LED AFTERGLOW DUE TO SWITCH-OFF DELAY LAB A7

1. TASK

After switching off the battery supply in the control circuit of a transistor (base-emitter path) an LED should still light up for up to 30 seconds.

2. SOLUTION APPROACH

In the collector circuit of the transistor a sufficient current still has to flow for about 30 seconds in order to drive the LED.
For this purpose a corresponding base current is required. With a charged capacitor as an energy storage this current can be held for a certain time - depending on the dimensions of the RC element in the base-emitter circuit of the transistor T1.

3. EXPERIMENT DESCRIPTION

Short circuit the capacitor by bridging the two terminals on its contacts to fully discharge it. Then close switch S (*) for approx. 2s. This will charge C to the voltage of about 9V. Then open switch S again. Resistance R2 is already mounted on the LED module.

* A switch can also be realized by two magnetic contacts and one magnetic wire.

4. OBSERVATION AND EXPLANATION

After closing switch S the capacitor C is charged to the voltage of about 9V. The LED lights up. After opening switch S the charge stored in C discharges through the base resistor R1 and the base-emitter diode of T1. Over a period of about 30s a sufficient base current still flows through the LED.

Note: Since the base current discharges the capacitor over time the voltage across the capacitor C and hence also the base-emitter voltage decreases. As a result the internal resistance of T1 continues to increase.

5. MATHEMATICALVIEW

The capacitor C and R1 form an RC time constant. It is by equation F13:

$\tau = R*C = 100k*100uF = 10s$.

After 10s, the voltage at C has dropped to about 63% of its initial value (see diagram D11).

LEARNING SUCCESS

With an RC element a time delay can be realized. This makes it possible to influence electronic switch-off operations in the timing.

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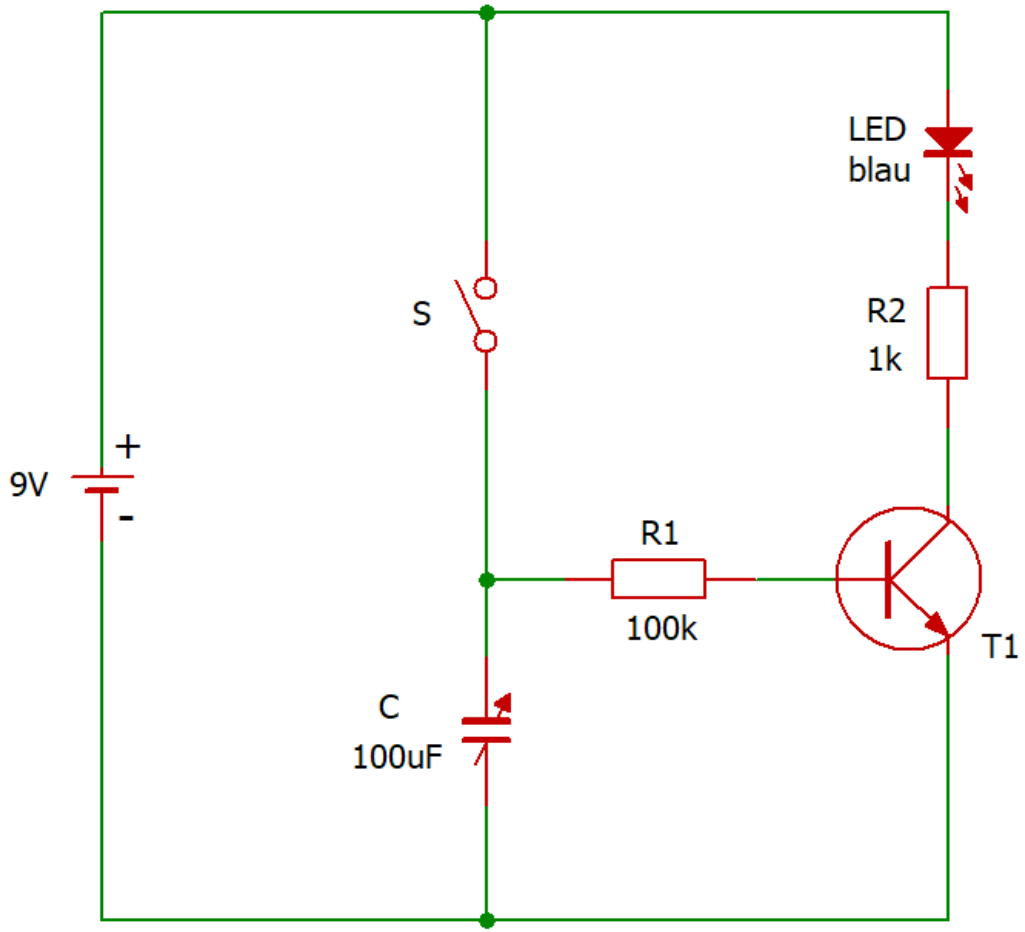

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