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# EXPERIMENT 4
# TRANSISTOR CHARACTERISTIC CURVE

Aldagel

Bring a diskette to save your data.

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**OBJECT:**

The objective of this lab is to investigate the DC characteristics and operation of bipolar junction transistor (BJT). The transistor recommended to be used in this lab is 2N3904 (npn) transistor.

- Determination of $\beta$.
- Gathering data for the DC characteristics

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**APPARATUS:**

Dual DC Power Supply, Voltmeter, 100 kΩ and 1 kΩ resistors, 2N3904 NPN Transistor.

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**THEORY:**

In BJT, the primary current path is between the "collector" and "emitter", and this current is controlled by the current in the "base" terminal. The arrow in the BJT symbol indicates the direction of current flow in a device that is biased in the forward active region. The base-emitter junction is modeled by a diode, so immediately we can see that current will only flow if the diode is "on"; that is, if the base is forward biased with respect to the emitter by the diode turn-on voltage (~0.7V for Silicon devices).

When the base-emitter junction is forward biased, the action of the transistor causes a current flow in the collector that is proportional to the base current; the proportionality factor $\beta$ is appropriately called the current gain of the device. One nice feature of the BJT is immediately apparent: the relationship between collector current and base (control) current is a simple, linear function.

Typical I-V characteristics are shown below. The device is turned "off" when the base-current is zero, and turned on when a base-current is allowed to flow (base-emitter diode is forward biased). Clearly there are qualitative similarities between all the transistors in terms of their I-V curves, but the terminology used in BJTs is unfortunately a little different.

For example, the shaded region in the I-V curve is called "saturation" here, and the region where the collector current is relatively constant is called the forward active region. The boundary between the two occurs when $V_{ce,sat} \approx 0.3$.