

Electronics with the Modular System

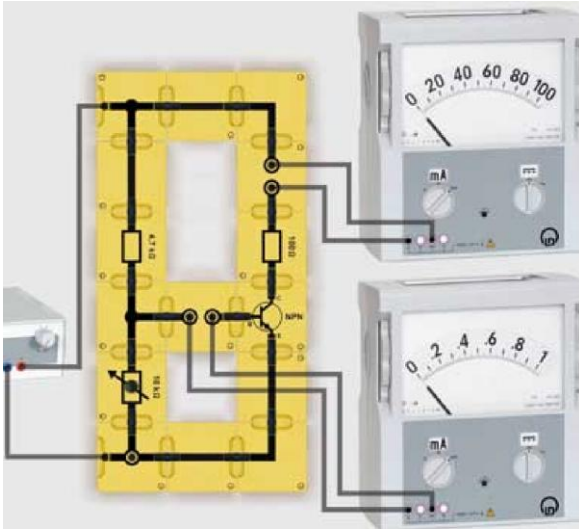
Basic Electronic Circuits
Transistors

Transfer characteristic of a transistor

Objectives of the experiment

1. To investigate the relationship between the base current I_B and the collector current I_C .
2. To calculate the current amplification of the transistor.

Setup



Apparatus

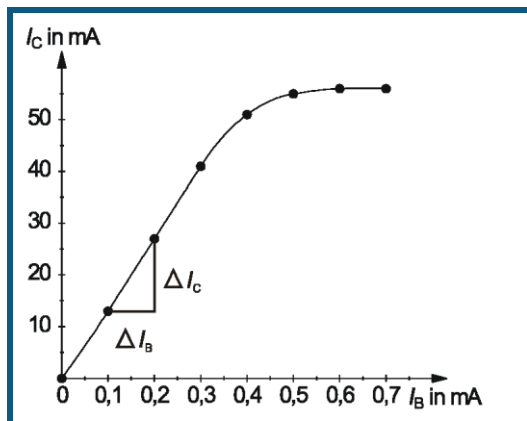
1	539 043	Transistor NPN, BD 137, BST
1	539 009	Resistor 100 Ω , BST
1	539 012	Resistor 4.7 k Ω , BST
1	539 015	Variable resistor 10 k Ω , BST
4	539 001	Connector blocks BST, straight
2	539 003	Connector blocks BST, straight, 2 sockets
2	539 004	Connector blocks BST, 90° angle
2	539 006	Connector blocks BST, T branch
1	539 007	Connector block BST, T branch with socket
16	539 000	Bridging plug, BST
2	531 906	Demo multimeter, passive
1	521 49	Power supply, 12 V DC, 230 V
6	500 644	Safety connection lead, 100 cm
1	301 300	Demonstration experiment frame
1	301 301	Adhesive magnetic board

Carrying out the experiment

- Set up the circuit.
- Adjust a voltage of approx. 6 V at the power supply and set the variable resistor to maximum resistance.
- By reducing the resistance on the variable resistor, increase the base current I_B in 0.1 mA increments.
- Read the collector current I_C on the demo multimeter and enter the values into the table.
- Calculate the current amplification B from the quotient of ΔI_C (e.g. $I_C(3) - I_C(2)$) and ΔI_B (e.g. $I_B(3) - I_B(2)$).

Measuring example

Base current I_B / mA	Collector current I_C / mA
0	0
0.1	13
0.2	27
0.3	41
0.4	51
0.5	55
0.6	56
0.7	56

Evaluation

The collector current I_C rises proportionally to the base current I_B up to a current I_B of approx. 0.3 mA.

The collector current I_C is controlled by the base current I_B .

A very small change in the transistor's base current I_B produces a large change in its collector current I_C .

The transistor works in this field as a current amplifier.

The current amplification B of a transistor can be determined from the quotient of ΔI_C and ΔI_B :

$$B = \frac{\Delta I_C}{\Delta I_B}$$

In the experiment example, the current amplification is:

$$B = \frac{27 \text{ mA} - 13 \text{ mA}}{0,2 \text{ mA} - 0,1 \text{ mA}} = 140$$

When the base current I_B reaches a value of approx. 0.6 mA, the collector current I_C remains almost constant.

A change in the base current I_B no longer produces a change in the collector current I_C .