# Modeling of double gate MOSFETs

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<th>Project ID number:</th>
<th>PV1-02</th>
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**Aim and objectives**

Our aim is to carry out simulations of double gate (DG) MOSFETs. The objectives are to improve the performance of MOSFETs by studying the MOSFETs with double gate.

**Introduction**

DG MOSFET have many potential advantages over single gate (SG) MOSFET. This project is a simulation-based project to model the performance of DG MOSFETs. We choose the software, Medici, to construct, design, simulate and test the MOSFETs. Newly designed SG and DG MOSFETs were constructed.

**Background**

**What is double gate MOSFETs?**
- New type of MOSFET
- Similar to Single Gate MOSFET
- Top gate and Bottom gate

**Advantages of DG MOSFETs**
- Smaller in size
- More applications
- OR gate on single MOSFET
- Separate control of both gates.
- Reduced short channel effects
- High channel mobility
- Better electrostatic control of channel and scaling potential
- Reduction of the sub-threshold slope

**Experiments**
- 1nm-5nm Oxide thickness
- 10nm-20nm Silicon thickness
- 100nm-500nm Channel lengths

**Structures**

*Structure of single gate MOSFET*

*Structure of double gate MOSFET*
Double gate MOSFETs with smaller size and better performance compared with SG MOSFET have been obtained. The DG MOSFETs can have separate control of both gates by different voltages, higher channel mobility and higher Idsat, and better short channel effect with small channel length, Si and oxide thickness. The saturation drain currents of DG MOSFETs are nearly two times of that of SG MOSFETs, giving a better current drive.
Potential contours of single gate MOSFETs with channel lengths from 50nm to 500nm

Potential contours of double gate MOSFETs with channel lengths from 50nm to 500nm

Comparison of Saturation Drain Current (Idsat) versus Saturation Drain Voltage (Vdsat) of Single gate MOSFET and double gate MOSFET of Channel Length 450nm.

Drain Current (Id) versus Gate Voltage (Vg) with Drain to Source Voltage(Vds)=2V of single gate MOSFET and double gate MOSFET with oxide thickness=5nm

Double Gate MOSFETs with Vds=2V, si=20nm, with different oxide thickness

Comparison of Double Gate Threshold Voltage vs Channel Length, Vds=2V of bg=-5 and bg=-3, with top gate set from -3V to 2V and top gate with bottom gate applied same voltage from -3V to 2V