Power Management for Biomedical Applications

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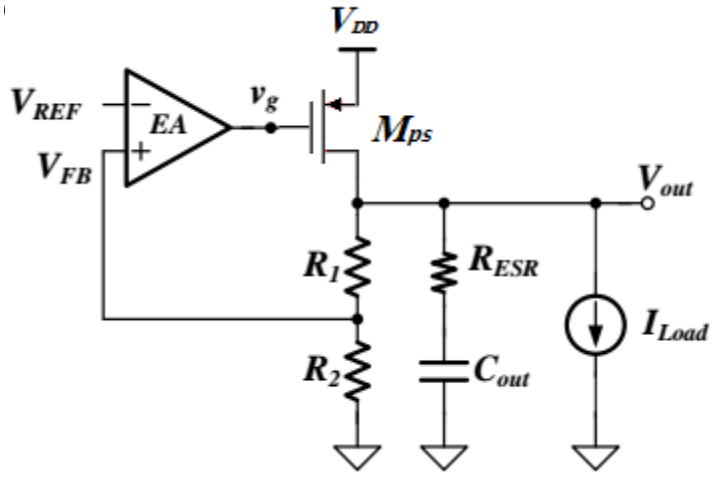
How to realize

- Take LDO topology for power management
- A low dropout LDO voltage regulator is a DC to DC regulator to provide a stable DC output voltage.
- Take LDO with ESR compensation to output a stable voltage of 2V with load current from 1mA to 100mA and analyze the properties of LDO.

LDO circuit Design

- LDO is composed of 5 parts : Power MOSFET, Error Amplifier, Feedback Resistors, Output Capacitor, Bandgap Reference Voltage.

- When there is a deference on ILoad, Vout and VFB will change accordingly. If VFB is smaller than VREF, the current of Power MOSFET increases which makes Vout rais
  and vice versa.



Properties of LDO Circuit

- Concerning the Dropout Voltage at heavy load, Line Regulation, Load Regulation, Undershoot, and Overshoot.

- Dropout Voltage is the difference between V_{DD} and V_{out} when the V_{out} starts to be stable.

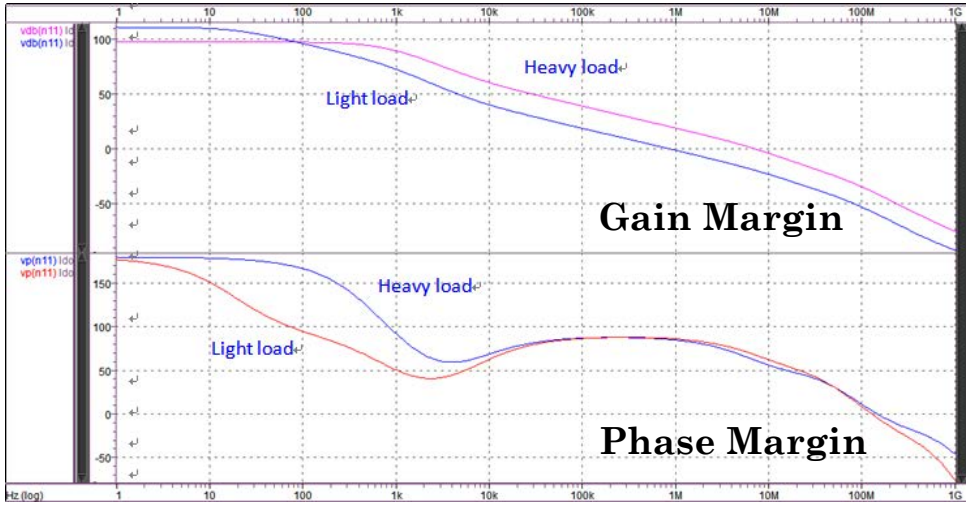
- *Line Regulation* = $\triangle V_{out} / \triangle V_{in}$

  Load Regulation = $\triangle V_{out} / \triangle I_{out}$

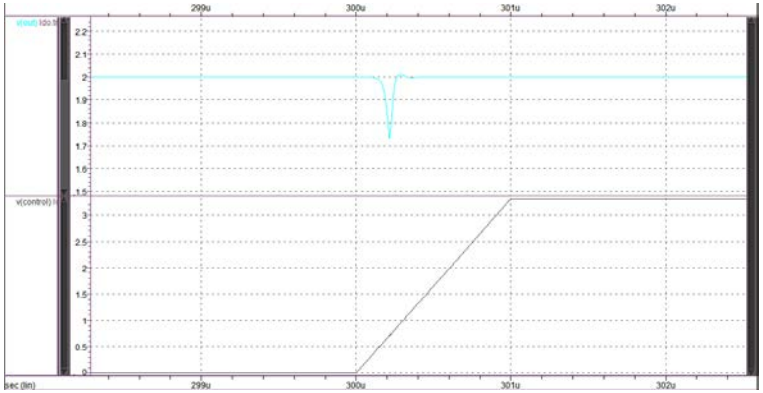
- Undershoot is the variation of V_{out} when the load changes from light to heavy. Overshoot is the variation of V_{out} when the load changes from heavy to light

Simulation Results

AC Response

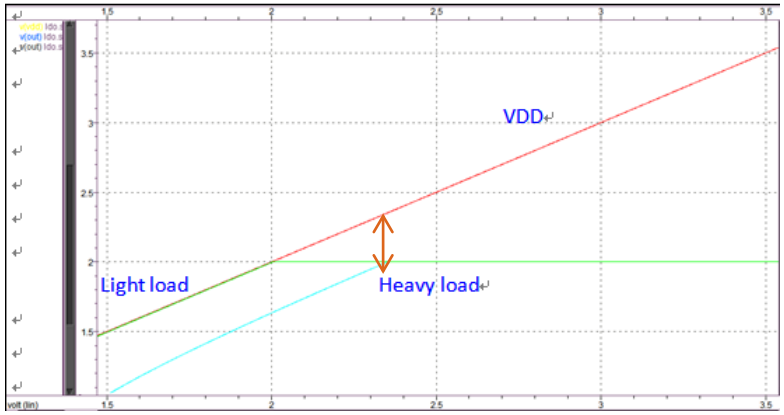


Undershoot



Load step from 1mA to 100mA in 1μs

Dropout Voltage



Parameters	Value		Parameters	Value	
Input voltage	2.7V~3.6V		Line regulation	0.19mV/V	
Dropout Voltage @I_{Load}=100mA	353mV		Load regulation	0.45mV/A	
DC gain	1mA	111dB	Light load to Heavy load	Undershoot	0.27V
	100mA	97.3dB		Recovery time	0.6us
Phase margin	1mA	86.5°	Heavy load to Light load	Overshoot	0.25V
	100mA	61.4°		Recovery time	3us