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Integrated ZVS Synchronous Buck DC-DC Converter with Adaptive Control for Improved ZVS Performance

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Inventors

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Intellectual Property Status

Patent Pending

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Background

In many electronics applications various blocks of components on the integrated circuit may have optimal power consumption at different operational voltages. Power optimization and low power requirements are getting even more critical in wireless applications. Several low power schemes are in use today. In some mobile applications, minimizing power consumption requires that a single battery supply different voltage levels to different parts of the circuit. This voltage level shifting is achieved with a DC-DC converter. Commercially available switched mode DC-DC converters require external filter components. Monolithic boost DC-DC converters have been introduced in order to increase the compactness. These suffer from high inductor current, switch saturation, and very low efficiency. Other converters use soft switching techniques with adaptive control to increase the efficiency of discrete switched mode DC-DC conversion.

Invention Description

Researchers at Arizona State University have invented an integrated zero voltage switching (ZVS) synchronous buck converter with adaptive controller. This adjusts the dead time between the gate triggering pulses of the power MOSFETs in the converter. This ensures ZVS operation over a wide range of load variation. The converter uses feedback control, can switch at very high frequencies, enabling use of passive components, and can be integrated onto a semiconductor device. The converter is self-contained and requires only the battery input for operation.

Potential Applications

- **Wireless Applications**
- **Portable Electronic Devices**
- **Consumer Electronics**
- **Remote Sensor Networks**

Benefits and Advantages

- **Low power and Compact** – The design provides even better low power solution as well as less weight and size.
- **Wide Load Variation** – The adjustment of the dead times in the converter ensures ZVS operation over a wide range of load variation.
- **Cost** – Both the load and converter in a single chip requiring only the power supply.
- **Robust** – Feedback control allows switching at very high frequencies, enabling use of passive components.