

Ultra-Low Power Electronics Using Floating-Gate Transistors

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PROJECT DESCRIPTION

The goal of this project is to develop techniques and methods for floating-gate circuits that allow the same degree of design automation as digital standard-cell design does today but resulting in circuits with three to four orders of magnitude lower energy consumption.

INTRODUCTION

In recent years there has been a growing interest in research in digital design for ultra-low power consumption. Here the figure of merit is basically only the power consumption and the speed requirements are low or very low. Self-contained systems with own power supply where the energy resources must sustain for their entire lifetime need ultra-low power circuits. By using floating-gate transistors operating in sub-threshold mode, large reductions in energy consumption can be achieved.

UV-PROGRAMMABLE FLOATING-GATES

In this project we are working with floating-gate circuits manufactured in a standard CMOS technology. The voltages on the floating-gates are controlled by a post-fabrication process that is called “programming”.

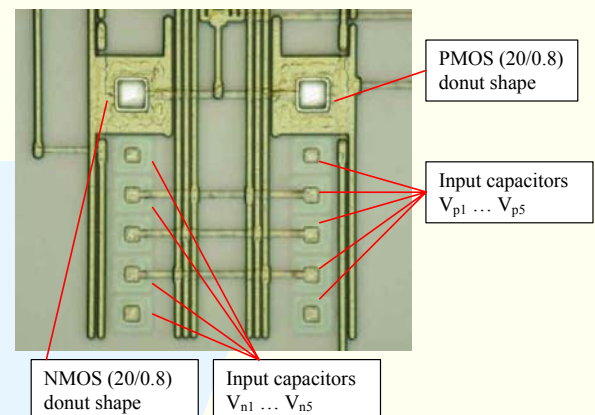
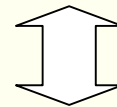
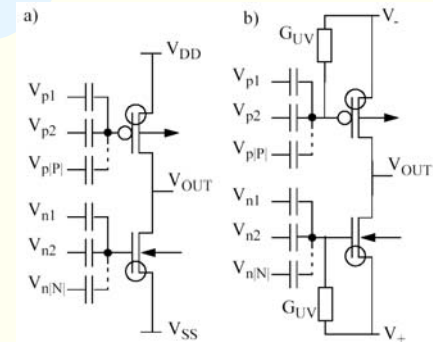
The main motives for using floating-gates are:

- Enables compact implementations of logic gates using Linear-Threshold Elements
- Sub-threshold operation is facilitated by a post-fabrication step for cancellation of processes variations

The post-fabrication step:

- For programming, UV-light is used for activation of electrical paths to the floating-gates
- Programming enables post-fabrication tuning of threshold voltage of the floating-gate transistor

LINEAR THRESHOLD ELEMENTS



PROGRAMMING AND CHARACTERIZATION SITE

