POWER MANAGEMENT FOR
BIOMEDICAL APPLICATIONS
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 $I_{Load}$, $V_{out}$ and $V_{FB}$ will change accordingly. If $V_{FB}$ is smaller than $V_{REF}$, the current of Power MOSFET increases which makes $V_{out}$ raise 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.

- \textit{Line Regulation} = \frac{\Delta V_{out}}{\Delta V_{in}}

- \textit{Load Regulation} = \frac{\Delta V_{out}}{\Delta 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

Gain Margin

Phase Margin

Undershoot

Load step from 1mA to 100mA in 1μs

Dropout Voltage

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>2.7V~3.6V</td>
<td>Line regulation</td>
<td>0.19mV/V</td>
</tr>
<tr>
<td>Dropout Voltage @ILow=100mA</td>
<td>353mV</td>
<td>Load regulation</td>
<td>0.45mV/A</td>
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<tr>
<td>DC gain</td>
<td></td>
<td>Light load to Heavy load</td>
<td>Undershoot</td>
</tr>
<tr>
<td>1mA</td>
<td>111dB</td>
<td>Recovery time</td>
<td>0.6us</td>
</tr>
<tr>
<td>100mA</td>
<td>97.3dB</td>
<td>Heavy load to Light load</td>
<td>Overshoot</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recovery time</td>
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