



西安电子科技大学
XIDIAN UNIVERSITY

Integrated DC-DC Converter

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March 16, 2017

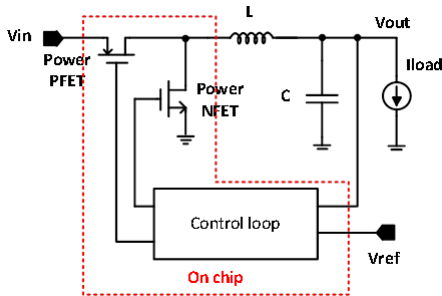


Figure 1: architectural of this design

- ▶ Could convert the $V_{in}(2.5V-5V)$ into a fixed $V_{out}(1.8V)$
- ▶ Using the voltage mode to achieve loop control
- ▶ Using PID compensation to achieve 1MHz system unity gain bandwidth ($V_{in}=3.6V$, $I_{load} = 300mA$)

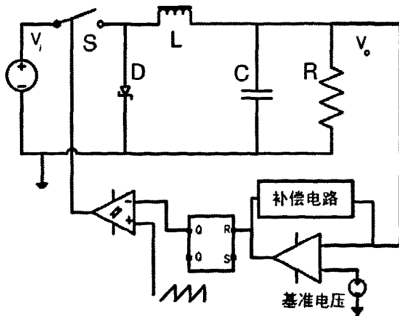


Figure 2: diagram of voltage control model

What need to be done:

- Realize a high speed comparator
- Realize a high gain operational amplifier

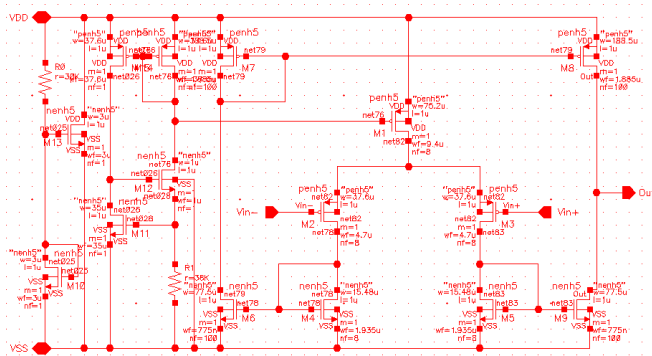


Figure 3: schematic of comparator

- ▶ It's easy because it do not need compensation
- ▶ Large current can enhance voltage swing



The diagram shows a three-stage operational amplifier. The first stage is a differential input stage with two op-amp blocks, I12 and I14, and a third op-amp block I15. The second stage is a common-mode input stage with two op-amp blocks, I13 and I16. The input signals are Vref (differential-mode input) and Vin (common-mode input). The output of the differential stage is Vout1 and the output of the common-mode stage is Vout2. The final output is Vout.

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- ▶ Deadtime is different when the value of $r1/r2$ varies

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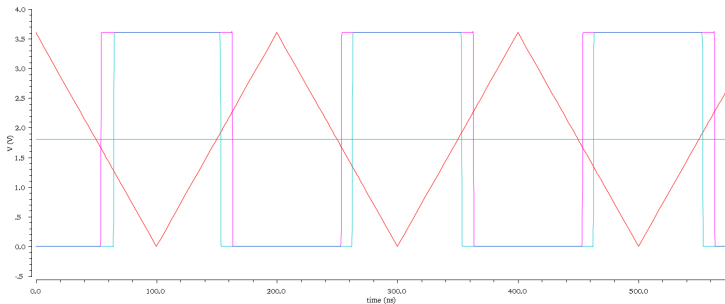


Figure 5: waves of deadtime generator simulation

- ▶ The circuit can generate waves that we want
- ▶ There is nonideal surge voltage hen it drives power MOSFET

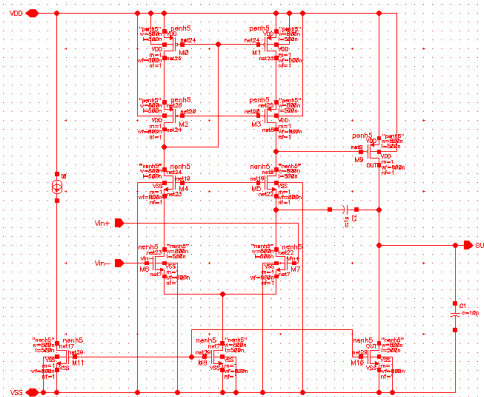


Figure 6: schematic of operational amplifier

Problems:

- ▶ Why it can work without a DC operation point?
- ▶ Why an EA have different simulation results when V_{in} differs



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THANK YOU!