Robert W. Erickson
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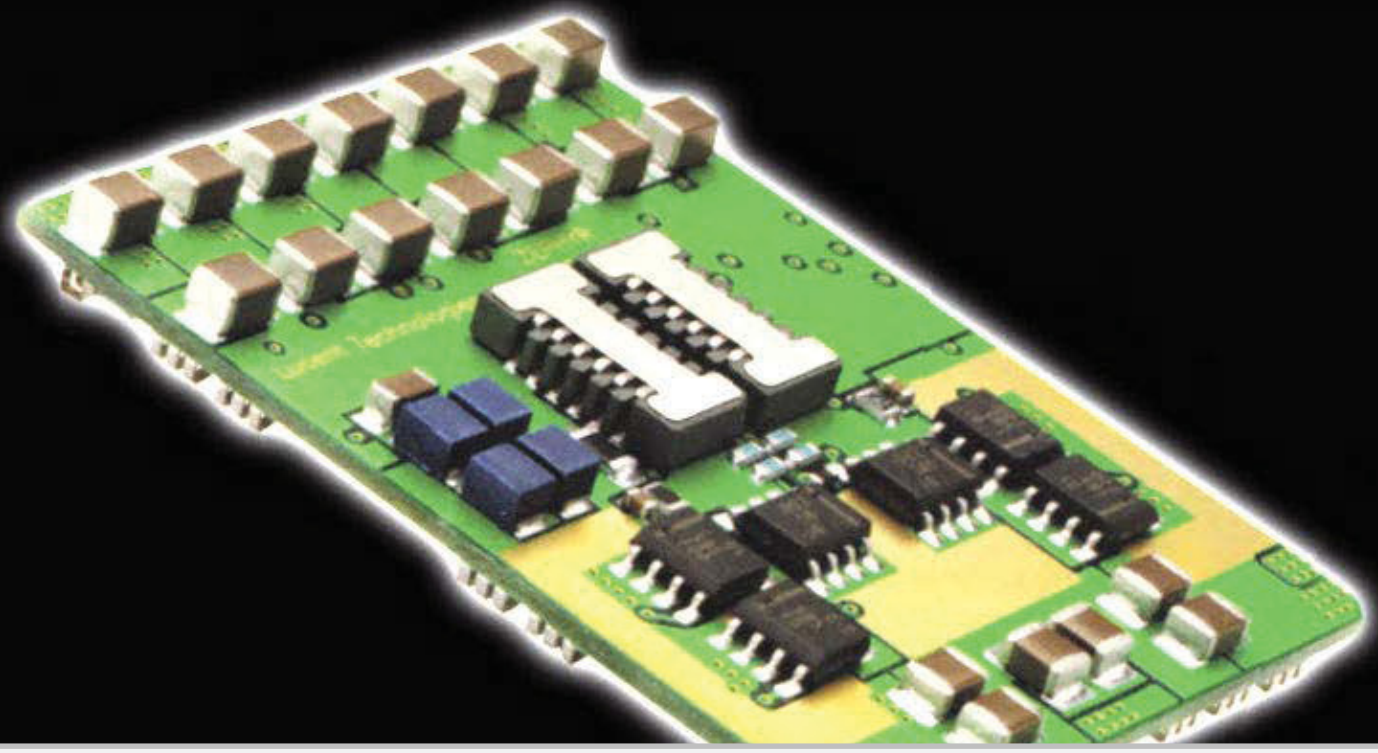
Fundamentals of Power Electronics

Second Edition



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Contents

$$0 = \frac{1}{T_s}\int_0^{T_s} i_C(t)dt = \langle i_C \rangle \tag{2.27}$$

The average value, or dc component, of the capacitor current must be zero in equilibrium.

This should be an intuitive result. If a dc current is applied to a capacitor, then the capacitor will charge continually and its voltage will increase without bound. Likewise, if a dc voltage is applied to an inductor, then the flux will increase continually and the inductor current will increase without bound. Equation (2.27), called the principle of *capacitor amp-second balance* or *capacitor charge balance*, can be used to find the steady-state currents in a switching converter.

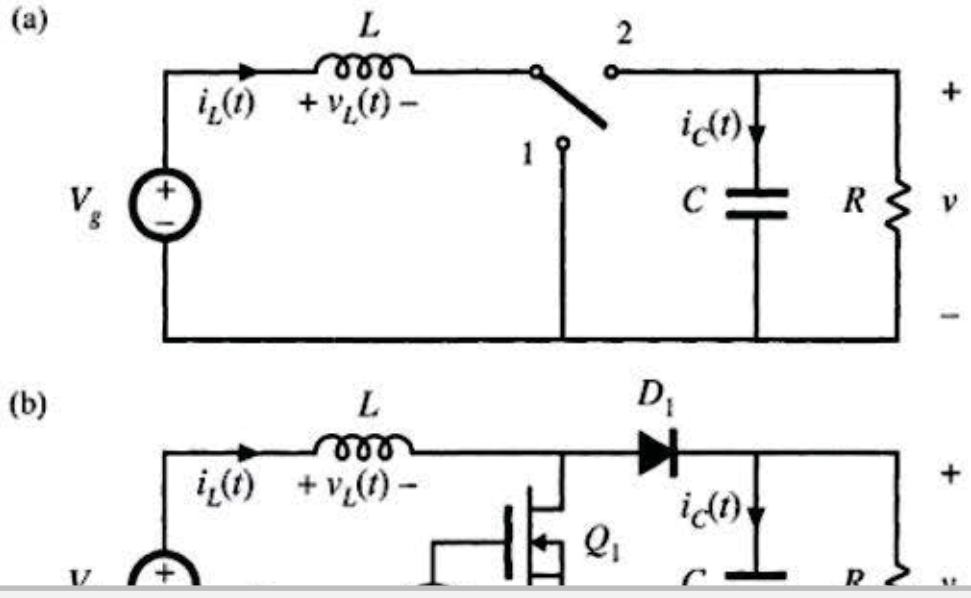
2.3 BOOST CONVERTER EXAMPLE

The boost converter, Fig. 2.13(a), is another well-known switched-mode converter that is capable of producing a dc output voltage greater in magnitude than the dc input voltage. A practical realization of the switch, using a MOSFET and diode, is shown in Fig. 2.13(b). Let us apply the small-ripple approximation and the principles of inductor volt-second balance and capacitor charge balance to find the steady-state output voltage and inductor current for this converter.

With the switch in position 1, the right-hand side of the inductor is connected to ground, resulting in the network of Fig. 2.14(a). The inductor voltage and capacitor current for this subinterval are given by

$$\begin{aligned} v_L &= V_g \\ i_C &= -\frac{v}{R} \end{aligned} \tag{2.28}$$

Use of the linear ripple approximation, $v \approx V$, leads to



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