SWITCHING POWER, INC.
Regulated D.C. Power

SPI-APPNOTES: POWER CONVERSION TOPOLOGIES

This *SPI-AppNote* provides a brief description of the switching power supply in addition to the output topologies currently employed by Switching Power, Inc.

Most electronic systems, servers, computers, etc., are powered internally by regulated DC current. In a switching power supply, the steps along the way begin with the AC current delivered by pubic or private utilities or generators. Until the 1970s, most electronic devices used linear power supplies to convert the AC to regulated DC. The size, weight, and low efficiencies of linear regulators encouraged the development and proliferation of switching power supply designs in the 1980s. Switching power supplies dramatically improved upon the shortcomings of linear supplies. Over the years since switchers first became used, they have become highly reliable and nearly as quiet electrically as linear supplies.

Switching power supplies directly rectify and filter the AC line voltage into a high voltage DC, without first using a 50/60 Hz transformer. The DC is chopped into a quasi-square wave by high power switching transistors and a high frequency transformer. It is finally filtered and rectified again.

Most switchers offered by Switching Power, Inc. use a **forward converter** topology that utilizes **pulse-width modulation, or PWM**. It controls the 'on' time vs. the 'off' time of the switching transistors. By varying the on/off time of the switches just enough energy is stored in the output inductors to supply a given load at a constant potential. This is the main output voltage on a multiple output supply, often referred to as V1.

There are two variations of the forward converter, **half bridge** and **full bridge**. With a half-bridge converter, two transistors drive the transformer's primary side. With full bridge, there are four transistors. Full bridge is used on higher power applications.

Main outputs, on multiple output power supplies, are typically the highest power. Auxiliary outputs use other means of regulation. The **magnetic amplifier**, or 'Mag Amp', is widely used. To control its output, the mag amp modifies the width of the pulse by delaying the pulse's leading edge. The switching function is performed by a saturable core which is an inductor wound on a magnetic core. Mag Amps can provide currents of 20 amps or more but are not cost effective below approximately 5 amps.

Under 5 amps, another means of achieving regulated auxiliary outputs is the **linear post-regulator** with its internal control device. The linear regulator is placed in series with the load. The control device conducts continually and dissipates the delta power between input and output. The dissipation of the control device limits the output current rating. Heat sinking the regulator is often required.

Standard multiple output products from Switching Power and others are designed to use various combinations of the above input and output topologies to reach the desired end configuration. Power supply designers can also choose between isolating the auxiliary outputs or commoning them with one another and the main output. Floating the auxiliary outputs provides and additional level of flexibility in the base design. Standard products from Switching Power are often offered with one or more floating outputs.