

Take a Glance at the Semiconductor LSI World ~Where SMALL Chips Lead the LARGE Industry~

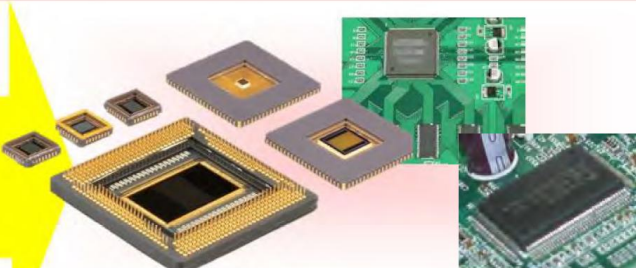
Advisers: Professor Rihito Kuroda
Assistant Prof. Takezo Mawaki
Open Seats: 6 students
Term: 2nd Semester



Course Description

*Almost EVERYTHING used
in the Human Society/Industry*

Semiconductor LSIs are working inside



What are
Semiconductor
LSIs ?

How Are They
Functioning ?

How Are They
Fabricated ?



Have You Ever Imagined ?

Semiconductor LSI chips are used in almost any scene of the today's human society. It's no exaggeration in saying that our life style highly relies on the Semiconductor LSI. However, not many people know the roles of the Semiconductor LSI chips and reason why they are so spread out. It's because the chips are so tiny and hidden deep inside of the electrical goods. Or, even though one finds a chip, it looks just like a "BLACK BOX". This interaction course offers you to experience in dismantling Semiconductor LSI chips, microscopic observation and LSI Layout pattern analysis, and take you to the **HUGE WORLD** expanding in the **SMALL BLACK BOXES**.

Contact information

email : takezo.mawaki.c3@tohoku.ac.jp

TEL : 022-795-4833

Electronic Engineering, and Information Engineering (ECEI) Building No.2, 4th floor, Room 404

(<https://www.eng.tohoku.ac.jp/map/?menu=campus&area=d&build=12>)

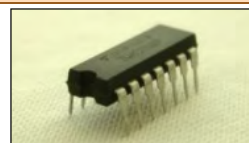
Course Schedule

1: Introduction

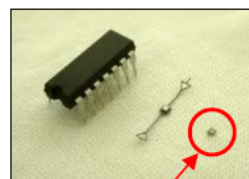
Lab.

2: Dismantling a Semiconductor Chip and Microscopic Observation

You will analyze deeply one of the basic Semiconductor LSI chip "series 74". Starting with taking the LSI chip out from the black box by using chemical solutions. Using a microscope, you will observe how the LSI chip look like in detail and take photos of it. Also, you will have a tour to the "clean room" and study the special facility and "process equipments" necessary for the LSI chip fabrication.



LSI Chip 「74HC00」

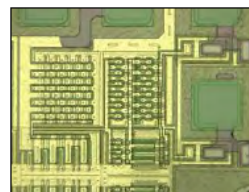


Chip been peeled out

3: Overall study of the Semiconductor LSI chips

Lab.

You will enlarge the microscopic images of the LSI chip from the previous lecture, and put together to complete the whole view of the LSI chip. Doing so, you will study the overall view of the LSI chips.

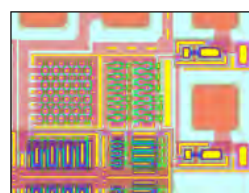


Microscopic View of the LSI world

4: Tracing the Circuit Patterns of the LSI chips

Lab.

You will take a look at the patterns on the LSI chip, and copy the patterns on the transparent sheet. Each pattern, each color and shape has its function. After understanding their function, you will feel yourself just like a circuit designer.

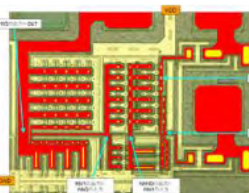


Tracing the Circuit Structure

5: Semiconductor LSI Chip Circuit Analysis

Lec.

Lectures will be given on the detailed functions and fabrication processes of the LSI chip that you have analyzed. Lectures will also cover the operation of the Semiconductor LSI, "how they operate calculations."



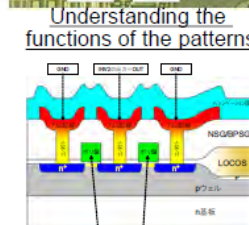
Understanding the functions of the patterns

6: Semiconductor LSI Chip Board Making (1)

7: Semiconductor LSI Chip Board Making (2)

Lab.

You will actually operate the Semiconductor LSI chips. To do so, you will need to make a "Circuit Board". It's a green board with LSI chips that you may have seen. Lab work will be an exercise of the electrical handicraft, starting from "how to use a soldering irons" and so on.



Cross section view and fabrication process

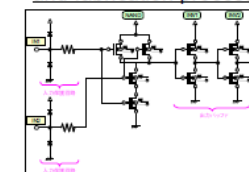
8: Electrical Measurement of the LSI Chip (1)

9: Electrical Measurement of the LSI Chip (2)

Lab.

Lab.

Using the board that you have made, you will experience the operation of the Semiconductor LSI chips. You input various signals to the LSI chips. What's the output? Are they functioning same as what you have estimated from the lecture 4 and 5?

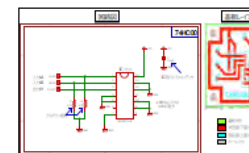


A physical chip to the circuit schematic

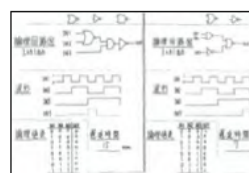
10: LSI Chip Circuit Design and Simulation

Lab.

What do you need in order to fabricate and operate the Semiconductor LSI chip just as you design? You will experience the computer aided design tools for the circuit design and simulation tools for the circuit simulation that enables you to predict the circuit performance before the actual chip fabrication.



A Board to operate LSI chip



LSI Chip Operation and Measurement