



Design of Semiconductor Devices

Fall 2016

10510ENE 535500

半導體元件設計

Design of Semiconductor Devices

CLASS INFORMATION

- Professor: 林崇榮
- Office: 台達903 (cjlin@ee.nthu.edu.tw ; ext. 62182)
- Handout: TBD
- TA: 孟尹、嘉玲(教育107 ext. 34107)
- Class: F2F3F4 (台達201)
- Reference: Handouts

Course Description

In this course, lessons consisting of VLSI device measurement and characterization by lectures and assigned projects, which developing students' CMOS device knowledge acquired in the previous device physics class. Students learn to know the characterization and design method of CMOS devices. They also learn to take accurate current, capacitance properties, bench measurement and test details. Extended device TCAD simulation is also performed and practiced. CMOS design rule and integration will be taught in class. New device design for layout and tape-out will be drafted for students and aspects of the new device characterization will be discussed.

Course Outcomes

- ❑ Understand CMOS Integration and Design Rule
- ❑ Understand CMOS Technology, Device Layout, and Process
- ❑ Execute the TCAD Process/Device Simulation for Assigned Performance
- ❑ Measure and Characterize Devices Accurately
- ❑ Compare and Discuss Simulation and Measurement Results from Process and Device Physics Viewpoints
- ❑ Stress Devices to Understand the Limitation and Reliability of CMOS Devices
- ❑ Design New CMOS Device to Obtain Required Performance and Application

Syllabuses

- Lecture of CMOS Logic Process & Technology (R201) 10/7
- TCAD Tool Training (TA's Time/R201) 10/14
- TCAD Simulation (Process / Device) **10/21, 10/28, 11/4**
- Measurement & Lab Training (TA's Time/EDU R111) 11/18
- Device Characterization (EDU R111) **11/25, 12/2, 12/9**
- New Device Simulation (Process / Device) 12/23 ~ **12/30**
- New Device Layout (0.18um) 1/6 ~ **1/20**

Class Presentation (R201): 11/11 (TCAD) ; 12/16 (Meas) ; 1/13 (New)

Date of Submitting Report to TA: The Dates in Blue

Grading Policy

- ▣ 30% - Participation and Attitude
- ▣ 40% - Reports
- ▣ 30% - Presentation

Final Project by Team

- 1. MTP (ref. EEPROM)
- 2. Oxide Breakdown OTP (ref. Kilopass/eMemory)
- 3. Floating Gate OTP (ref. eMemory/Impinj)
- 4. >32V HV MOSFET (ref. Drain Diffusion MOSFET)
- 5. 1.0V to 15V Charge Pump (ref. 4-Phase Pump)
- 6. 6T/8T/10T SRAM Cell (ref. CMOS SRAM)
- 7. 3T/4T CIS Pixel (ref. Photo Diode / Image Sensor)
- 8. eFuse/metal Fuse Cell (ref. metal or silicide Fuse)