Minimizing EMI in Switched-mode PSUs

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Developers of applications that feature power conversion elements, including home appliances, power tools, industrial and office equipment, will know only too well that electromagnetic interference (EMI) i s largely unavoidable. However, they should also know that it can be managed, so that its effects are minimized to the point that they no longer present a problem.

As engineers are aware, EMI is the phenomenon that causes one electronic device to be affected in some way by another device that is generating an electromagnetic field - stray energy in the radio frequency (RF) spectrum. It would be inaccurate to think of EMI simply as an inconvenient design problem that has to be dealt with; it is far more appropriate to see it as a regulatory requirement that must be managed within well-documented parameters, as compliance is mandatory in order for any product to be put into service.

One of the challenges with EMI is that it can be difficult to predict. At a system level, it is not easy to know just how much interference a product will generate, or how its own sub-systems may be impacted by local interference. However, there are best practices that design teams can follow to help them deal with these issues, starting with choosing components that have been designed to generate low levels of EMI. This can help considerably in overcoming the associated design challenge, but there are other ‘best practices’ that engineers can follow if they want to minimize EMI, especially in switched-mode power supply units (PSUs).

As a rule of thumb, suppressing EMI becomes harder as the operating frequency of a switch-mode converter rises. One recommendation is to reduce the need for suppression by designing-in components that generate less EMI. The trick, of course, is not making the design process any more complicated. Indeed, with the correct selection of components, design can even be simplified.

Low power and low EMI are becoming increasingly more critical factors when designing buck converters. To this end, Diodes Incorporated has developed a series of low EMI converters that enable engineers working on switched-mode power supply units to reduce the amount of EMI that their designs generate. By using more efficient switching devices it is also possible to reduce heat and make it easier to develop more compact devices.

A low EMI buck converter is ideal for a number of applications, from network systems to power tools, laser printers, industrial power and 12V/24V distributed power bus supplies, as well as consumer electronics that need highly efficient converters for FPGA, DSP and ASIC supplies. Low EMI buck

converters are also suitable for use in home audio systems, gaming consoles, white goods and small appliances, flat-screen TVs/monitors and set-top-boxes.

The AP6320x family of 2A synchronous buck converters from Diodes has been designed to deliver best-in-class EMI performance and ultra-low quiescent current. All the devices in the range – the AP63200, AP63201, AP63203 and AP63205 – are designed for ease of use with peak current mode control, minimizing the external component count.

The low EMI converters have an input voltage range of 3.8V to 32V supporting 5V, 12V and 24V power supplies and can withstand a 40V, 400ms input surge. In addition, integrated 125mΩ high-side and 68mΩ low-side power MOSFETs are included to support high efficiency step-down DC-DC conversion. The whole family of products incorporates features that help to keep EMI down to a minimum when designing switched-mode PSUs. These include Frequency Spread Spectrum (FSS) with a switching frequency jitter of ±6%, which reduces EMI by not allowing emitted energy to stay in any one frequency for any significant amount of time. They also have a proprietary gate driver scheme that resists switching node ringing without sacrificing MOSFET turn-on and turn-off times – this also removes high-frequency radiated EMI noise that can be caused by MOSFET switching.

Other features of the low EMI buck converters include ultra-low Iq, high efficiency at light load, adjustable undervoltage lockout points to increase design flexibility, and optimized pinout to minimize the AC switching current loops, which in turn minimize system noise. The AP63203 and AP63205 units in particular are fixed output buck converters that feature the best design in terms of reducing EMI, as a simpler PCB layout design cuts the number of external components required and ensures there are short current loops on the PCB, making EMI issues even less likely. The number of external components is reduced still further with fixed 3.3V and 5V output options.

It’s clear that by understanding the root causes, it is possible to devise the best ways to minimize EMI in switched-mode power supply units. To this end, Diodes has developed a portfolio of products that feature ultra-low quiescent current buck conversion to enable engineers to keep EMI to a bare minimum in their designs.

For more information on the AP6320x series, visit us at Diodes.com.