

1. TASK

A switching process should be triggered by music or clapping. As with a light organ an LED should flicker to the beat of the music.



2. SOLUTION APPROACH

Clapping e.g. creates sound waves. These can be converted via a microphone MIC into electrical AC signals. The weak microphone signals must first be pre-amplified by a transistor since the signals of the microphone are not sufficient for the direct control of an LED.



3. EXPERIMENT DESCRIPTION

R2 must be set so that the collector voltage of T1 does not yet drive the second transistor stage T2 (base-emitter voltage of T2 < 0.7V). With R3 you can change the exact operating point of T2 so that the LED is not yet lit (about 8.4k)

Then e.g. clap your hands or play music.



LEARNING SUCCESS

An electret condenser microphone generates weak AC signals suitable for driving a transistor. Due to the functional principle it has to be supplied with a small external voltage.



4. OBSERVATION AND EXPLANATION

If a certain volume level is exceeded the LED flickers in the rhythm of the volume fluctuations.

Since the microphone signal is transmitted via C the internal resistance of T1 is slightly larger for a negative voltage half-wave causing the collector voltage of T1 to increase slightly. As a result the internal resistance of T2 decreases and its collector current increases. During this neg. half-wave the LED lights up a bit brighter.

With a positive AC half-wave the internal resistance of T1 drops slightly (UBE of T1 increases) causing the collector voltage of T1 to drop slightly. This increases the internal resistance of T2 and its collector current drops. During this pos. half-wave the LED lights up a little less.



5. MATHEMATICAL VIEW

At the base of T1 the base bias set by R2 and the audio voltage generated by the microphone are superimposed.

Therefore UBE of T1 is calculated as follows:

$$U_{BE_{ges}} = U_{BE} - U_{mic} = 0.7V + (-0.05V) = 0.65V \text{ (neg. half-wave)}$$

$$U_{BE_{ges}} = U_{BE} + U_{mic} = 0.7V + (+0.05V) = 0.75V \text{ (pos. half-wave)}$$

