Low Loss High-Frequency Switching Power Supply

Article Overview

Optimizing high-frequency SMPS for low loss involves using GaN transistors, low-loss ferrite cores like PC200, soft-switching topologies, and careful PCB layout to minimize parasitics.

Key Strategies

1. Use of Low-Loss Ferrite Cores Selecting ferrite materials with low core loss at high frequencies is critical. TDK's PC200 ferrite, for example, is optimized for frequencies from 700 kHz to 4 MHz, with peak efficiency around 1.8–2 MHz. It suppresses heat generation in transformers and inductors, making it ideal for high-frequency DC-DC converters and automotive ECUs . 2. GaN Power Devices Gallium Nitride (GaN) transistors offer superior switching speed, high thermal conductivity, and reduced energy losses compared to silicon MOSFETs. GaN devices are particularly effective in high-frequency SMPS (up to ~1 MHz), enabling smaller, lighter, and more compact designs with improved reliability . 3. Soft-Switching Topologies Implementing soft-switching techniques, such as zero-voltage or zero-current switching, reduces switching losses by minimizing voltage and current overlap during transitions. This approach is especially beneficial when using high-speed GaN devices, improving efficiency and reducing thermal stress . 4. PCB Layout Optimization At high frequencies, PCB parasitics (inductance and capacitance) significantly impact efficiency. Minimizing loop areas, using high-frequency laminates (e.g., Rogers), and optimizing copper thickness and spacing reduces conduction and switching losses. Proper layout also mitigates EMI and crosstalk, which are more pronounced at multi...

Article Content

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

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

Design Considerations for High Frequency Magnetic Materials

Measurement of high frequency power loss. Leveraging Existing Materials in Emerging Application New Material Development The

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

PowerPlus High Frequency Power Supply | NWL

NWL is the leading manufacturer of high frequency switch mode technology power supplies for use in high power industrial applications.

AN-140: Basic Concepts of Linear Regulator and Switching Mode Power ...

However, higher switching frequency also means higher AC-related power loss, which requires larger board space or a heat sink to

MOSFET fast switching: motivation, implementation and precautions

These features make it the best fit for high-switching-frequency applications, fulfilling the requirements of high efficiency while

Understanding switched-mode power supplies (SMPS)

An in-depth exploration of switched-mode power supplies (SMPS), the principles, architecture, converter topologies, and making the

Design tips for linear and switched-mode power supplies

Compared to their linear predecessors, switched-mode power supplies are not only much smaller and lighter, but they are more

Low-Noise and Low-Ripple Techniques for a Supply Without an LDO

Many noise-sensitive systems use low-dropout regulators (LDOs) to provide low-noise and low-ripple power to sensitive analog

Challenges of designing high-frequency, high-input-voltage DC/DC

A DC/DC converter operating at 1 or 2 MHz seems like a great idea, but the switching frequency impacts the power-supply sys -tem

Frequency Selection in Switching Power Supply Designs (Part II)

Power engineers must consider numerous factors to determine the operating frequency range and variation characteristics of

Frequency Selection in Switching Power Supply Designs (Part I)

This article is the first part of a two-part series delving into switching frequency design. Part I will discuss calculating for the key

Switched Mode Power Supply: A High Efficient Low Noise Forward ...

This paper proposes a low noise high-frequency forward converter SMPS. The primary target in the power electronics industries is to

Switched Mode Power Supplies

Switched-mode power supplies (SMPS) are defined as power supplies that utilize semiconductor switching technology to convert

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