Announcements

• Midterm Exam begins after class
  – Due Friday 10/23 by 5:00pm
  – No collaboration allowed
  – No web resources other than course webpage
  – Can ask questions to instructor

• Friday Lecture → Office Hours

Homework 7 Solution
Remaining Switching Losses

\[ V_g \]

Switching Losses:
1. \( \frac{C_{sw}}{C_{ssl}} \rightarrow \text{Eliminated} \)
2. Overlap - turn-on \( \rightarrow \) eliminated, turn-off \( \rightarrow \) may be worse
   \( \left( \frac{I_{sw}}{I_{ssl}} \right) \)
3. Reverse Recovery \( \rightarrow \) eliminated
4. \( Q_{off} \rightarrow Q_{g} \rightarrow \text{no change} \)
5. Body diode conduction \( \rightarrow \) (probably reduced)
6. Shoot-through \( \rightarrow \) (improved short)
7. Coil ringing \( \rightarrow \) (?)

Idealized Switching Waveforms

\[ i_{ds} \]

\[ t \]

Drop before turn-off

\[ V_{ds} \]

Limited overlap loss
Class-E Amplifier

Fig 2—Schematic of a low-order Class-E amplifier.

N. O. Sokal, “Class-E RF Power Amplifiers,” 2001

Class $\Phi_2$ Inverter

Fig 3—Actual transistor voltage and current waveforms in a low-order Class-E amplifier.

J. M. Rivas, O. Leitermann, Y. Han, A. D. Sagneri, and D. J. Perreault, “A High-Frequency Resonant Inverter Topology With Low-Voltage Stress”, 2008
Chapter 20: Resonant Switch Topologies

• Introduction

• 20.1 The zero-current-switching quasi-resonant switch cell
  20.1.1 Waveforms of the half-wave ZCS quasi-resonant switch cell
  20.1.2 The average terminal waveforms
  20.1.3 The full-wave ZCS quasi-resonant switch cell

• 20.2 Resonant switch topologies
  20.2.1 The zero-voltage-switching quasi-resonant switch
  20.2.2 The zero-voltage-switching multiresonant switch
  20.2.3 Quasi-square-wave resonant switches

• 20.3 Ac modeling of quasi-resonant converters

• 20.4 Summary of key points
The resonant switch concept

General idea:
- PWM switch network is replaced by a resonant switch network
- This leads to a quasi-resonant or quasi-squarewave version of the original PWM converter

Example: realization of the switch cell in the buck converter

High Frequency Switch Network

Converter examples

High-frequency view of the switch network

Basic switch implementation options
- Q: single-quadrant (transistor)
- D: single-quadrant (diode)
- Q: current-bidirectional (e.g. MOSFET)
- D: current-bidirectional synchronous rectifier (e.g. MOSFET)
ZVS-QSW: Review

Converter examples

High-frequency view of the switch network

Basic switch implementation options

Q: single-quadrant (transistor)
D: single-quadrant (diode)
Q: current-bidirectional (e.g. MOSFET)
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