

## Standard Exercise 5.1-1

### Integrated Transistors

Answer the following questions, make simple drawings and explain key features. Give approximate number wherever possible

- a) Draw the cross section of an *integrated bipolar transistor* (please denote, which type you have drawn) and denote the function and doping of all layers.
- b) Shortly describe the individual steps during the *fabrication* of a bipolar transistor.
- c) Draw a cross section of *two* adjacent *integrated MOS transistors* (please denote, which type you have drawn) including the metallization layer. Denote in the drawing the materials and the purpose of the decisive layers! Include typical lateral and vertical dimensions for the gate dielectric!
- d) Give key requirements for the *dielectrics* in a **MOSFET**!
- e) Draw qualitatively the source-drain-current  $I_{SD}$  vs. the gate voltage  $U_G$  (for both polarities at the gate) for the one of the transistors which you have drawn in c)  
If you have drawn two different transistors in c) then please indicate for which transistor you are drawing the characteristic!
- f) Suggest two measures to lower the *threshold voltage* of the **MOS** transistors (with explanation)!