ABSTRACT

A buck converter or step-down switch mode power supply can also be called a switch mode regulator. Popularity of a switch mode regulator is due to its fairly high efficiency and compact size and a switch mode regulator is used in place of a linear voltage regulator at relatively high output. The project is regarding the switch mode power supply (SMPS) with 24 volt input voltage and 9 volt output voltage. The main specifications of buck converter design among others are to look for the values inductor and capacitor relative to the switching frequency and duty cycle. MOSFET device have been used in buck converter circuit because of its higher switching speed. Multisim simulation software is used in the analysis and design process. Once obtaining the results the hardware or the real Buck Converter circuit with known specifications are built.
\[(V_{in} - V_o) \, DT + (-V_o) \, d_T = 0\]  \hspace{1cm} (2.10)

![Diagram showing Buck Converter - Discontinuous Conduction]

Figure 2.5 : Buck Converter - Discontinuous Conduction

\[\text{dout} = \frac{i_{\text{peak}}}{2} \, d + \delta_d\]  \hspace{1cm} (2.12)

Considering the change of current during the diode conduction time

\[i_{d\text{peak}} = \frac{V_o \, \delta d}{L}\]  \hspace{1cm} (2.13)

Thus from (6) and (7) we can get

\[i_{\text{dout}} = \frac{V_o \, \delta d}{2} \, (d + \delta d)\]  \hspace{1cm} (2.14)
The disadvantages are:

- Higher resistance than a bipolar transistor.
- Can be destroyed by high voltages, especially static electricity

2.5 Power Supplies

Power supplies, which are used extensively in industrial applications, are often required to meet all or most of the following specifications:

1. Isolation between the source and the load.
2. High-power density for reduction of size and weight.
3. Controlled direction of power flow.
4. High conversion efficiency.
5. Input and output wave forms with a low total harmonic distortion for small filters.
6. Constant power factor (Pf) if the source is an ac voltage.

Depending on the type of output voltages, the power supplies can be categorized into two types:

1. Dc power supplies.
2. Ac power supplies.
2.5.1 Switch Mode Power Supply (SMPS)

The switching mode power supplies have high efficiency and can supply a high-load current at low voltage. A switching regulator as output stage, switched repetitively on and off, together with energy storage components (capacitors and inductor) to generate an output voltage. Regulation is achieved through the adjustment of the switch timing based on feedback sample of the output voltage. In fixed-frequency regulators, the switch timing is adjusted through modulation of the pulse width of the switch voltage – this is known as PWM control.

In gated-oscillator or burst-mode regulators, the switch pulse width and frequency is kept constant, but the output switch is gated on or off by the feedback control. Depending on the arrangement of switches and energy storage components, output voltages can be generated that are greater than or less than input voltage, and multiple output voltages can be generated with one regulator.

In most cases, a buck (step down) switching regulator will convert the source more efficiently than will a linear regulator, given the same input voltage and output power requirement.

These types of regulators whilst relatively economical for low current requirements are notoriously inefficient, difficult to regulate with varying loads and suffer from residual power line ripple. Switched mode power supplies or SMPS on the other hand while extending circuit complexity, offer significantly improved efficiency (perhaps 80%), greatly reduced system weight and size in higher current application, and reduced costs.