

Effective Mobility Lesson

Lesson Topic: Effective Mobility

Objective of Lesson: To understand how the gate field in a MOSFET pulls carriers to the semiconductor-oxide interface, increasing.

Reading Assignment: Section 17.2.1

Discussion Questions:

1. Why does the effective mobility decrease with increasing $V_G - V_T$?
2. Why do we plot effective mobility versus $V_G - V_T$ rather than V_G ?

Homework: None

What do you need to know for the exam?

1. What is the effective mobility?
2. Why does the mobility decrease in the channel of a MOSFET relative to a bulk semiconductor with the same doping concentration?
3. Why does the MOSFET channel mobility decrease further with increasing $V_G - V_T$ (n-MOSFET)?

Summary

The MOSFET has a field normal to the flow of carriers and that field pulls carriers to the semiconductor-oxide interface where they scatter off the interface. This additional scattering mechanism reduces the mobility of the carriers crossing the channel.

Effective Mobility

The ideal MOSFET is turned on by applying a bias to the gate, attracting carriers to what will be the conducting channel. This field is normal to the flow of carriers and that field pulls the channel carriers to the semiconductor-oxide interface where they can scatter off the interface. This additional scattering mechanism reduces the mobility of the carriers crossing the channel to a mobility below what it would be in a bulk semiconductor—this is the effective mobility. The animation we have linked to earlier illustrates this mechanism and discusses the equations used to derive the effective mobility.

This is a brief section of the text. It is a simple concept that is explained clearly in the text. Figure 17.7 summarizes all the discussion with a figure showing how the mobility is affected by the strength of the field originating with the gate—indirectly through the gate bias.

Get the point of “effective” mobility and I think you should understand the key concepts here.

Other Useful Links

[MOSFETs demo](#)

Definitions

Effective: Existing in fact, actual.