

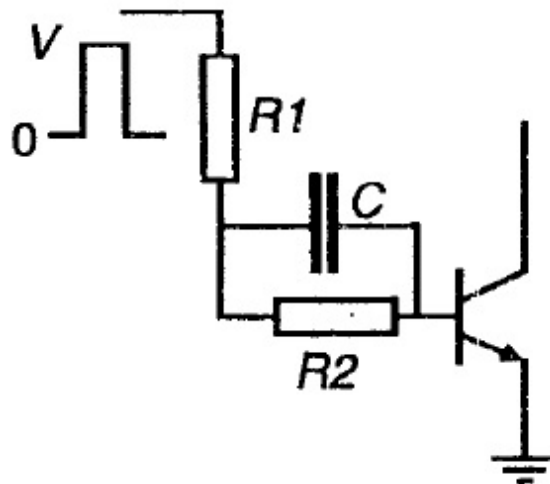
Base Drive Circuits: Driving Power BJT

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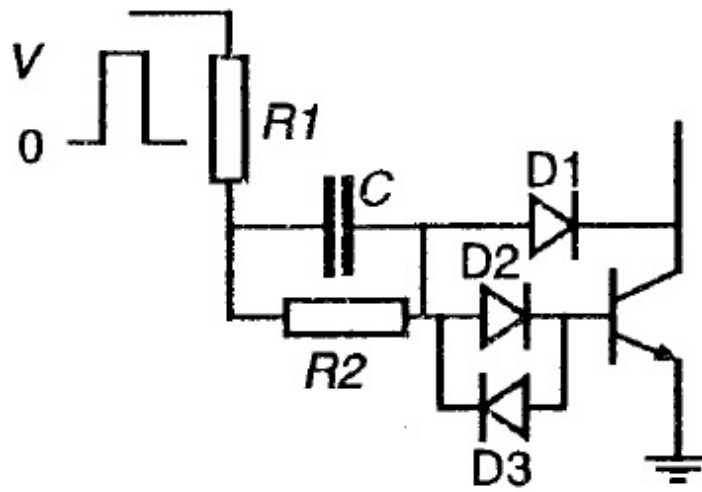
Base Drive Circuits: Driving Power BJT

This post will explain about the Power transistor base drive circuit. It is good to know about Power transistor basics, Characteristics and Construction before proceeding further. Power BJT is a three layer(P-N-P or N-P-N), three terminal (Emitter, Base, Collector) semiconductor device. The main application of power BJT is behave as a static switch in the power electronics circuits. [Click here to know about the Basics of Power Transistor.](#)

- A Power BJT switching a large current needs a base drive current sufficient to keep the transistor turned ON.
- The current gain may be quite low, so the base drive may will be 10% of the load current.
- At turn-off there will be a large stored charge in the base. This stored charge must be removed.
- To achieve this, a reverse voltage is applied to the base at turn-off to help remove the stored charge by conduction through the base connection.
- In addition to ensure a rapid turn-on, it is desirable to provide an increased base drive for a short time so as to increase the rate at which the base is charged.
- The following figure shows the simple base drive circuit which may be used to provide a suitable drive.



- The circuit is driven from a voltage source which switches between 0 and V volts.
- The bias current is limited by V and $R1+R2$, with an initial current surge to charge up the base limited in magnitude by $R1$ and duration by C .
- At turnoff the charge in the capacitor C drives the base negative and helps the recovery.
- Saturation of the device should be avoided to ensure the fast switching.
- It means that the base drive must ensure that the collector-to-emitter voltage is kept as low as possible (to minimize losses), while not allowing the collector base junction to become forward biased.
- We can achieve this by using [Baker's clamp](#). The following figure shows the BJT base drive circuit with Baker's clamp.



- The diode $D1$ will conduct if the collector voltage falls below the base voltage, thus limiting the base current to that needed to reduce the collector-base voltage to about zero.
- The diode $D2$ provides an offset voltage to allow for the voltage drop across $D1$.
- The diode $D3$ provides a path for applying a reverse base drive.

Following are the important points about BJT to be remembered when designing the base drive circuit for the transistor.

1. BJT is a current controlled device. Its operation is controlled by the base current.
2. The Power BJT is used as ON/OFF switch in the power converter circuits.
3. Power BJT operates in saturation and cutoff region when used as a switch. ie, when the device operates in saturation region it is in ON and when the device operates in cutoff region, it is in OFF state.
4. Sufficient base current is required to drive BJT in saturation.
5. Amount of carrier injected in base region determine storage time of BJT.
6. Storage time determines turn-on and turn-off times of the transistor.
7. There should be mechanism to control the amount of saturation so as to control storage time.