## 2.2.1 Silicon and Microelectronics

## What is Microelectronics?

Flat Chip Test Strucures Wafer (150 mm diameter) and chips (16 Mbit DRAM memories from about 1990)

If you don't have some idea about what "microelectronics" means, you might be studying the wrong subject. So let's be brief: Microelectronic means that

- Many basic electronic components are integrated into an integrated circuit, an "IC"
- The components of choice are mostly transistors, sometimes capacitors, rarely resistors, and almost never inductors.
- Integrated transistors come in two variants:
  - MOS transistors

## Bipolar transistors

**MOS** transistors are the most popular ones, and **MOS technology** (especially in the variant **CMOS** technology) is the name of the major game in semiconductor technology. You know all there is to know at present about these transistor types because you learned it before - see the links from above.

- Usually, integration means that > 1.000.000.000 components are made in and on one piece of Si, about 1 cm<sup>2</sup> in size, called a chip. The transistors and other components are first isolated from each other and are then linked by conductors in such a way that a circuit or system results. The system could be a memory, a microprocessor, or whatever.
- Chips are made as part of a Si wafer, typically 150 mm 300 mm in diameter. Obviously you want as many chips as possible on one wafer.

Next, single chips are cut out and "packaged". As a result you get the typical "IC" - e.g. a little black "brick" with many little "legs" by which it is connected (via soldering) to the circuit board.

## Class Exercise:

- What is the approximate lateral size of one transistor in an IC?
- Why are there no 16 GB memory chips now.?
- What properties should a semiconductor have for making IC's?
- What exactly produced complexity and market growth rates of 30 % for more than 30 years?
- Where will it end?

Here is a picture of an (old) printed circuit board with plenty of chips and other components:

