High-Efficient Charge-Pump for Non-Volatile Memories

MP2-07

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A charge pump is a DC-DC converter that is commonly used to generate voltages larger than the available supply voltage for non-volatile memories, in the context of low voltage switched-capacitor systems and integrated amplifiers. The technological paradox common today is this: devices are constantly scaling down in size while becoming more demanding in terms of power consumption, especially in the realm of mobile electronics. Consequently, designing efficient charge pumps meeting these stringent requirements is becoming an evermore complex and interesting task for engineers.

**Aims**

In this project, we are aimed at studying and optimizing the charge pump on the purpose of high efficiency and fully on chip for low power application. In order to reduce the production cost, N-Well CMOS Technology is used instead of using the expensive Twin-well CMOS Technology.

**Design Specification**

<table>
<thead>
<tr>
<th>Technology</th>
<th>0.35um N-Well CMOS Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplied voltage</td>
<td>1.2V</td>
</tr>
<tr>
<td>Frequency</td>
<td>10MHz</td>
</tr>
<tr>
<td>Output current</td>
<td>10uA</td>
</tr>
<tr>
<td>Output ripple voltage</td>
<td>&lt;50mV</td>
</tr>
<tr>
<td>Flying capacitance</td>
<td>2.5pF</td>
</tr>
<tr>
<td>Load capacitance</td>
<td>10pF</td>
</tr>
</tbody>
</table>
In this project, PMOS pass transistors with dynamic control of the gate and body voltages are presented. By controlling the gate and the bulk of each pass-transistor, the voltage loss due to the device threshold is removed.
The above table shown the dual charge pump has the highest output voltage among the three circuits for 5 stages at the same current level 10uA with 1.2V input voltage.

Which shown that the dual charge pump has the highest output voltage among the three circuits have the same current level 10uA

Which shown that the output ripple voltage is less than 50mV for all four circuits.