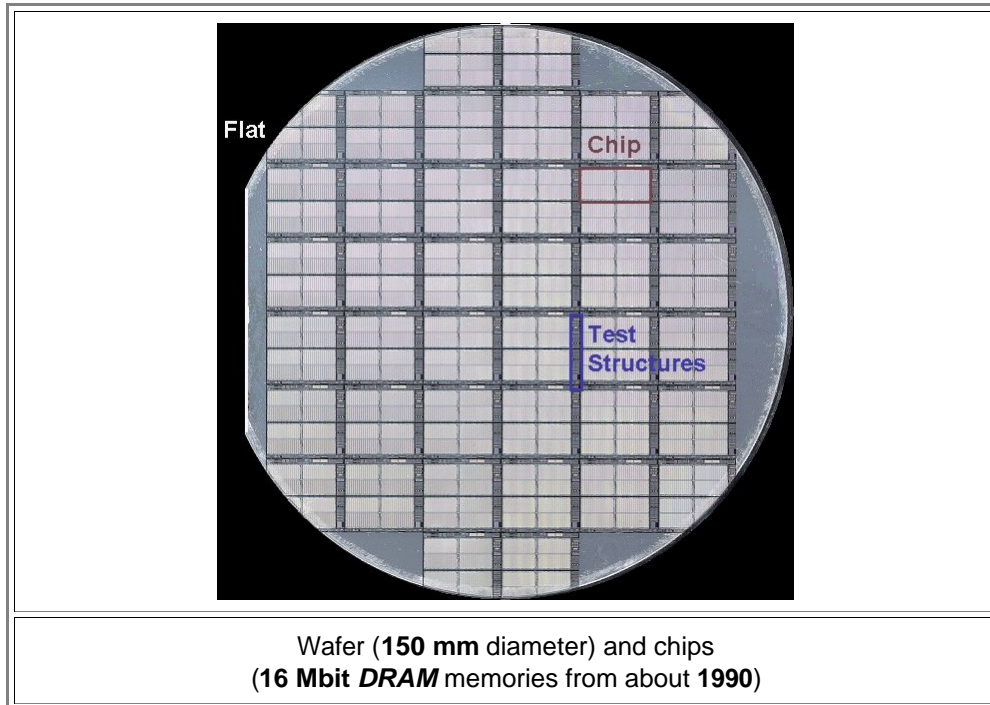


2.2 Silicon

2.2.1 Silicon and Microelectronics

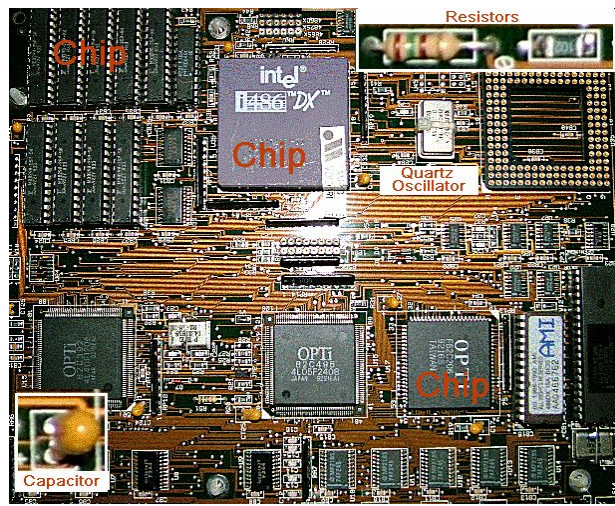
What is Microelectronics?

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 cm²** 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:



Circuit board (about1995) with *chips* and other stuff