POPULAR SCIENTIFIC ABSTRACT

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Compact High-Efficiency DC/DC Converter using Planar Magnetics

With the increased consumption of electricity in applications such as renewable energy, electric vehicles, data centers, and medical equipment, the performance of power supplies has become increasingly important in recent years. The introduction of new components, such as wide-band-gap (WBG) devices, contributes to this advancement. It is possible to significantly reduce the size of power supplies by using these components. However, as power supplies become more compact, it becomes more difficult to cool the various components due to a reduction in surface area. Power supply transformers and inductors, also known as magnetic components, are examples of such components. It is possible to increase the surface area of the magnetic components without increasing their size by making them flatter in shape. Following the introduction of WBG devices, there has thus been an increase in the development of these flat magnetic components.

The purpose of this thesis, "Compact High-Efficiency DC/DC Converter Using Planar Magnetics," is to investigate how to properly model and design flat magnetic components. To aid in the design of flat magnetic components, various calculation methods have been developed. During the design process, the ability to precisely determine the undesirable properties of the magnetic component is critical. To determine these undesirable properties, a precise simulation method was developed. Measurements on various constructed magnetic components were used to validate both the calculation and simulation methods.

A high-efficiency 5kW power supply was created using the developed magnetic components. In comparison, a typical laptop power supply can deliver around 100W. As a result, the developed power supply can deliver 50 times more power at approximately the same volume.