DESIGN NOTES

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Floating Input Extends Regulator Capabilities

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Many applications require circuit performance that is unachievable with conventional regulator design. This results in added complexity to the circuit. However, some problems can easily be solved by floating the input to the regulator. A floating input can either be a battery, or a secondary winding that is galvanically isolated from all other windings. With this method high efficiency negative voltage regulation, high voltage regulation, and low saturation loss positive buck switching regulator can all be achieved easily.

Low dropout negative voltage regulators are not currently available. This would seem to preclude high efficiency negative linear regulators. Such regulation is frequently desired in switching supply post regulators; however, if the secondary windings are isolated from one another, a low dropout positive voltage regulator can be used for negative regulation (Figure 1).

In this circuit the LT1086 servos the voltage between the output and the adjust pin to 1.25V. The positive regulation is accomplished by conventional regulator design. Negative voltage regulation is achieved by connecting the output of the positive voltage regulator to ground. The V_{IN} pin floats to 1.5V or greater, above ground. This technique can be used with any positive voltage regulator, although highest efficiency occurs with low dropout types.

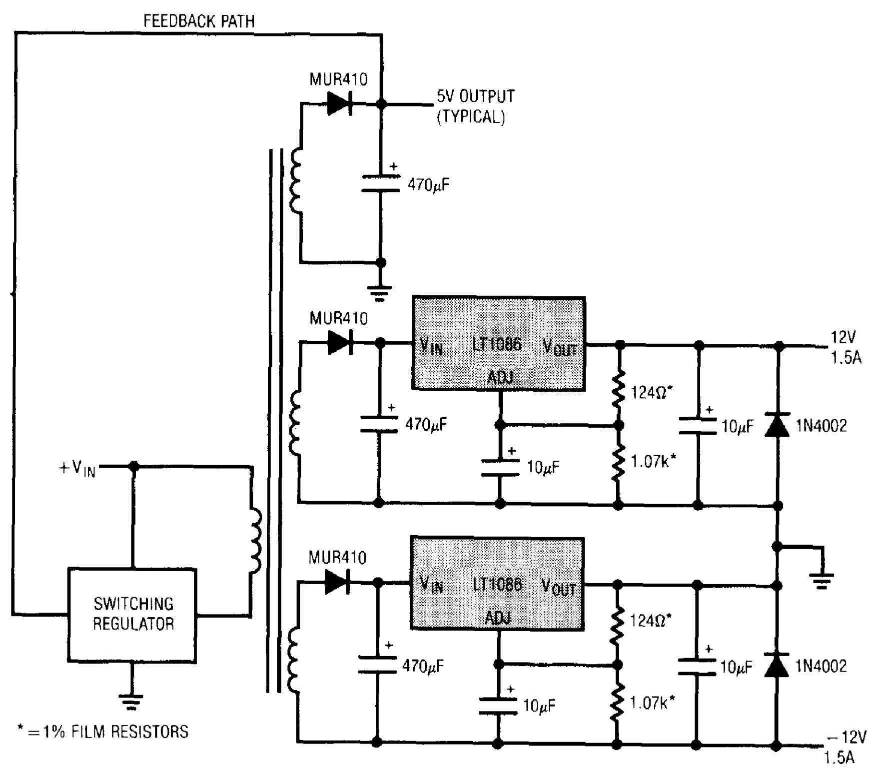

Figure 1. High Efficiency Negative Voltage Regulation

Another example where floating a linear regulator can be useful is shown in Figure 2. In this case high voltage regulation can be handled if split secondary windings are available. This allows the regulators to be connected in series. Neither regulator exceeds its maximum differential voltage even under short circuit conditions.

High current positive buck switching regulators can have excessive saturation losses since most switches are Darlingtons. As much as 2V can be dropped across a Darlington or composite PNP switching transistor. However, efficiency can be increased and power dissipation requirements greatly reduced if the input is allowed to float (Figure 3).

The circuit in Figure 3 uses an LT1070 to perform a buck conversion. The LT1070 is a current mode switching regulator. The V_{SW} pin output is a collector of a common emitter NPN, so current flows through it when it is low. The 40kHz repetition rate is set by the LT1070's internal oscillator. When the V_{SW} pin is "on," current flows through the load, the inductor, and into the V_{SW} pin. During this time a magnetic field is built up in the inductor. When the switch in turned "off," the magnetic field collapses dumping energy into the load through D1. The input of the switching regulator floats to a potential set by the output.

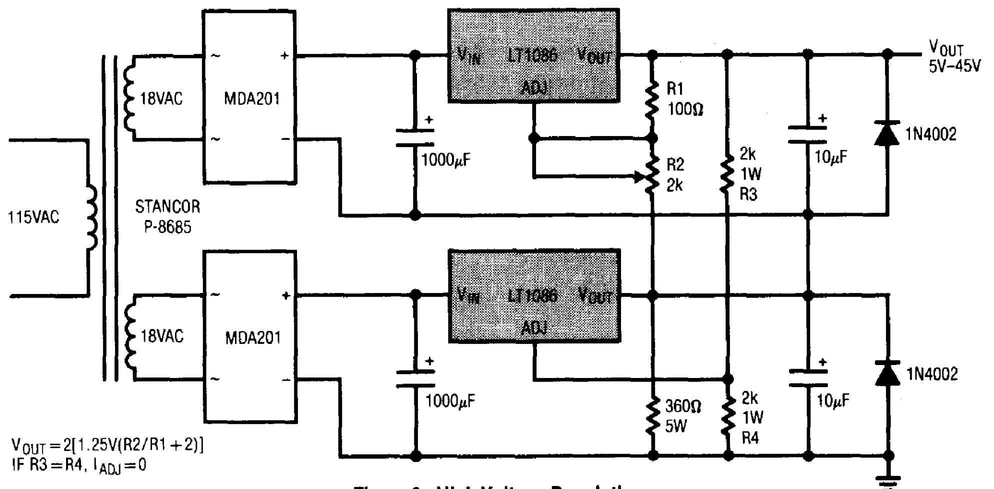

Figure 2. High Voltage Regulation

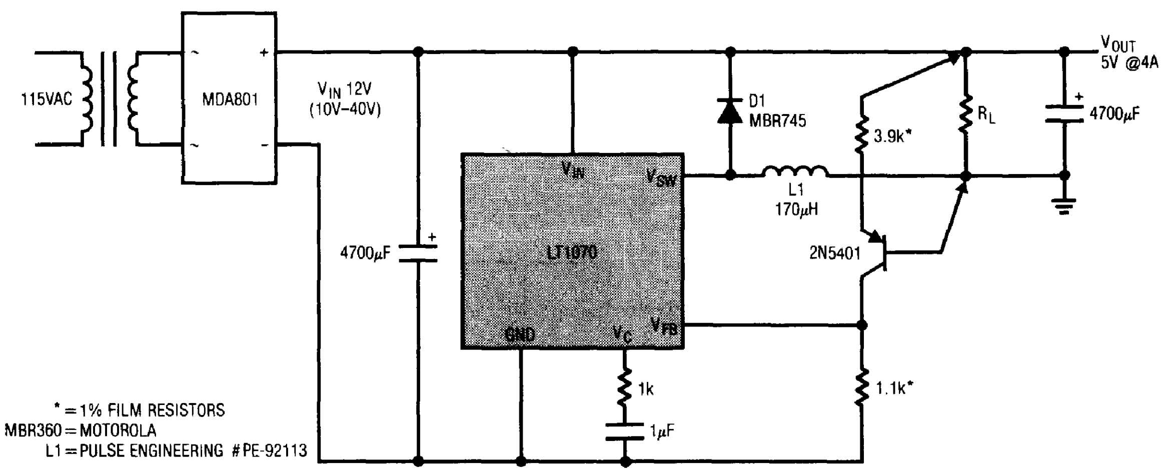

Figure 3. Floating Input Low Saturation Loss Buck Regulator

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