

Low-loss solution for high-frequency switching power supplies



AI Overview

A low-loss, high-frequency switching power supply (SMPS) achieves high efficiency and compact size by rapidly switching semiconductor devices, minimizing conduction and switching losses, and using high-frequency magnetics and capacitors. Overview A switching power supply (SMPS) converts AC or DC input into regulated DC output using high-speed switching of transistors or MOSFETs, unlike linear regulators that dissipate excess energy as heat. High-frequency operation, typically from hundreds of kHz to several MHz, allows the use of smaller transformers and inductors, reducing size and weight while maintaining high power density. Efficiency and Loss Reduction Efficiency in high-frequency SMPS is influenced by three main loss mechanisms: Switching Losses: Occur during the transition of the switch from on to off and vice versa. Higher switching frequency increases the number of transitions per second, but modern devices like GaN transistors minimize these losses due to fast switching and low gate charge. Conduction Losses: Caused by the on-resistance of the semiconductor switch. Using low-resistance MOSFETs or GaN devices reduces these losses. Driver and Passive Losses: Losses in gate drivers, inductors, and capacitors. Optimizing component selection and layout reduces these contributions. High-frequency operation also reduces output voltage ripple, as smaller inductors and capacitors can filter the output more effectively, improving transient response and load regulation. Topologies and Design Considerations Common SMPS topologies for high-frequency, low-loss designs include: Buck Converter: Steps down voltage efficiently for lower output voltages. Boost Converter: Steps up voltage while maintaining efficiency. Half-Bridge and Full-Bridge LLC Resonant Converters: Provide isolation and high efficiency, often used in server and datacenter PSUs. Interleaved...

Article Content

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Frequency Selection in Switching Power Supply

This article builds on switching frequency concepts to analyze switching power supply designs for three different frequency ranges, sorted from low to high.

The Design of High Frequency LLC Switching Power Supply

The combination of LLC resonant converter and GaN device can further improve the switching frequency and power density of the power supply. In order to meet the needs of power

How the Switching Frequency Affects the Performance of Buck

To realize a better performance, it is important to know the role of switching frequency in the power system. This application report analyzes the major power loss, output voltage ripple, and transient

(PDF) MINIMIZING HIGH-FREQUENCY SWITCHING

This energy harvesting solution permits the autonomous supply of low power sensor nodes, without a chemical battery, allowing their extensive use

Frequency Selection in Switching Power Supply Designs (Part I)

Part I will discuss calculating for the key variables of switching frequency, as well as the challenges with higher frequencies. Part II will cover how to design a switching power supply for frequency ranges in

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PowerPoint Presentation

Silent Switcher 3 can achieve nearly same phase noise performance as an ultralow-noise LDO! SS3 can replace LDOs even in the most supply-noise sensitive applications such as PLLs! Switchers that do

Technical Reviews of Power Loss Optimization in High

Power losses of switches and inductors are consistent challenges that hinder the development of high-frequency power supply in package (PSiP).

High-Frequency SMPS Efficiency Optimization: Full

Optimize high-frequency PCB signal and power copper spacing for lower crosstalk and safer voltage performance. Learn key design rules and

Modeling and Simulation of High-frequency Switching Power Supplies

Introduction High-frequency switching power supplies have become integral to modern electronic systems due to their ability to efficiently convert electrical energy with minimal losses. These power

Integrated Very-High-Frequency Switch Mode Power Supplies: Design ...

This paper presents a power supply using an increased switching frequency to minimize the size of energy storing components, thereby addressing the demands for increased power

Optimizing soft-switching operation of GaN at high frequency

With a broad voltage range of 60 V to 700 V and various packages, they offer superior switching speed, high-power density, and reduced energy losses, resulting in smaller, lighter, and more compact

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High-Frequency, Low-Loss Ferrite Material PC200

With the spread of GaN semiconductors, which can operate at high frequencies, switching power supplies have been upgraded to higher frequencies. Ferrite material is used in transformer products,

Considerations for Using Gallium Nitride Technology in Switch-Mode ...

The benefit of using the GaN device with the small gate capacitance results in much faster switch transition times and reduced switching losses, which ultimately result in higher power conversion

Design Trade-offs when Selecting a High-Frequency

Advantages and trade-offs of designing a power supply based on high-frequency switching regulators, component examples from TI, Maxim,

Improving Efficiency at Higher Loads with High Switching Frequencies

With higher switching frequencies, design requirements such as output current ripple, output voltage ripple, and load transient can be achieved by using less inductance and output capacitance. This

Quick Tips to Diagnose and Stabilize an Unstable

Introduction An unstable power supply can cause severe system issues, such as audible noise from the passive components, unexpected jittering in the switching

GaN Transistors Improve Switching Efficiencies

To be able to significantly increase the switching power supply's efficiency with these fast-switching components by means of lower switching losses, it is necessary to also reduce conducting

An Efficiency Primer for Switch-Mode, DC-DC Converter Power Supplies

Techniques for calculating and predicting efficiency losses in each component of switch-mode power supply (SMPS) are detailed. In addition features and techniques that improve switching

AN-140: Basic Concepts of Linear Regulator and

This article explains the basic concepts of linear regulators and switching mode power supplies (SMPS). It is aimed at system engineers who may not be very

Improving Efficiency at Higher Loads with High Switching Frequencies

a physically smaller inductor with a similar DCR. This application note reviews the primary contributors of buck converter power losses, and then compares the efficiency of two different switching frequency

MOSFET fast switching: motivation, implementation and precautions

These converters use the oscillation created by one inductor and one capacitor to achieve soft-switching of the switching device, where it then operates in either zero-voltage switching (ZVS), zero-current

What Is a Switching Power Supply (SMPS)? | Tektronix

Visit our dedicated Switching Power Supply Product Category to find the perfect power solution for your application. Connect directly with Tektronix

Integrated Very High Frequency Switch Mode Power

Soft switching based on resonant operation, through mitigating switching loss and alleviating electromagnetic interference, is essential to high

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