Chapter 10

SOFT-SWITCHING IN DC-DC CONVERTERS AND CONVERTERS FOR INDUCTION HEATING AND COMPACT FLUORESCENT LAMPS

HARD-SWITCHING IN SWITCHING POWER-POLES

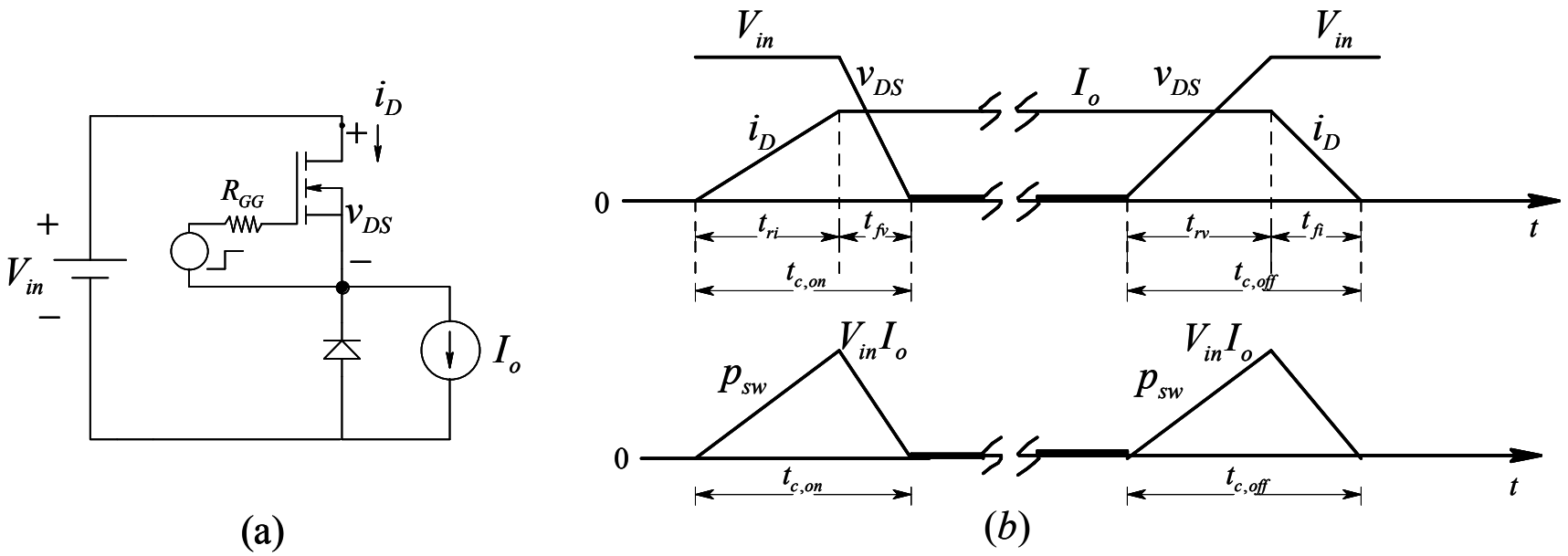


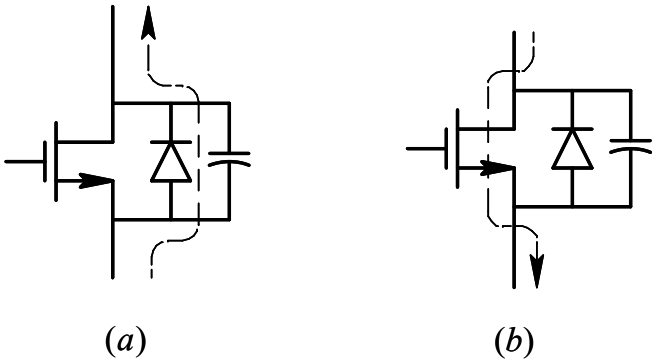
Figure 10-1 Hard switching in a power-pole.

$$P_{sw} \propto f_s \left(t_{c(on)} + t_{c(off)} \right)$$

SOFT-SWITCHING IN SWITCHING POWER-POLES

- ZVS (zero voltage switching), and
- ZCS (zero current switching)

Zero Voltage Switching (ZVS)



(*a*) (*b*)

Figure 10-2 ZVS in a MOSFET.

Synchronous Buck Converter with ZVS

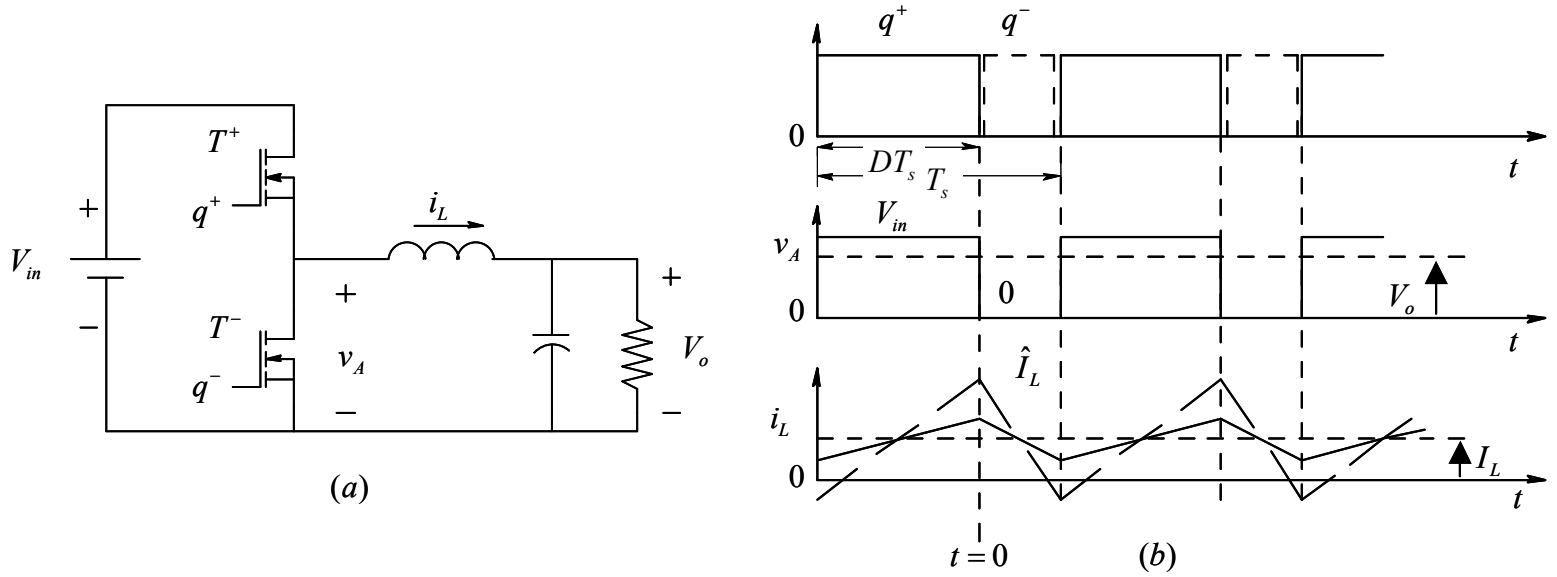


Figure 10-3 Synchronous-rectified Buck converter.

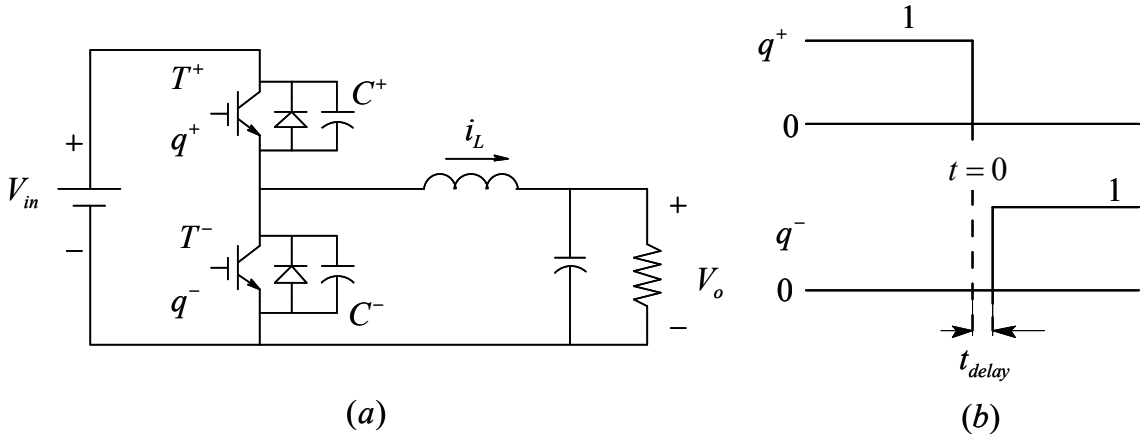


Figure 10-4 Synchronous-rectified Buck converter with ZVS.

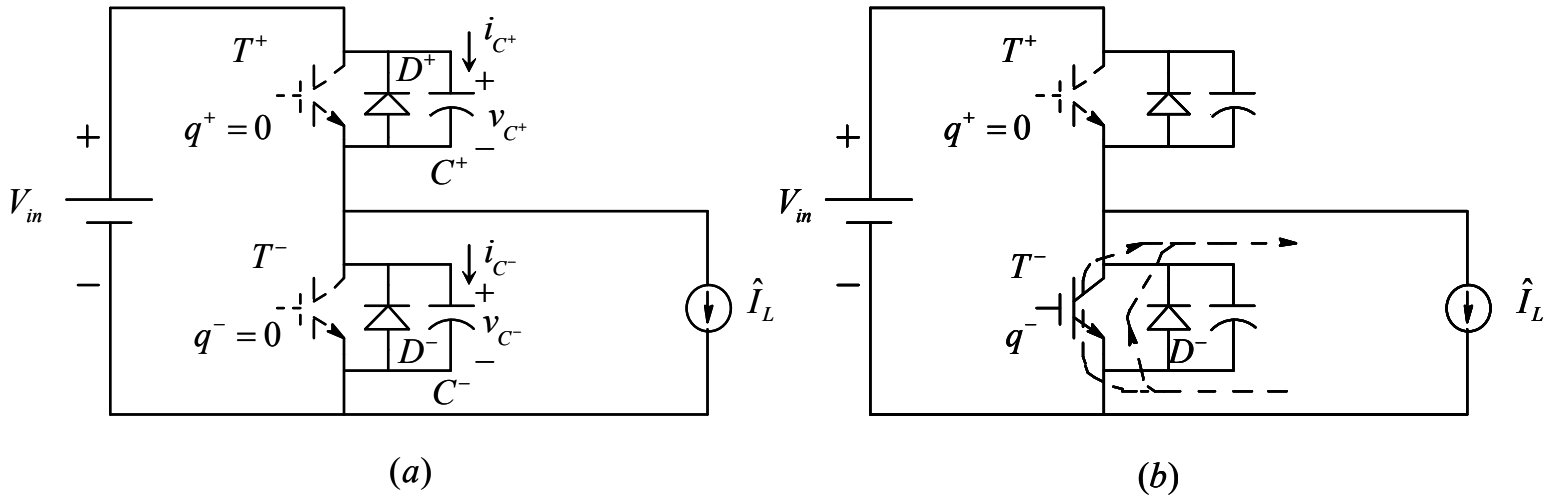


Fig. 10-5 Transition in synchronous-rectified Buck converter with ZVS.

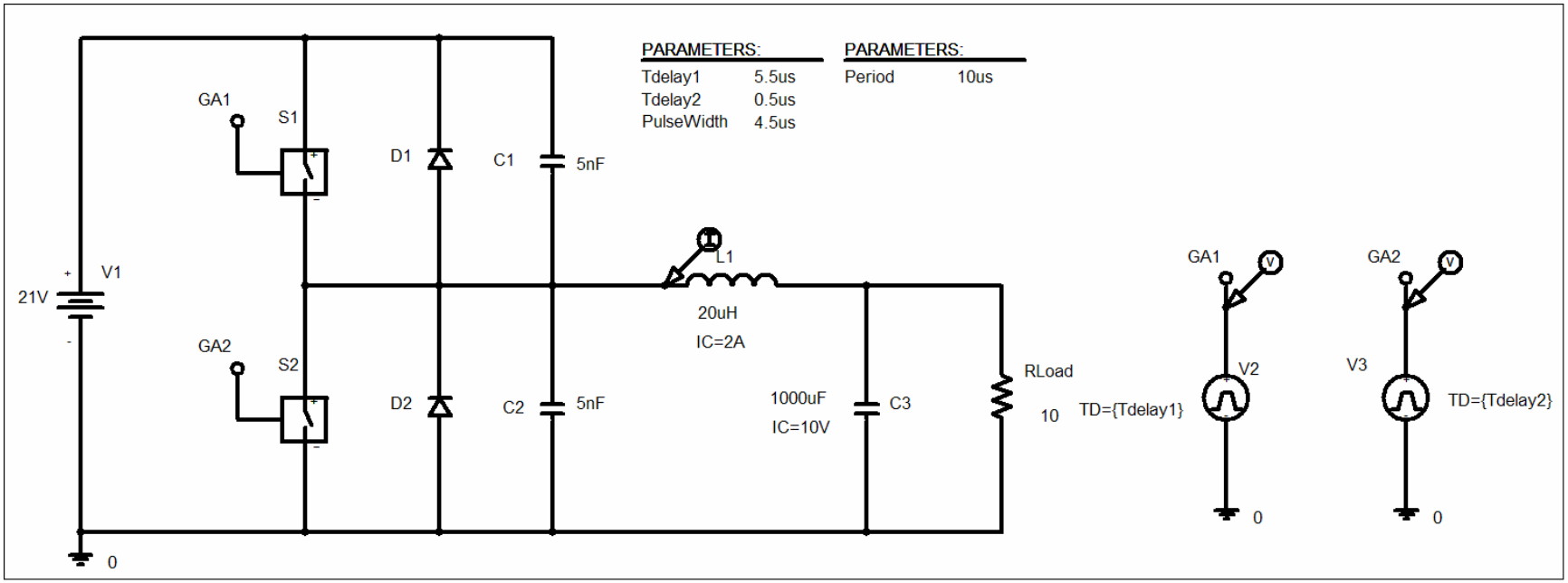
$$v_{C^+} + v_{C^-} = V_{in}$$

$$C\frac{d}{dt}v_{C^+} + C\frac{d}{dt}v_{C^-} = 0$$

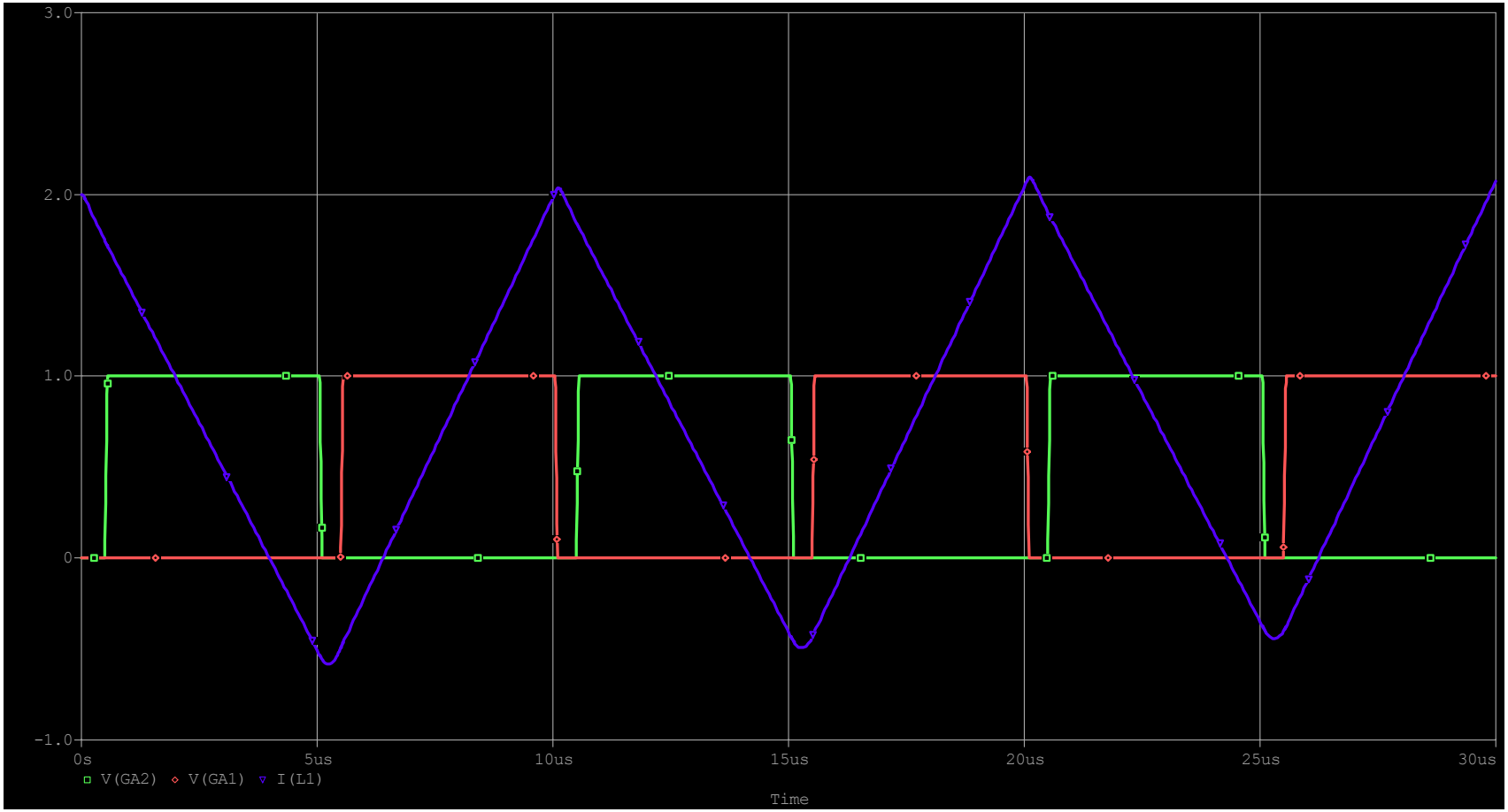
$$i_{C^+} + i_{C^-} = 0 \qquad \Rightarrow \qquad i_{C^+} = -i_{C^-}$$

$$i_{C^+} = -i_{C^-} = \frac{\hat{I}_L}{2}$$

PSpice Modeling: C:\FirstCourse_PE_Book03\zvscv.sch



Simulation Results



Phase-Shift Modulated (PSM) DC-DC Converter

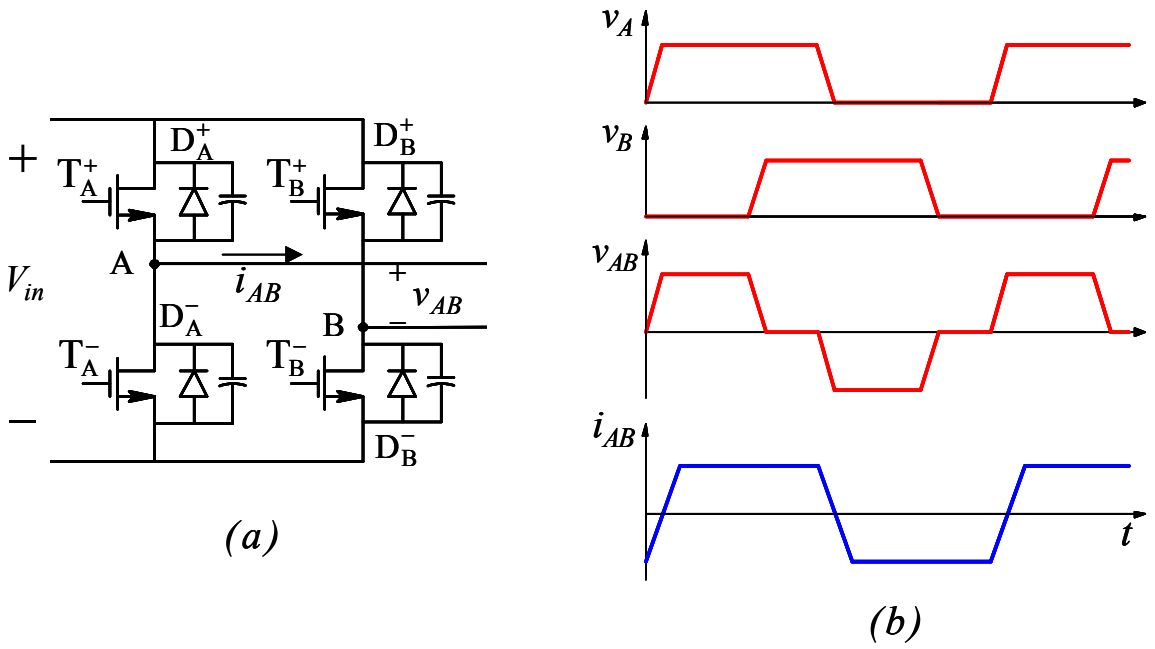


Figure 10-6 Phase-Shift Modulated (PSM) DC-DC Converter.

Hybrid Topology

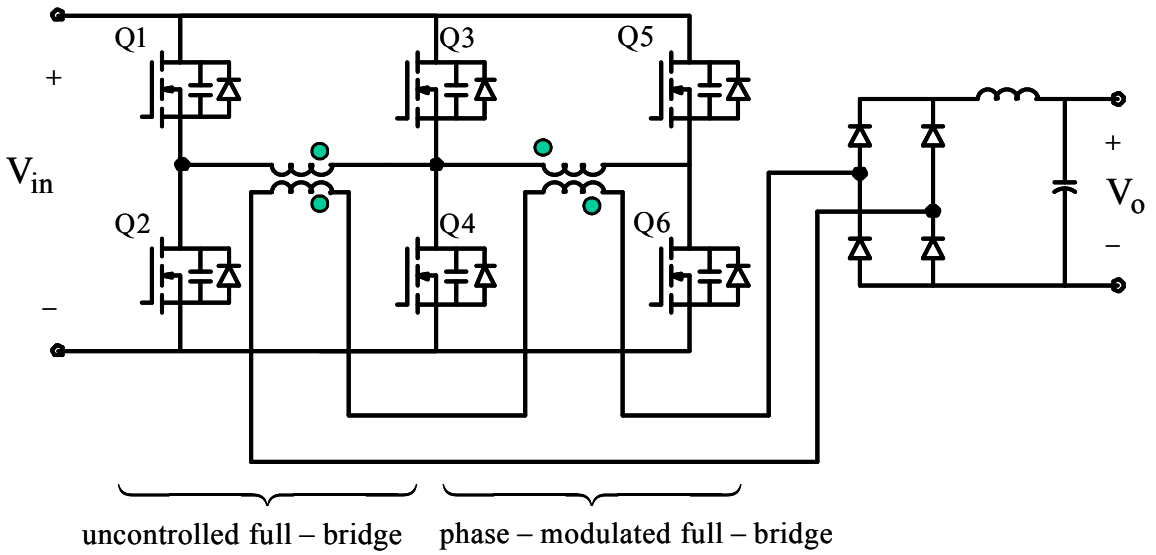


Figure 10-7 A superior hybrid topology to achieve ZVS down to no load [3-5].

R. Ayyanar, N. Mohan, "Zero voltage switching DC-DC converter," ***US patent 6,310,785*****, 2001.**