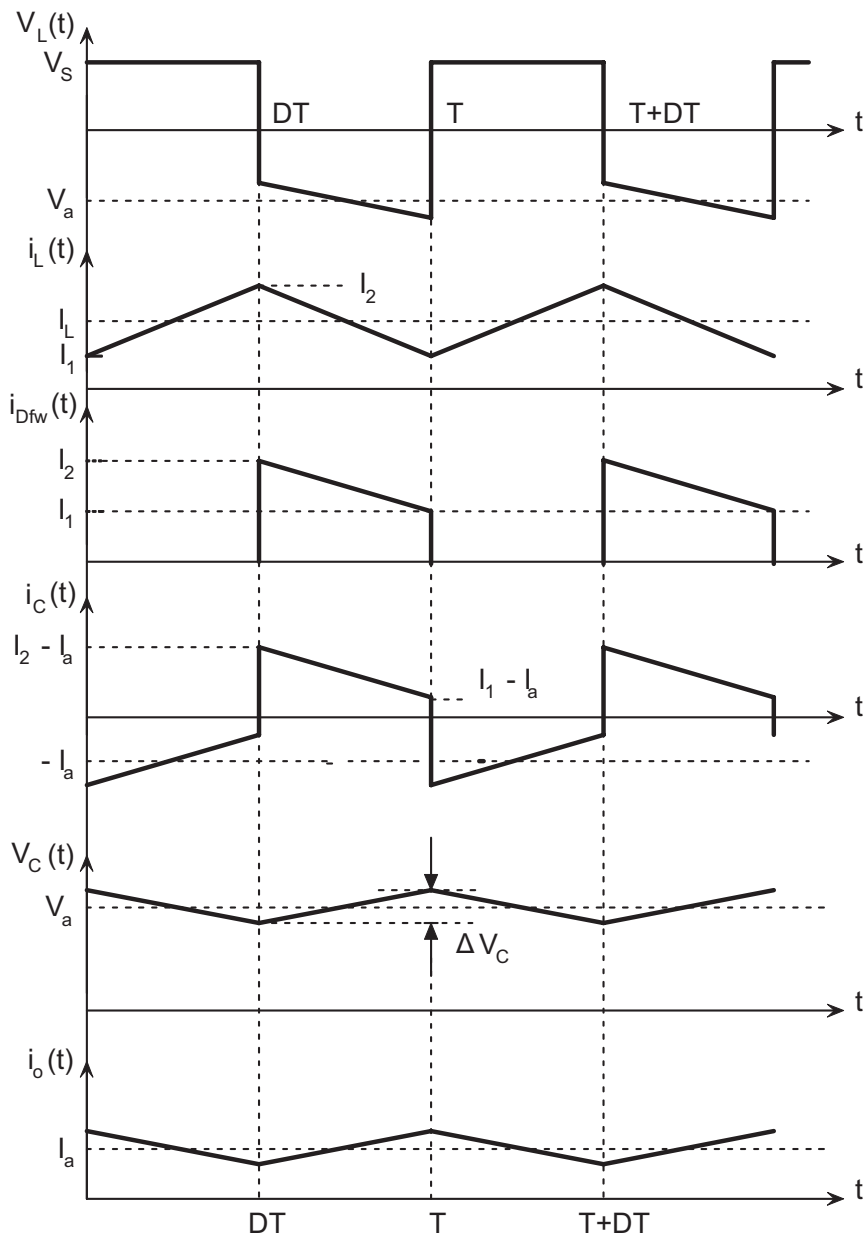


FIGURE 2.27

Mode 1 equivalent circuit of the buck-boost converter ($0 < t \leq t_{on}$).

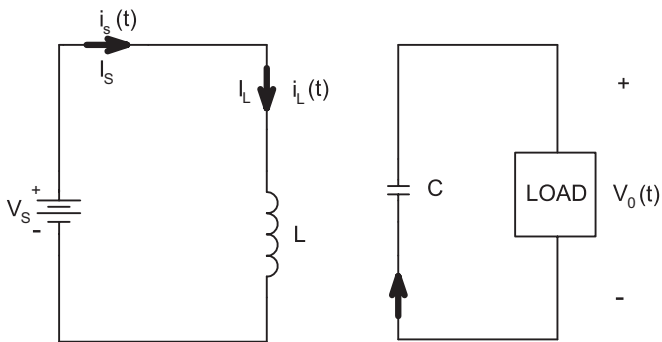


FIGURE 2.28

Mode 2 equivalent circuit for the buck-boost converter ($t_{on} < t \leq T$).

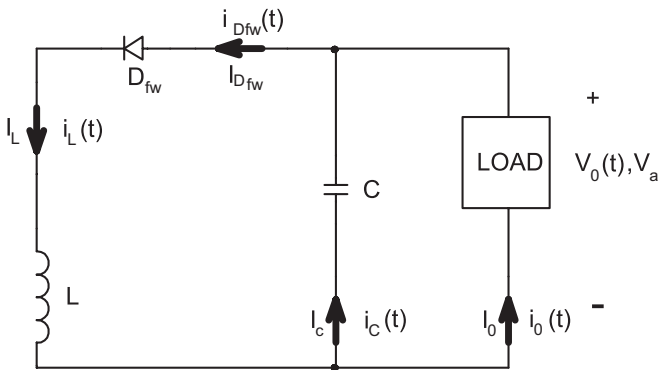


FIGURE 2.29

Open-loop voltage conversion ratio versus duty cycle of the buck-boost converter operating in the continuous and discontinuous modes.

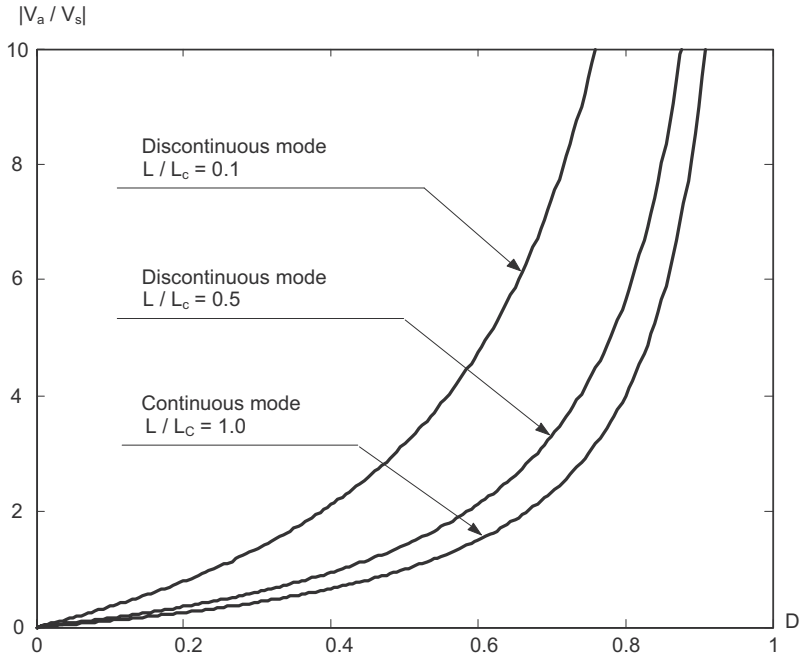


FIGURE 2.30

Comparisons of the voltage conversion ratios of buck, boost, and buck-boost switching converters.

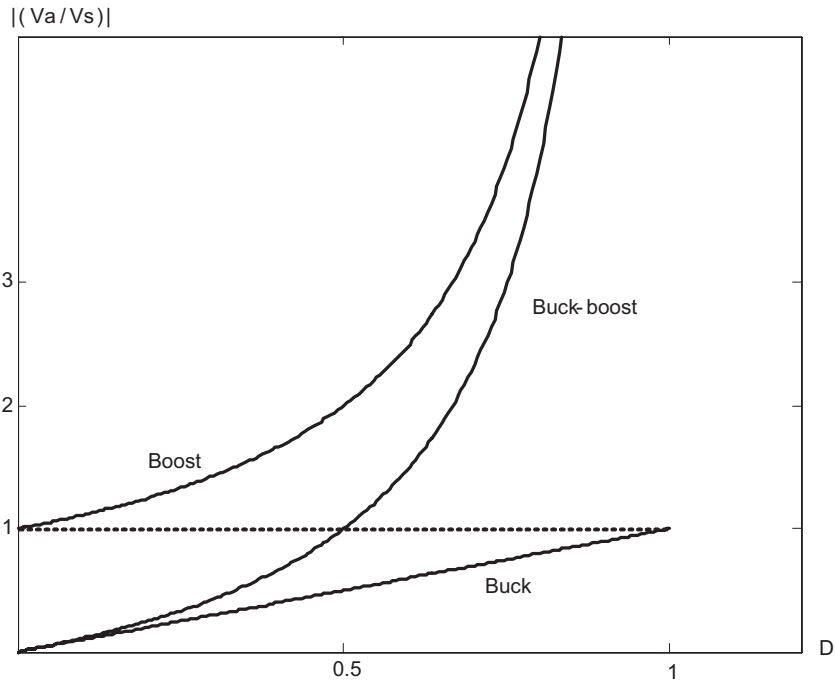


FIGURE 2.31

Circuit schematic of a Cûk converter.

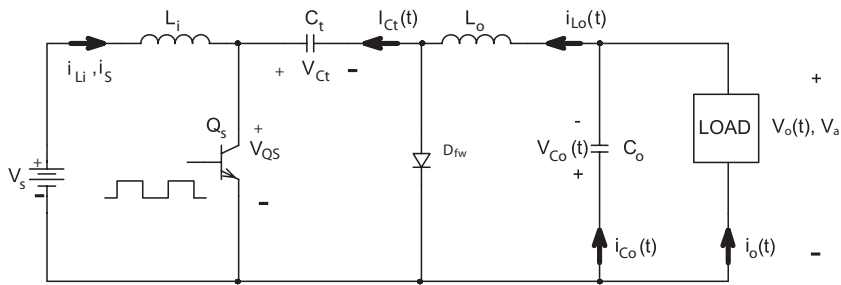


FIGURE 2.32

Cûk converter switching waveforms.

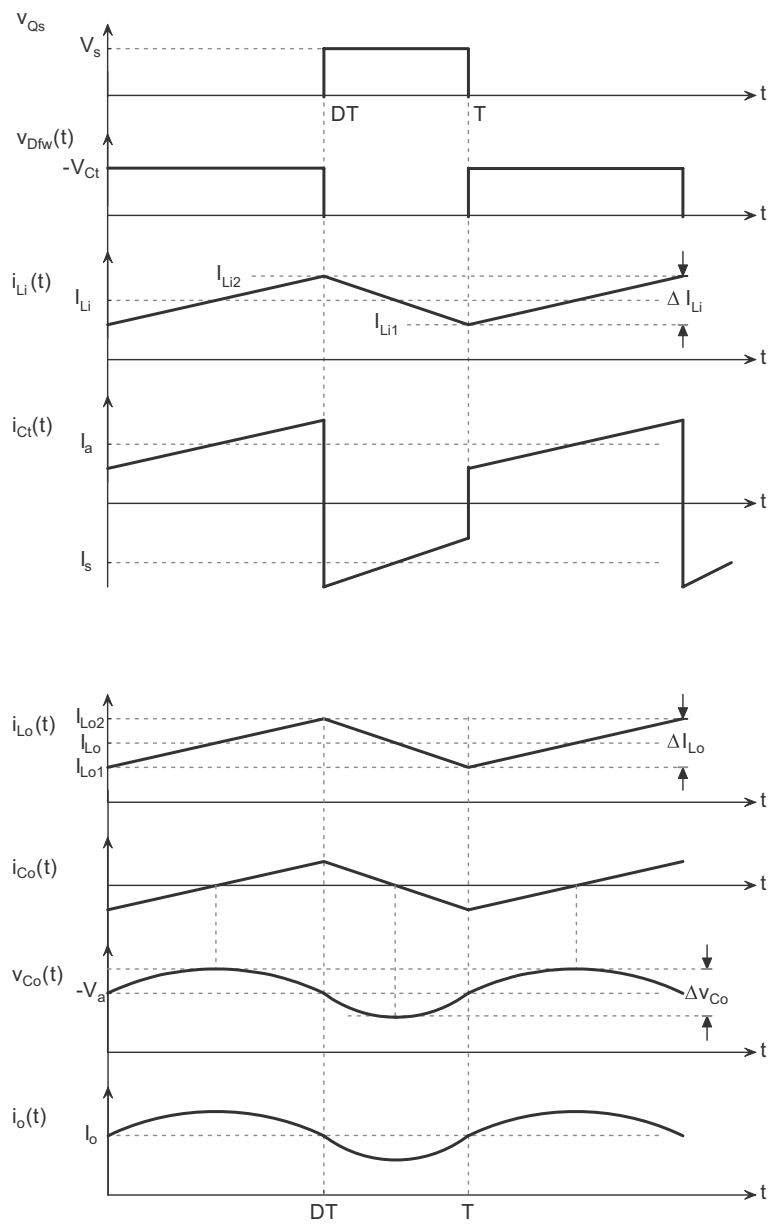


FIGURE 2.33

Mode 1 equivalent circuit for the Cúk converter.

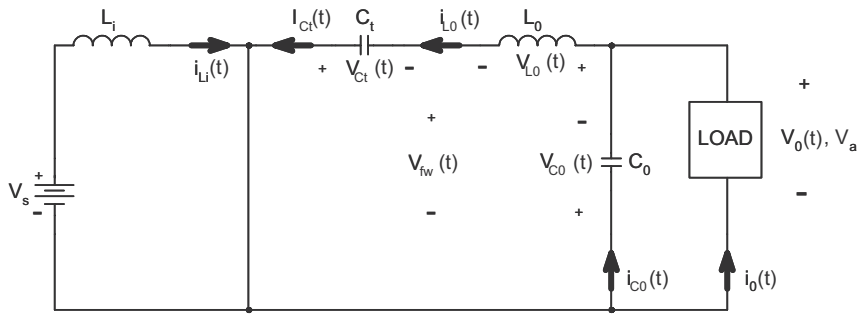


FIGURE 2.34

Mode 2 equivalent circuit for the Cuk converter.

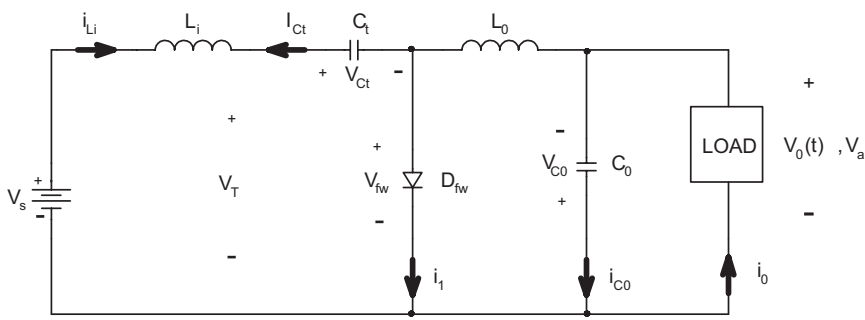


FIGURE 2.35

SEPIC converter.

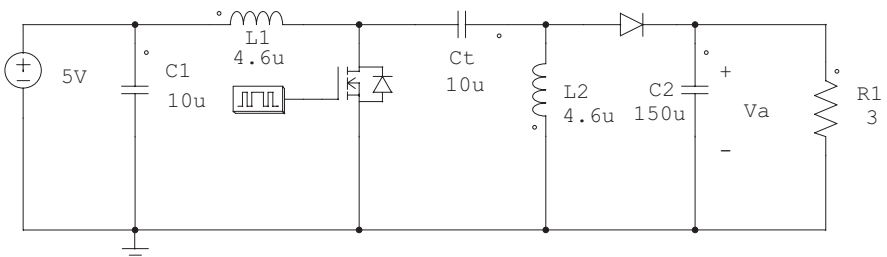
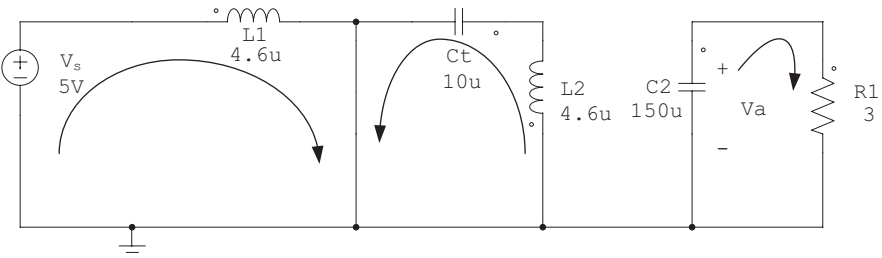
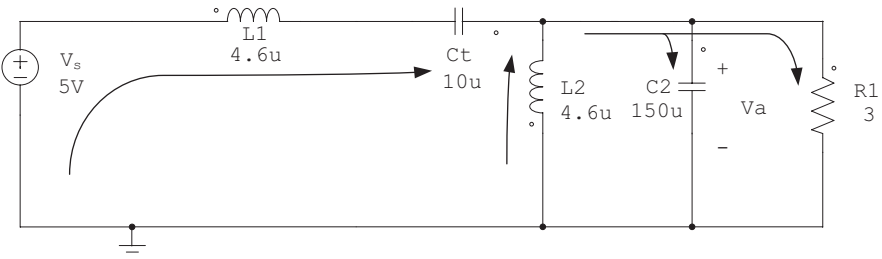


FIGURE 2.36

Equivalent circuits of the SEPIC converter in the continuous conduction mode.



a) Equivalent circuit during t_{on}



b) Equivalent circuit during t_{off}

FIGURE 2.37

Simulated switching waveforms of the CCM SEPIC converter.

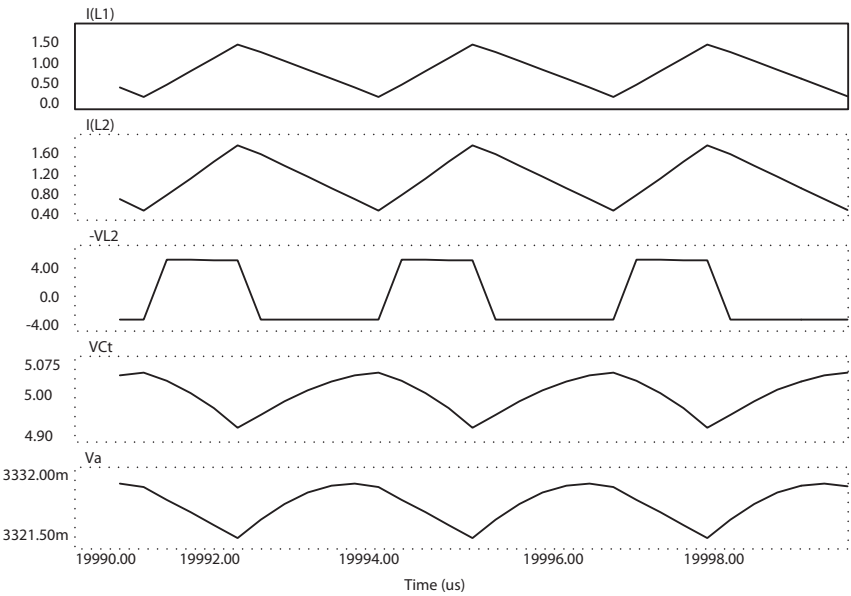


FIGURE 2.38

Zeta converter.

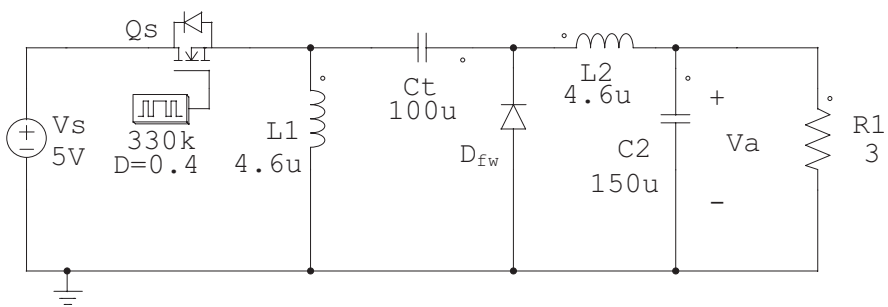
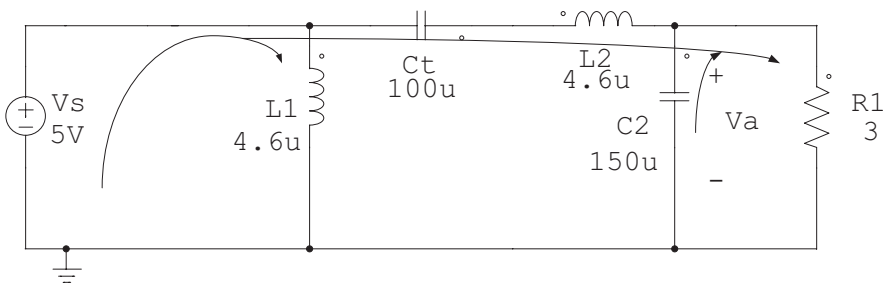
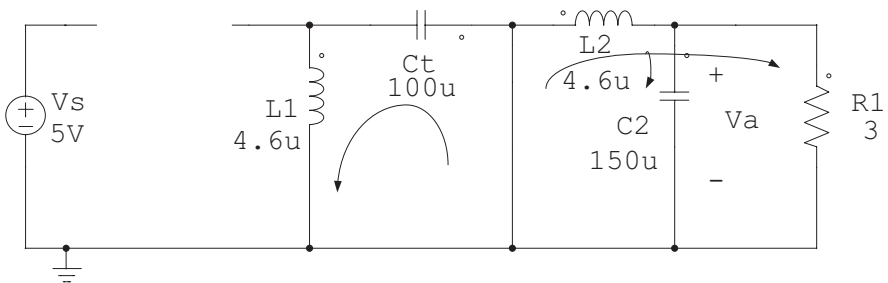


FIGURE 2.39

Equivalent circuits of the Zeta converter in the CCM.



a) Equivalent circuit during t_{on}



b) Equivalent circuit during t_{off}

FIGURE 2.40

Switching waveforms of the CCM Zeta converter.

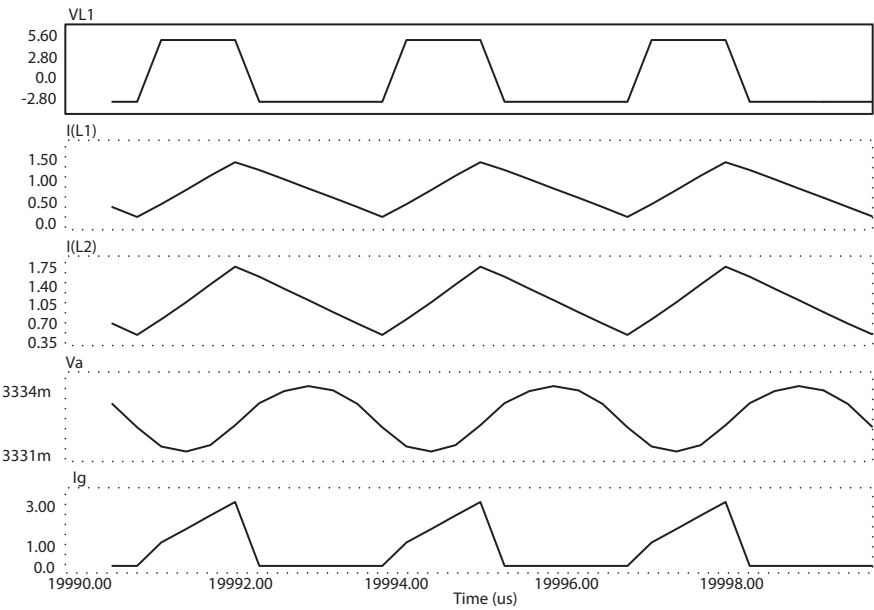


FIGURE 2.41

Inductor model.

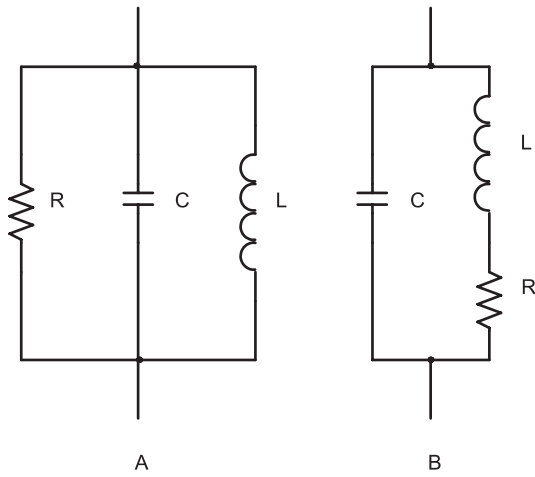


FIGURE 2.42

Capacitor model.



FIGURE 2.43

Typical power electronics circuit.

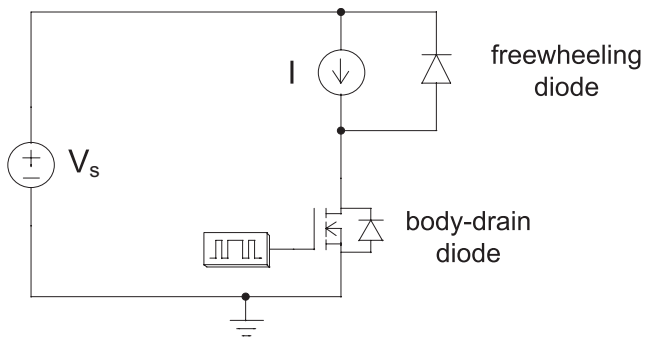


FIGURE 2.44
Switching waveforms.

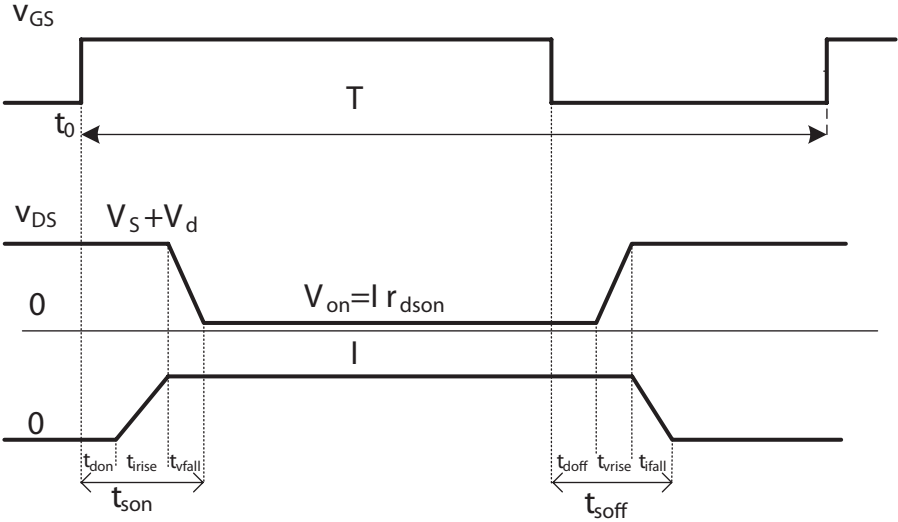


FIGURE 2.45

Equivalent circuit of a buck converter including losses.

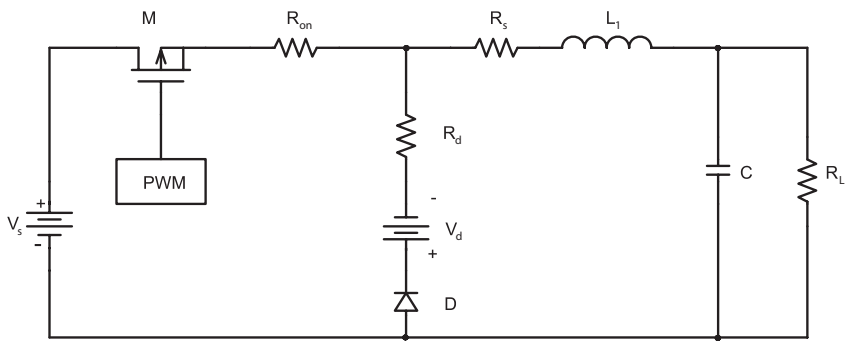


FIGURE 2.46

Circuit schematic of the switching converter for Problem 7.

