Abstract

Power electronics has become so pervasive and embedded in our daily lives. Main aims of power electronic systems are to control, convert, and condition electrical power flow from one form to another through the use of solid-state electronics. Regardless of application, a power electronic system or subsystem comprises three key sections: input filter, high-frequency switching network, and output filter. The switching network is the main power processing unit that manipulates power from the input to the output with low power dissipations in the switching devices. The input filter is used to prevent unwanted noise generated by the switching network from getting into the source, and assure compliance with regulatory electromagnetic compatibility standards, while the output filter is used to pass wanted electrical output form and attenuate unwanted noise to the load. Both filters are made up of passive components.

As practical switching devices and passive components are non-ideal, major amount of power losses in the system is in the conduction and switching losses of the switching network, and the ohmic and magnetic core losses of the filters. Although recent advances in new and emerging materials, device technologies, and network topologies have resulted in reducing the losses of switching devices and increasing the operating frequency for reducing the filter size, the filter sections still occupy considerable space and constitute a major part of the total power loss.

The ever-increasing density of power electronic systems is straining designers’ abilities to squeeze space for the filters without sacrificing performance. However, there have been no significant enhancements in the filter structure and design in today’s power electronic systems, as compared to the conventional approach. The filter section will become a key limiting factor in advancing the power density and performance of the future power electronic systems. The speaker will share a filtering technology, named “Power Semiconductor Filter (PSF)”, as a substitute for passive input filters. He will illustrate how the PSF is applied to different power converters.



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