Transistor (MOSFET)

Bipolar junction transistors (BJTs) can be used as switches for controlling loads, because of their efficiency in dimming LEDs.

It is noted that BJTs heat up significantly when controlling larger loads due to energy loss in the collector-emitter path, indicating a need for improved circuit efficiency.

With MOSFETs, overall circuit efficiency can reach up to 97%, making them an attractive option for various applications.

The structure of n-channel MOSFETs like the IRLZ44N has three pins: gate, drain, and source.

Unlike BJTs that require current at the base to switch on loads, n-channel MOSFETs only need a high enough voltage at the gate.

The required gate voltage must exceed the threshold voltage but remain below the maximum rated gate-source voltage; with 5 volts from an Arduino, it can control around 5 amps while minimizing drain-source voltage.

After connecting PWM signals from Arduino to the gates, the circuit's functionality should be verified through oscilloscope readings showing expected behavior during operation.

When applying 5 volts to turn on larger loads like light bulbs, additional load voltage is necessary; bootstrapping is mentioned as one common solution.

An easier alternative involves using P-channel MOSFET where +5 volts turn it off and zero volts turn it on; this requires a pull-up resistor instead of a pulldown.

Upon testing with bigger loads, damped oscillations reaching peaks around 64 volts are observed when switching off the MOSFET due to parasitic capacitances between terminals.