



Prof. Dr. Bernd Becker
Dipl. Inf. Tobias Schubert
M. Sc. (Eng) Matthew Lewis

**Mobiles Hardware-Praktikum
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**Lab 1
Fundamentals of Analog and Digital Circuits**

This lab investigates the properties of a transistor when used as a switch. The use of a transistor as a switch is the basis for most digital computers. Illustration 1 shows the schematic drawing of an NPN transistor with the 3 main terminals (Base, Collector and Emitter). Illustration 2 shows the pin allocation for the BC547 and BC548 transistors which are compatible and interchangeable.

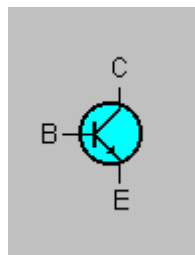


Illustration 1: Diagram of an NPN transistor



Illustration 2: Pin allocation for the BC547 and BC548 NPN transistors

Illustration 3 shows a typical one transistor digital switching circuit which implements the NOT function. If the switch in this circuit is closed, the transistor allows the "conventional" current to flow from the collector to the emitter. When this happens the diode goes off as

the transistor effectively shorts it out of the circuit. However, if the switch is opened, no current can flow through the transistor. This then simplifies the output circuit to only a resistor and diode allowing the diode to turn on.

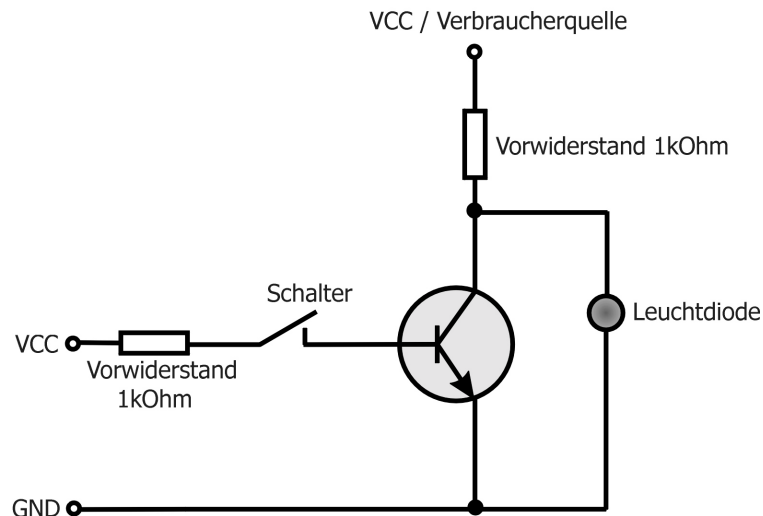


Illustration 3: A transistor as a switch

For the two following exercises in this lab you will need the open extension board for the PICee (refer to *Die Erweiterungsmodule zum PICee-Entwicklungssystem*). Connect the extension board to the PICee system by placing it ontop of the main PICee board and then connecting the large parrallel connector. Lastly, since the PIC16F84 processor is not used in this lab you can clear its program memory with the help of the *IC Programmer*.

Exercise 1

Create a logical 2 input NOR gate using the extension board, two transistors, three 1 K Ω resistors, the black and white push buttons for inputs, and a light emitting diode for the output. Since this is a NOR gate the LED output should only light up if both inputs are a logical "0".

Exercise 2

Create a logical 2 input NAND gate using the extension board, two transistors, three 1 K Ω resistors, the black and white push buttons for inputs, and a light emitting diode for the output. As this is a NAND gate the LED light should light up when at least one of the two inputs has the logical value "0". Only when both inputs have the logical value "1" the light should go off.

Important: Remember to make sure that there is a resistor between all paths from VCC to GND. If you fail to do this you risk destroying the diodes, transistors, or other components.

When you are finished with the lab you are required to hand in sketches, pin assignments, and other results obtained from the lab. Compress all appropriate files into one ZIP file and then submit it through the courses Web Site Portal.