

New High-Frequency Switching Power Supply for IoT Applications

Article Overview

High-frequency switching power supplies for IoT applications enable compact, energy-efficient, and high-performance power conversion using advanced topologies and adaptive control strategies.

Overview

High-frequency switching (HFS) power supplies are increasingly critical for IoT devices, which demand low power consumption, compact size, and high efficiency. Operating at frequencies typically in the hundreds of kHz to MHz range, these power supplies reduce the size of inductors and capacitors, improve transient response, and allow for higher power density, making them ideal for space-constrained IoT systems .

Key Design Considerations

- o Efficiency and Power Management: High-efficiency DC-DC converters, such as buck converters, are widely used to step down voltage while minimizing energy loss. Techniques like pulse-frequency modulation (PFM) improve efficiency at light loads by reducing switching losses and quiescent current, extending battery life .
- o Control Strategies: Modern HFS power supplies often employ adaptive control methods, dynamically switching between PWM and PFM modes based on load conditions. This ensures stable voltage regulation at high loads while optimizing efficiency at low loads .
- o Thermal and EMI Management: High-frequency operation generates heat and potential electromagnetic interference. Advanced materials, such as wide-bandgap semiconductors (GaN, SiC), and careful layout design help mitigate thermal issues and improve overall reliability .
- o Voltage Ripple and Stability: Two-stage HFS designs with optimized PWM rectifiers and DC-DC converters can reduce voltage ripple significantly (e.g., from 8 V to 1 V), ensuring stable output for sensitive IoT sensors and electronics .

Advanced Features

- o High Pulse Current Support: Some HFS power supplies, like Astrodyne TDI's AWG, support high pulse currents with fast slew rates, making them suitable for applications requiring rapid current transitions, such as semiconductor lasers or pulse plating .
- o Polarity Control: Certain designs allow reversible output polarity, enhancing flexibility for IoT and industrial applications .
- o Parallel Operation: Converter blocks can be connected in parallel to increase output power while maintaining efficiency and low ripple .

Benefits for IoT Applications

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- o Miniaturization: Smaller passive components reduce device footprint, critical for embedded and wearable IoT devices .
- o Improved Efficiency: Adaptive switching and modern semiconductor devices maintain high efficiency across varying loads .
- o Better Dynamic Response: High switching frequencies enable faster control loops, improving transient response and system stability .
- o Cost and Weight Reduction: Reduced component size lowers material costs and overall system weight .

Conclusion

New high-frequency switching power supplies for IoT applications combine compact design, high efficiency, adaptive control, and advanced semiconductor technologies to meet the stringent power requirements of modern IoT devices. By addressing challenges such as thermal management, voltage ripple, and dynamic load response, these power supplies provide reliable, energy-efficient solutions for battery-powered and embedded systems .

Switching power supplies (SMPS) have become a cornerstone of modern electronics, powering everything from

In modern electronic products, the high frequency transformer is a key component of the

While a wide range of isolated topologies are available, the phase-shifted full-bridge converter is more suitable for

INTRODUCTION The industry drive toward smaller, lighter and more efficient electronics has led to the development

In switching power supply designs the input voltage is rectified and filtered at the input. Then it goes through a chopper, which

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

Hybrid PFM-PWM Digital Controller for Miniaturized High-Frequency LLC Converters Integrated in Advanced IoT Devices Abstract:

PowerPlus(TM) Series High Frequency Switch Mode Power Supplies NWL first developed the PowerPlus(TM)

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Figure 1 shows the target applications in relation to the power capacity and the switching

Abstract--This paper presents a power supply using an increased switching frequency to minimize the size of energy storing

High-frequency switching power supplies are widely used in various electronic devices and systems due to their

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

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

A high-frequency switching-mode power supply (HF-SMPS) converts AC or DC input into tightly regulated DC output

The ongoing demand for smaller and lighter power supplies is driving the motivation to increase the switching

Discover what a switching power supply (SMPS) is and how it efficiently converts AC to DC

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