

Unit 6 - Week 4

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Digital LDO, Technique to Avoid Limit Cycle Oscillations in Digital LDO

Hybrid LDO, Short-Circuit Protection

Hiccup Mode and Foldback Current Limit

Introduction to Switching Regulators

Volt-second Balance, Non-Idealities in the Power Stage of a Buck Converter

Transformer Model of a Buck Converter, Conduction Efficiency, Efficiency of an LDO versus Efficiency of a Switching Regulator

Synchronous versus Non-Synchronous Switching Regulators, PWM Control Techniques

Losses in Switching Regulators (Conduction Loss, Gate-Driver Switching Loss)

Dead-Time Switching Loss in DC-DC Converters

Quiz : Assignment 4

Week 5

Week 6

Week 7

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Download Videos

Assignment solutions

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-02-26, 23:59 IST.

1) State whether the following statement is true or false. "For fixed input and output voltages, the duty cycle of a switching buck converter increases with an increase in the gate driver switching losses."

1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

2) State whether the following statement is true or false. "For fixed input and output voltages, the duty cycle of a switching buck converter increases with an increase in the dead-time switching losses (arising from increase in the dead-time)."

1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

3) State whether the following statement is true or false. "If both the high-side and low-side switches in a switching buck converter have the same ON-resistance, then for a fixed input voltage and a fixed load current, ignoring losses due to the inductor ripple current, the conduction loss of the converter does not change with an increase in the output voltage."

1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

4) Fill in the blank with one of the given choices. "For fixed input and output voltages, when $D > 0.5$, the inductor ripple current of a buck converter operating at a fixed switching frequency ____."

1 point

- increases with an increase in R_{DCR}
 decreases with an increase in R_{DCR}
 does not depend upon R_{DCR}

No, the answer is incorrect.
Score: 0

Accepted Answers:
does not depend upon R_{DCR}

5) State whether the following statement is true or false. "Limit-cycle oscillations in a digital LDO can be avoided by making the resolution of the A/D converter more than that of the output D/A converter."

1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

6) If the output time constant of a digital LDO is $10 \mu\text{s}$, what is the fastest possible update rate of the accumulator while ensuring stable operation?

1 point

- 100 Hz
 1 kHz
 20 kHz
 100 kHz

No, the answer is incorrect.
Score: 0

Accepted Answers:
20 kHz

7) State whether the following statement is true or false. "In a hybrid LDO, it is preferable to have the digital LDO delivering the bulk of the load current."

1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

Consider the switching converter shown in Figure 1, for questions 8 to 12. It is designed for the following specifications. $V_{IN} = 5 \text{ V}$, $V_O = 1.2 \text{ V}$, switching frequency (f_{SW}) = 1 MHz, $L = 1 \mu\text{H}$, $C_O = 10 \mu\text{F}$ and $R_O = 1.2 \Omega$. Assume that inductor $R_{DCR} = 100 \text{ m}\Omega$, R_{DS_ON} of $M_P = 200 \text{ m}\Omega$, R_{DS_ON} of $M_N = 100 \text{ m}\Omega$, gate capacitance of $M_P = 25 \text{ pF}$ and that of $M_N = 10 \text{ pF}$. Adhere to the units mentioned in the question while filling in numerical answers. The duty cycle D always lies between 0 and 1.

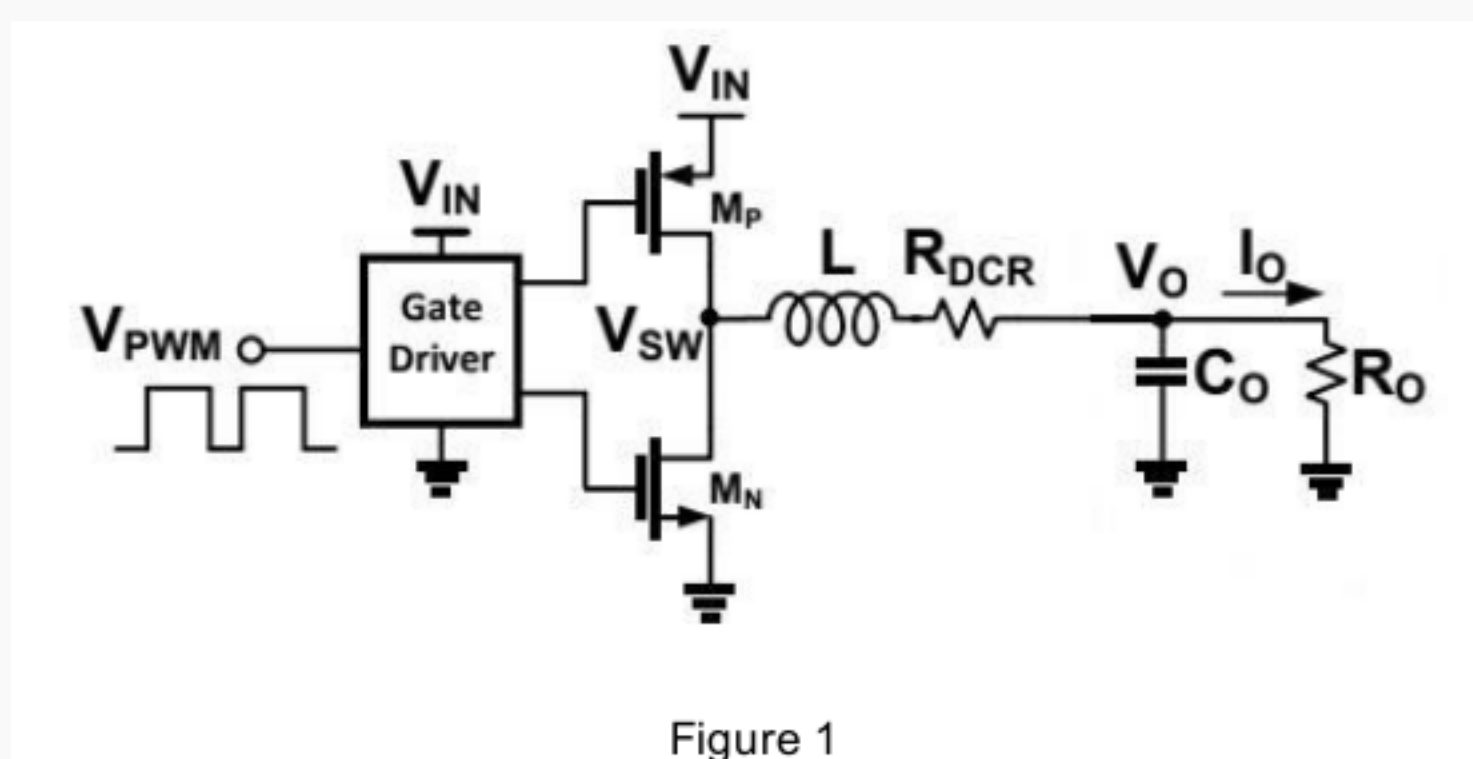


Figure 1

8) Fill in the blank with a numerical answer: The duty cycle of V_{PWM} (in respect of the converter shown in Figure 1) is $D = \underline{\hspace{2cm}}$ (up to 3 decimal places).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.279,0.291

2 points

9) Fill in the blank with a numerical answer: The average voltage drop across R_{LOSS} (in respect of the converter shown in Figure 1) is $V_{LOSS} = \underline{\hspace{2cm}}$ mV (up to 1 decimal place).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 224.1,233.1

1 point

10) Fill in the blank with a numerical answer: The average current drawn from V_{IN} (in respect of the converter shown in Figure 1) is $I_{IN} = \underline{\hspace{2cm}}$ mA (up to 1 decimal place).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 279.8,291.4

1 point

11) Fill in the blank with a numerical answer: The gate switching losses (in respect of the converter shown in Figure 1) amount to $\underline{\hspace{2cm}}$ μW (up to 1 decimal place).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 865,885

1 point

12) Fill in the blank with a numerical answer: The overall efficiency of the converter shown in Figure 1 (ignoring the losses due to inductor ripple current and dead-time) is $\eta = \underline{\hspace{2cm}}$ % (up to 1 decimal place).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 82.3,85.7

2 points