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What's all this stuff about "Digital Power"?

It seems that every 2-3 weeks an article or news announcement about "Digital Power" appears in electronic design periodicals or online news links. In fact, one industry newsletter seems to be having a love affair with digital power, as it mentions it in just about every issue.

So what is all this fuss about Digital Power and what is it anyway? Well, the simple answer is that there are two basic types of digital power. These are Digital Control (used internal to the power devices) and Digital Power Management (provides external control and communications between power devices and a master controller).

Digital Control

The majority of switchmode AC-DC and DC-DC power supplies/converters use analog techniques to regulate/control the output voltage, current, and power factor correction circuits, etc. The closest that most of these devices come to looking a bit digital (On/Off states) in nature is by employing Pulse Width Modulation (PWM) in their switching regulator circuits; but even that is a bit of a stretch.

In recent years, new integrated circuits (ICs) have been developed that can replace "analog" control ICs and discrete circuits, which are used extensively in all power devices, with those that are, at least in part, "digital" in nature. These internal ICs and circuits perform such control functions as: voltage regulation (VR), power factor correction (PFC), pulse width modulation (PWM) control, internal monitoring/alarms, and external communications.

The advantage of these digital ICs is that they can be programmed by engineers with digital or analog electronics training. And, since the Universities are pumping out more digital (e.g., computer science) than analog engineers these days, these digital ICs are becoming attractive. However, at present the cost of these digital ICs (along with NRE for the equipment needed to program the devices) is still higher than for the mature analog ICs. Nonetheless, some predict that these IC costs will become equal within the next 12 months or so. A potential disadvantage of these digital ICs is that, by their nature, they require a high speed clock to operate, which can add to the radiated and conducted noise coming from the power supply or converter. However, advanced functions such as fault diagnostics/prevention and improved power efficiencies are among the promises of the new digital control ICs.

Digital Power Management

As mentioned above, Digital Power Management (DPM) involves the external control and communications between power supplies (or converters) and a master controller. Currently, many analog-based power solutions already have the ability to communicate with an external computer or controller via digital communications links (e.g., RS232, RS485, GPIB, or I2C bus).

Newer DPM control and communications formats have evolved that are designed to operate with the new digitally-controlled power devices. These include DPM technologies such as PMBus (Power Management Bus) and Z-One. Sadly, these technologies are not compatible or interchangeable. In fact, currently there are lawsuits between the backers of both of these technologies.

If I were a potential user of these Digital Power Management schemes, I would stay clear of them until the lawsuits are settled (expected to occur within the next 12 months), rather than find out later that the cost of these DPM ICs or controllers have substantially increased due to royalties that must now be paid to the company that won the lawsuit.

The potential advantages of the DPM and digital power technologies in general, include enhanced bidirectional communications, fault diagnostics, remote programming of the linked power supplies/converters, automatic compensation of dynamic input and output load changes, and overall improvements in efficiencies that relate to green-power.

In Summary

Although "Digital Power" is a popular buzzword these days, especially by those companies who have developed or adopted the technologies, the bottom line will always be: "What do I get for my money?" At present, there are hardly any power supply or converter applications that "must have" digital power when

compared to the many lower cost and field-proven analog solutions that exist.

For example, during their new power-product design and development process, Lambda has designed in-parallel devices that employed both analog along with those that use digital control ICs and technologies. In all cases, the final decision on which technology ultimately goes into production has been based on comparative price/performance factors; which is the dominant decision factor for their customers.

When the time comes that digital power products offer the same or better performance and reliability, along with the ”needed features”, at the same or lower price as analog-based products, that is when Digital Power will become the winning technology. Realistically, someday digital power will provide a price/performance advantage over purely analog power devices. Who knows for sure when that time will come.

Posted by Power Guy