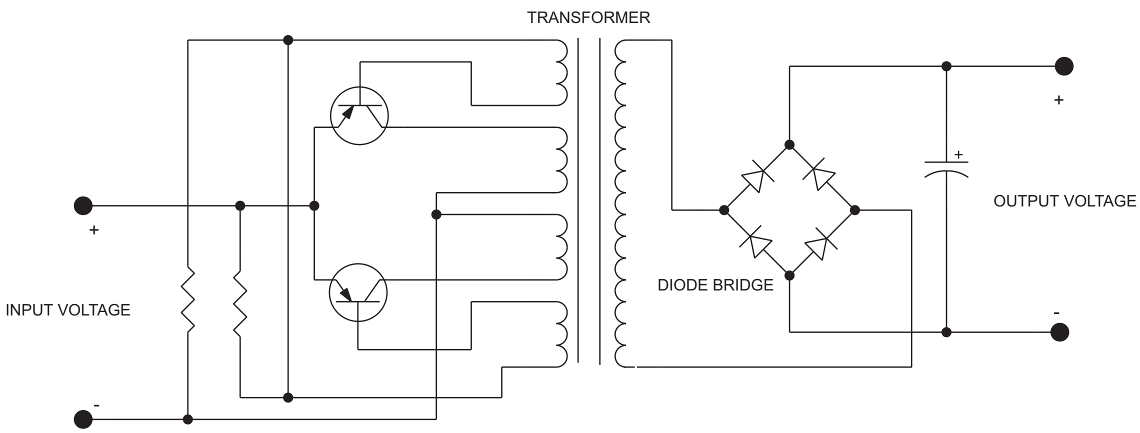
PRINCIPLES OF POWER CONVERSION

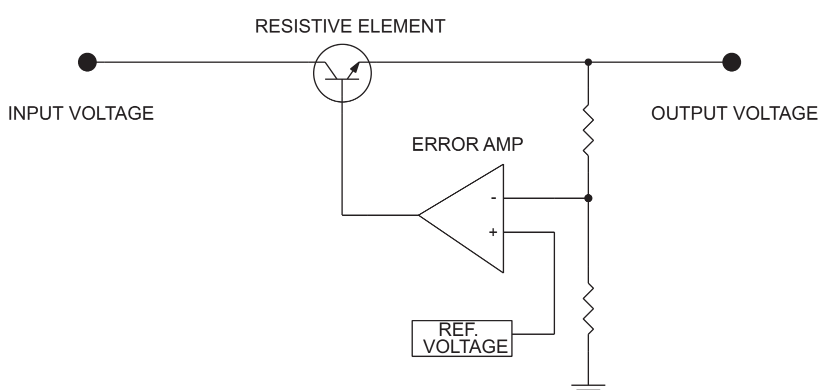
Square-Wave Converter

This is the classic DC/DC converter circuit. In its various versions it may be know as the Jensen, Royer or Jensen-Royer circuit. It is also know as a multivibrator or oscillator because one transistor conducts current while the opposite one does not; then the reverse occurs. What characterizes a square-wave converter is low input/output noise, narrow input voltage operating range, and unregulated output voltage (The output voltage linearly follows the input voltage). The output voltage can be used directly, or it can be post regulated, normally via a linear regulator. A transformer is an inherent part of this design and therefore the converter can provide excellent isolation between the input and output.



Linear Regulator

The Technique used in this converter enables it to regulate a varying input voltage to a constant output by placing a controllable resistive element between the input and output. With the use of a divider network the output voltage can be compared to a fixed reference voltage by means of an error amplifier controlling the resistance element to keep the output voltage constant regardless of changes in output load current or input voltage. The input voltage must always be higher than the output voltage. Linear regulators have low input and output noise and a very fast transient response as well as excellent regulation. However, since the entire voltage difference between the input and output voltage must be dropped by resistive element the efficiency is often very poor.



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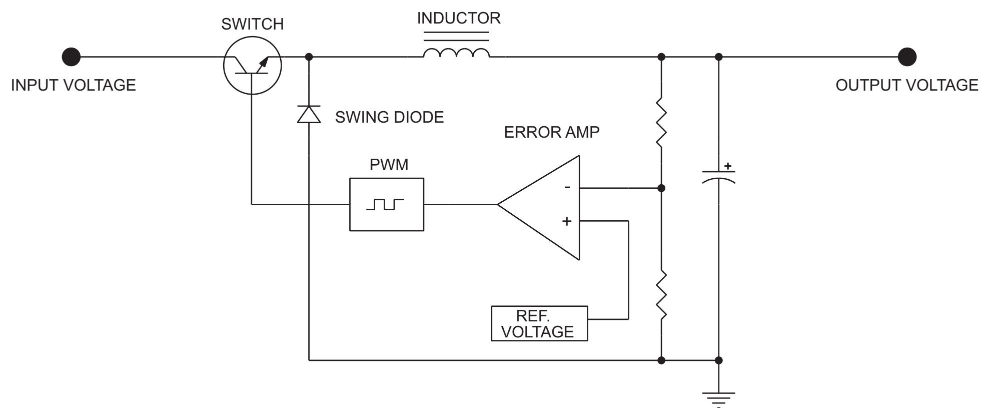
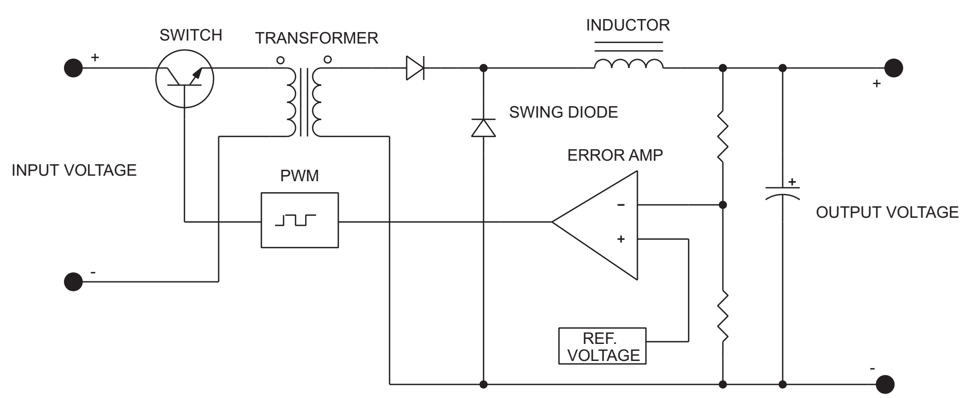
Buck Regulator

The topology used in this design regulates an output voltage down from a higher voltage of the same polarity. When the switch is on, energy is stored in the inductor as current flows to the output then when the switch is turn off, the stored energy in the inductor is allowed to flow backwards through the swing diode to the output, This technique maintains nearly constant efficiency over a wide input voltage range. Similar to the Linear regulator, the error amplifier adjusts the Pulse Width Modulator (PWM) to control both the on and off time of the switch. The output noise is low, but the input reflected ripple can be high and may require extra filtering. The line and load regulation is excellent, however, the transient response is slower than that of a linear regulator. The output generally does not have short circuit protection.



Forward Converter

This design adds a transformer to the Buck regulator topology to achieve isolation between the input and output. This arrangement allows the output voltage to be either higher or lower than the input voltage depending on the turns ratio of the transformer. Feedback from the output controls the pulse width of a fixed frequency switch. The ripple and overload characteristics are similar to buck regulator. Auxiliary quasi-regulated outputs can easily be produced by adding additional winding to the output inductor.



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Flyback Converter

In this design an Isolation transformer is used as an energy storage element, placing energy into the transformer from the input and then releasing it though a rectifier diode to the output. Feedback is created in much the same way as the forward converter although, requiring fewer components overall. The output voltage can be higher or lower than the input depending on the turns ratio of the transformer but can generate higher ripple currents on both input and output. Auxiliary quasi-regulated outputs can easily be produced by adding additional winding to the transformer.