

Transistor (BJT)

BJTs can function as electronic switches or amplifiers, with applications such as controlling high-power LEDs or driving speakers.

BJT (ABC 637 NPN) has three terminals: emitter, collector, and base.

A simple switch circuit can be made where the emitter connects to the ground and the load connects between the supply voltage and collector; caution is advised regarding maximum rated voltages.

The initial setup fails due to insufficient collector current; this is explained by the relationship between base current and collector current defined by the transistor's beta (current gain).

Connecting the base directly to supply voltage leads to excessive current flow, risking damage. A current-limiting resistor is necessary for safe operation.

After calculating an appropriate base resistor value based on worst-case beta values, adjustments are made to improve circuit performance.

If loads are connected differently (to ground instead of supply), PNP BJTs are recommended due to their reversed polarity requirements.

For larger loads like a 6V 21W light bulb, a more robust BD 535 transistor with higher maximum collector current capability is introduced.

Despite calculations indicating potential issues with saturation voltage at high currents, successful operation was achieved but resulted in significant heat generation.

High power loss through BJTs leads to lower efficiency; this becomes evident when measuring temperature increases during operation.