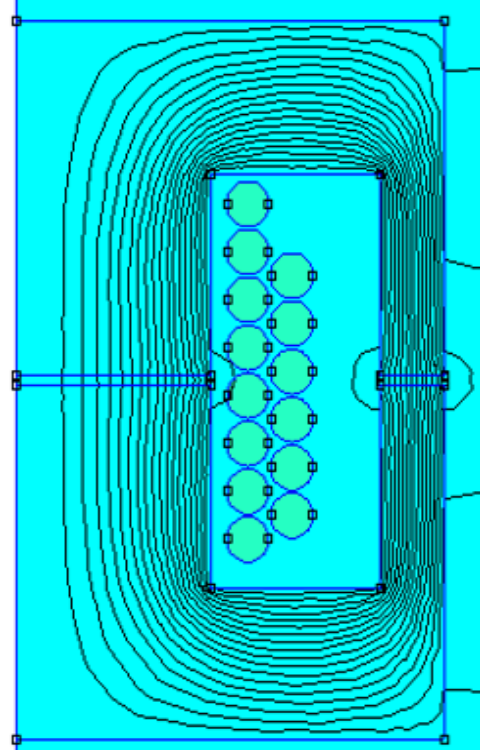
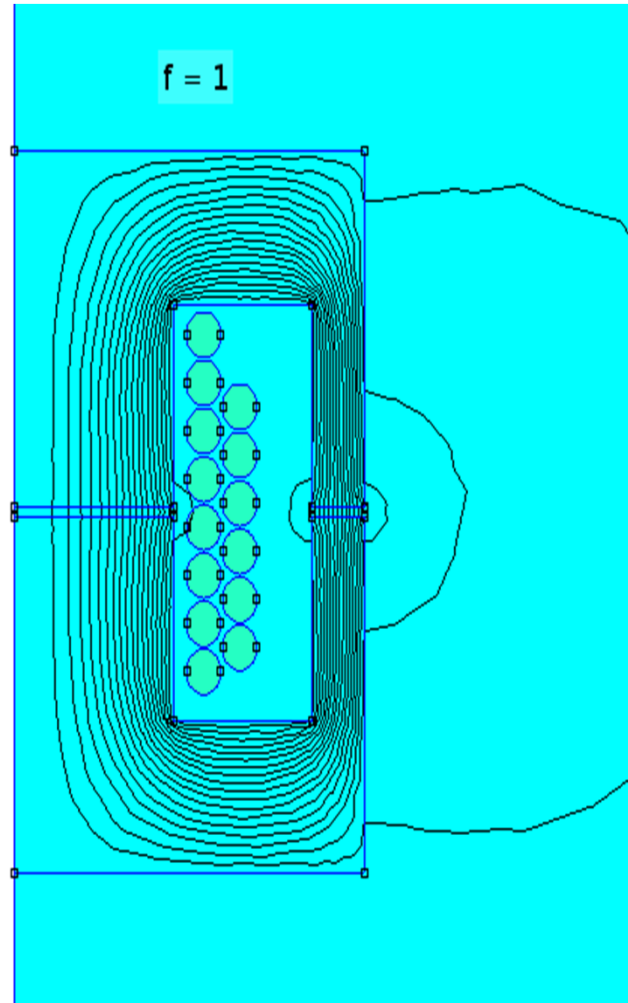


Fringing Flux



Fringing Flux Simulation



Litz Wire

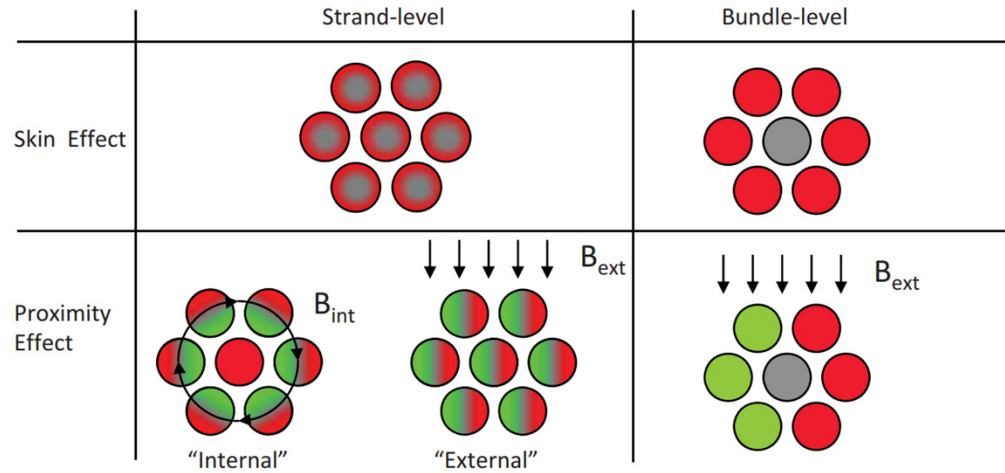
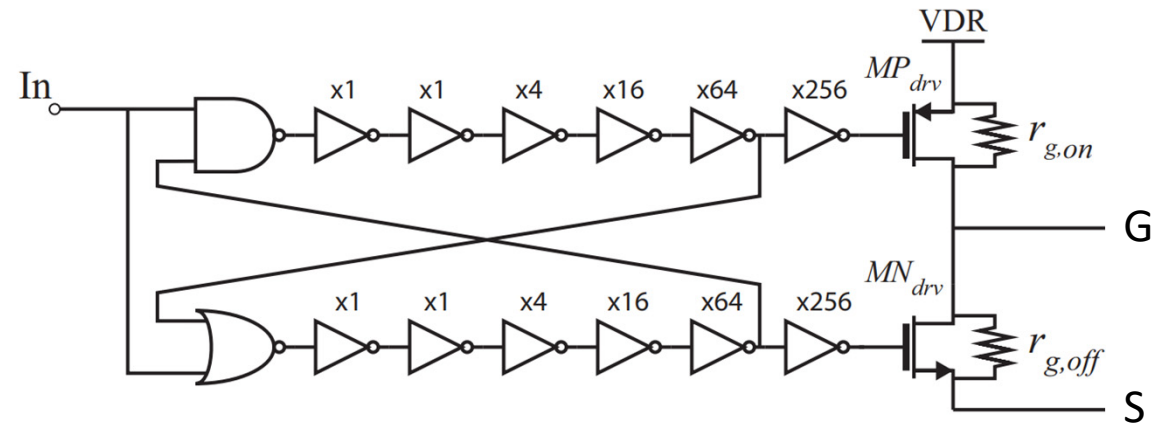


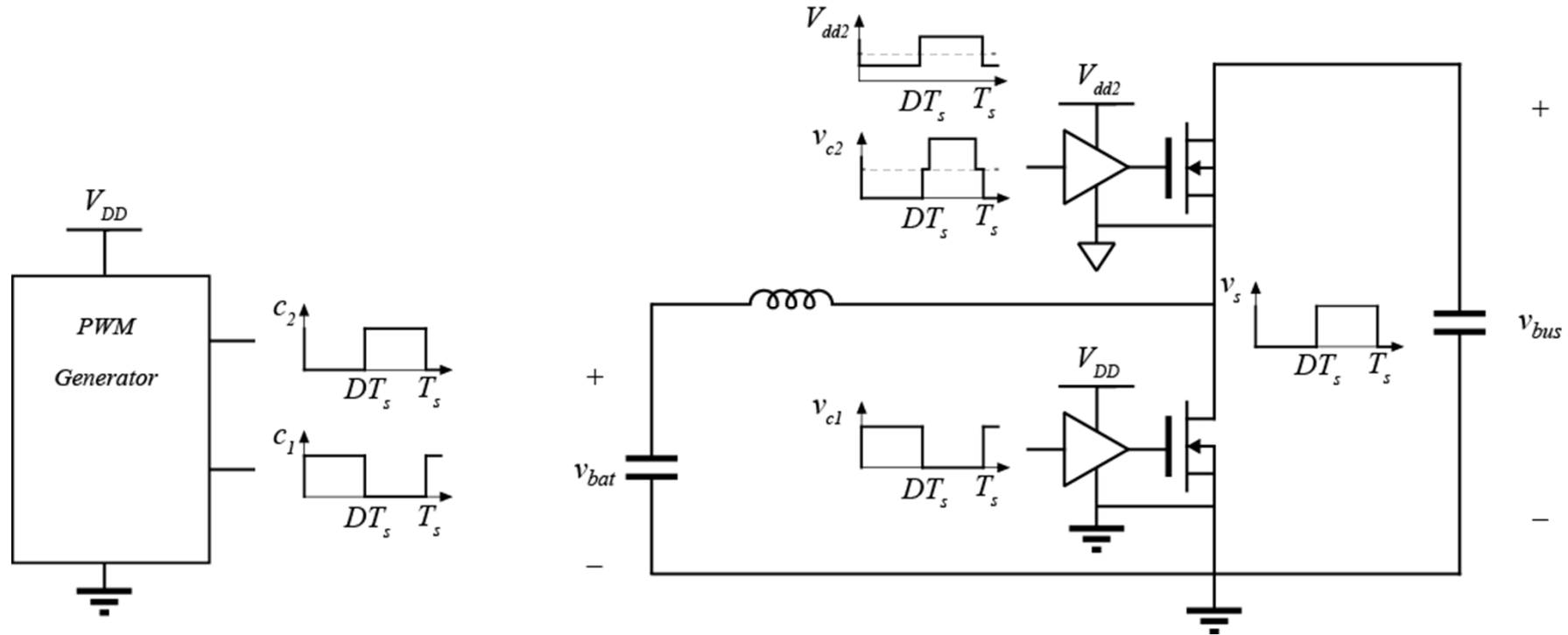
Fig. 1. Conceptual illustration of the types of eddy-current loss in litz wire. Note that the current distributions shown are not realistic for the wire construction shown, but instead show what would hypothetically happen if only the effect being illustrated were in effect and the others were magically turned off.

PRACTICAL TOPICS IN SMPS IMPLEMENTATION

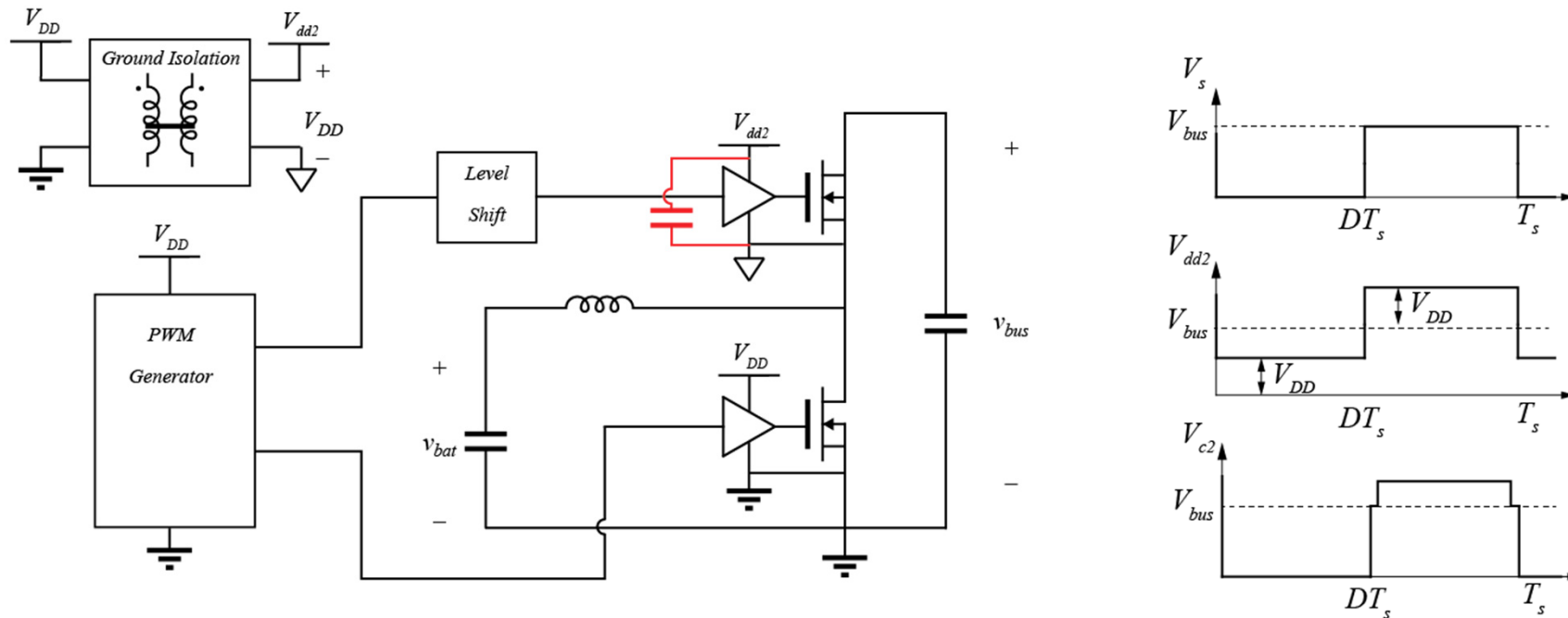
Gate Driver Implementation



Gate Driver: High Side Signal Ground



Generating Floating Supply



- Isolated supplies sometimes used; Isolated DC-DC, batteries
- Bootstrap concept: capacitor can be charged when V_s is low, then switched

Gate Driver: Bootstrap

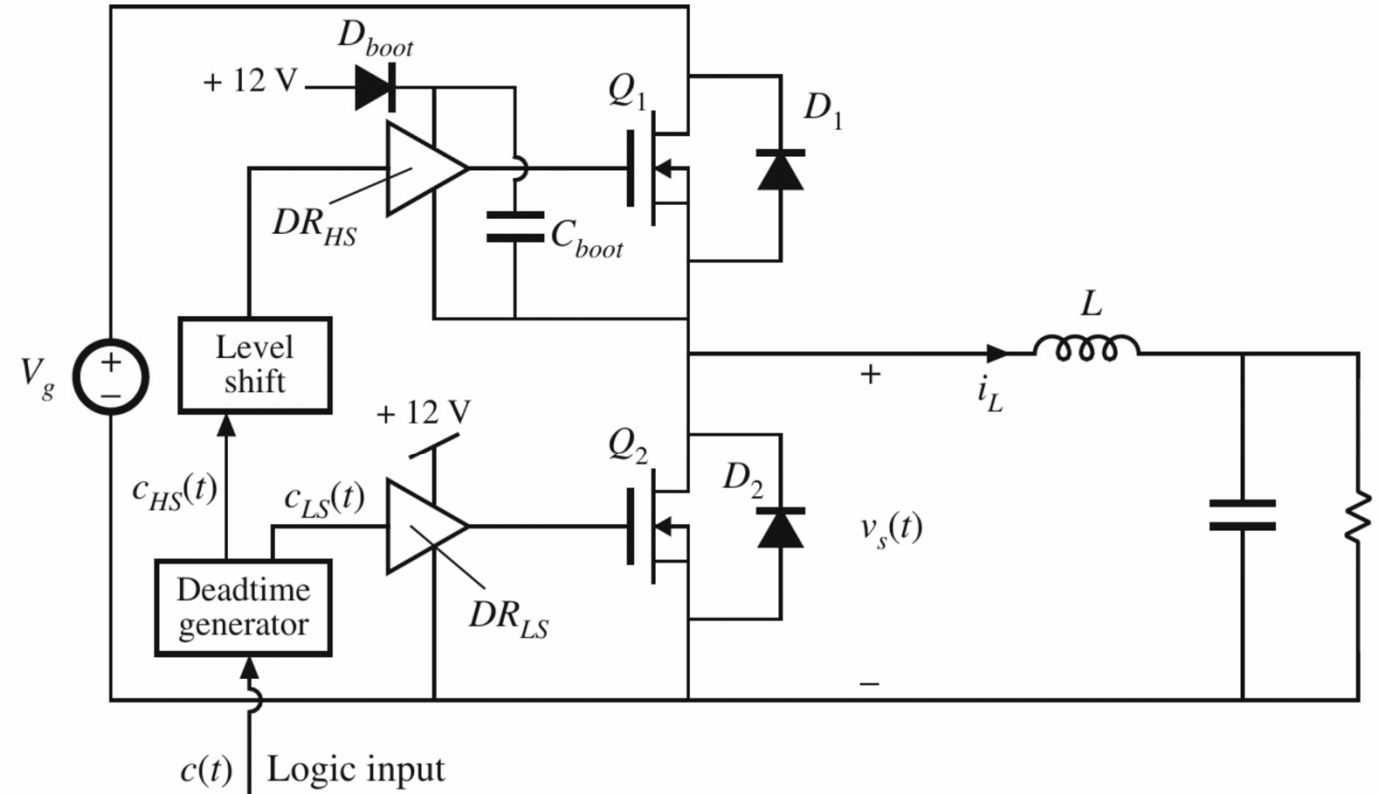
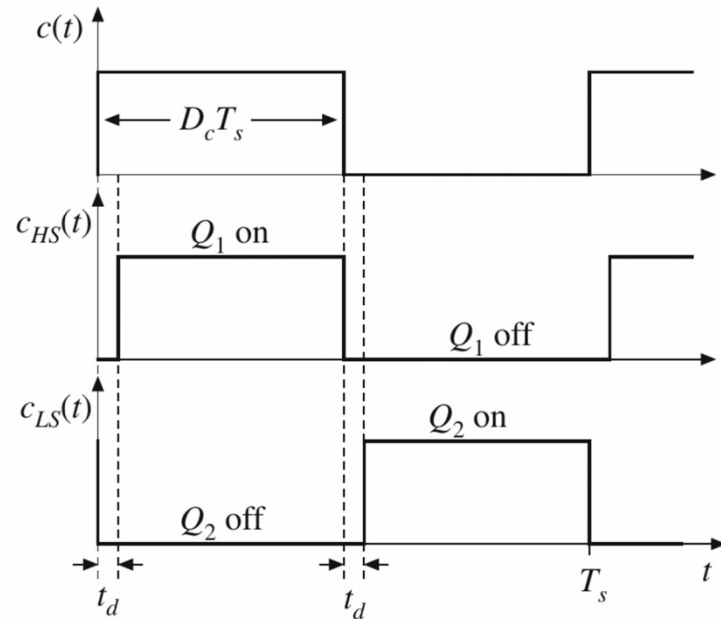
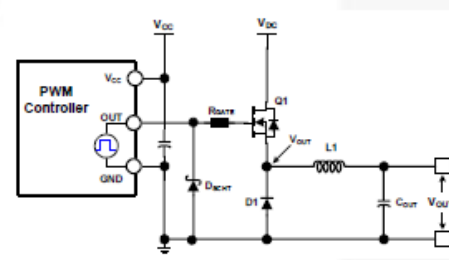


Fig. 4.54 Buck converter with MOSFET synchronous rectifier and half-bridge gate driver

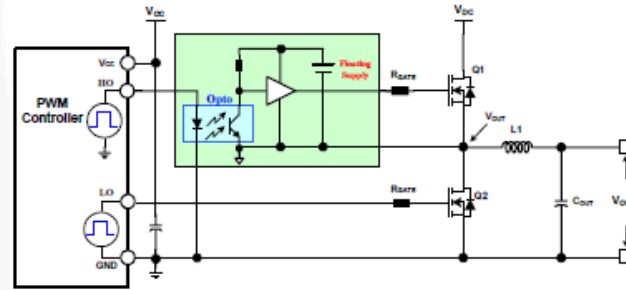
Direct Drive



Easiest high-side application the MOSFET and can be driven directly by the PWM controller or by a ground referenced driver, but it must meet two conditions, as follows:

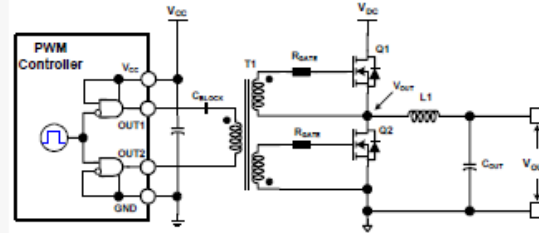
$$V_{CC} < V_{GS,MAX} \quad \text{and} \quad V_{DC} < V_{CC} - V_{GS,Miller}$$

Floating Supply Gate Drive



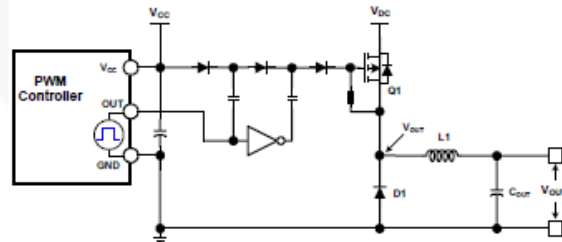
Cost impact of isolated supply is significant. Optocoupler tends to be relatively expensive, limited in bandwidth, and noise sensitive.

Transformer Coupled Drive



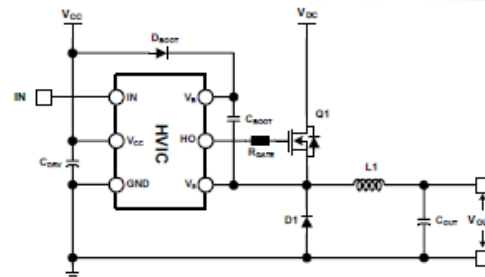
Gives full gate control for an indefinite period of time, but is somewhat limited in switching performance. This can be improved with added complexity.

Charge Pump Drive



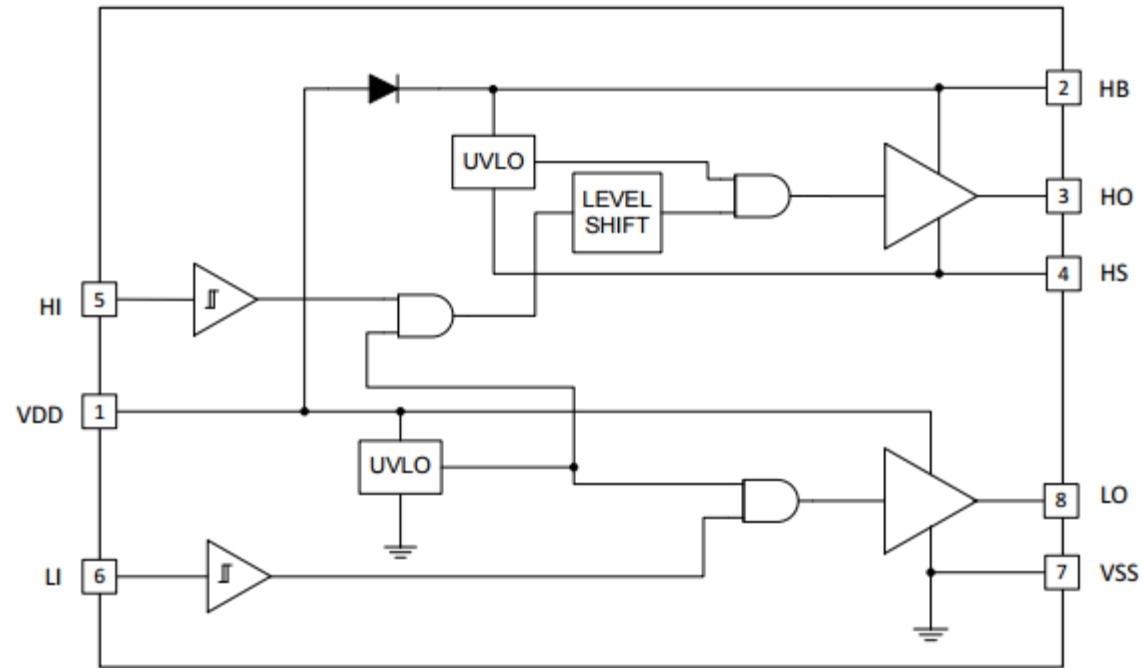
The turn-on times tend to be long for switching applications. Inefficiencies in the voltage multiplication circuit may require more than low stages of pumping.

Bootstrap Drive

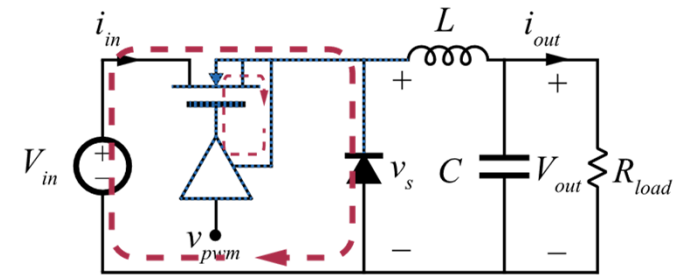
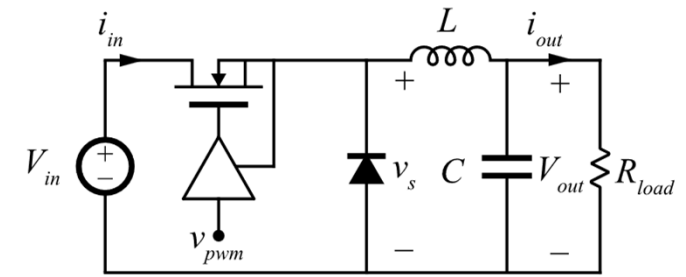


Simple and inexpensive with limitations; such as, the duty cycle and on-time are both constrained by the need to refresh the bootstrap capacitor. Requires level shift, with the associated difficulties.

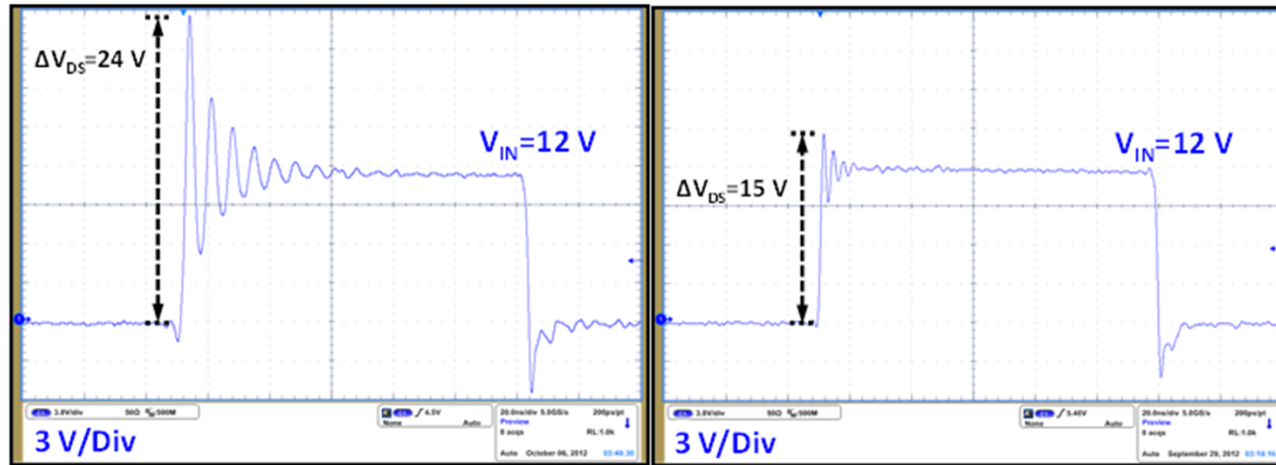
UCC27211a Internal Diagram



Practical Issues in PE: Parasitics

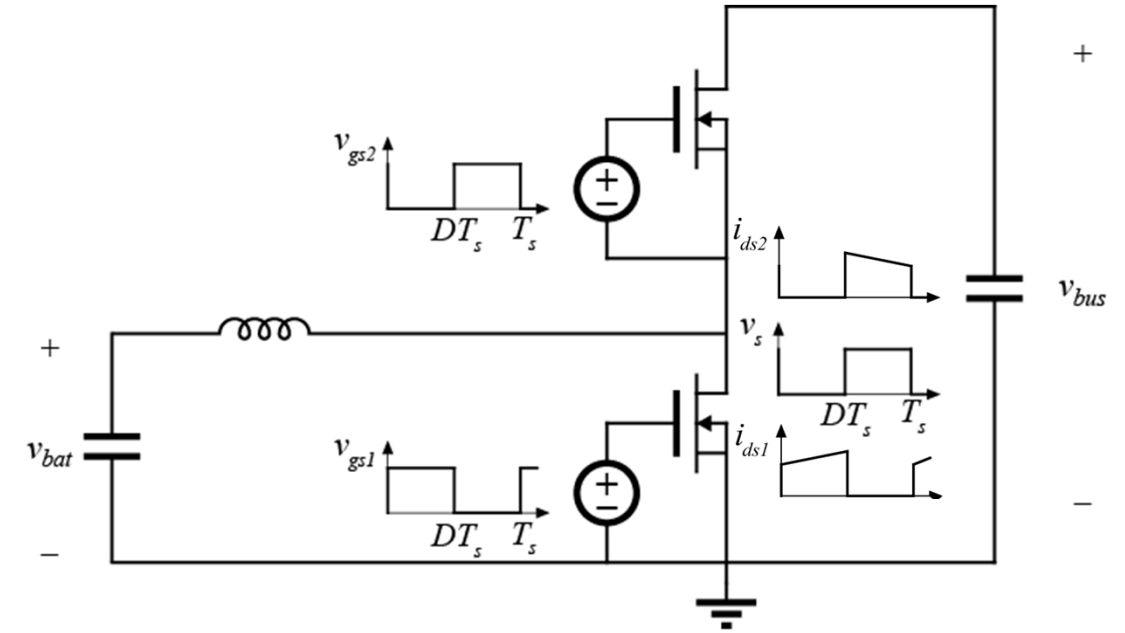


Real Switching Waveforms



(a)

(b)



Limitations on Switching Speed

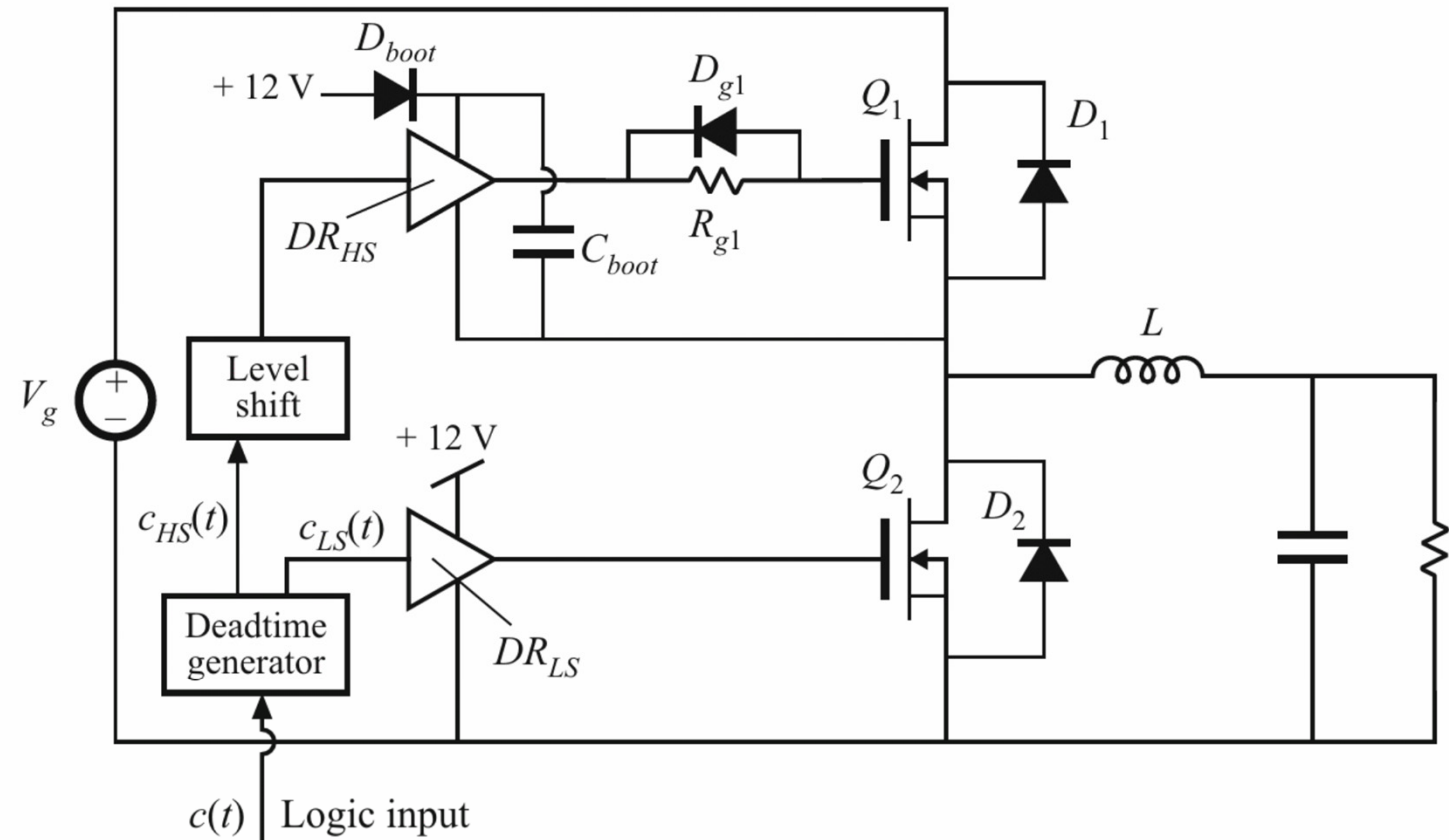


Fig. 4.58 Addition of resistor R_{g1} and diode D_{g1} between high-side driver and gate of Q_1 , to slow down the turn-on of Q_1 and maintain the V_{gs} of Q_2 below V_{th} during the Q_1 turn-on transition