Infineon Launches CoolMOS CS Server Series High-Voltage Power Transistors for High-End Power Supplies

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New MOSFETs Offer World's Lowest On-State Resistance and Fastest Switching Speed

Continuing its tradition of pioneering innovations for the semiconductor industry, Infineon Technologies today launched its CoolMOS CS Server series of high-performance power transistors, designed specifically for power supplies used in computer servers and other high-power-density applications such as telecom equipment and flat panel displays. Heat generated by the power supply can be a major problem and leads to costly thermal management efforts. Infineon's new family of power transistors will enable power supply designs that are smaller, more energy efficient and generate significantly less heat than alternative power transistors.

The CoolMOS CS Server series is being introduced at the 2005 Applied Power Electronics Conference, taking place this week. Based on a technical breakthrough that allows them to overcome the so-called silicon limit for performance, the new CoolMOS CS Server metal-oxide semiconductor field-effect transistors (MOSFETs) have the world's lowest on-state resistance of 99 mΩ (milliohms) in a standard TO 220 package, or 45 mΩ in a standard TO 247 package, coupled with the industry's fastest switching speeds of 150 V (volts) per nanosecond and a 600 V voltage blocking capability.

“Our latest generation of high-voltage power MOSFETs will make AC/DC power supplies more efficient, more compact and easier to use worldwide,” said Gerhard Wolf, director of marketing of Infineon’s power management division. “With today’s hunger for power, intelligent and efficient use of electrical power is a must.”

Infineon is demonstrating a 1000 W (watt) reference design for a server power supply, with one 99 mΩ CoolMOS CS power transistor. It produces 1.5 per cent higher efficiency compared to a similar power supply made using two commonly available, standard 250 mΩ MOSFETs, placed in parallel. This increased efficiency results in more than 10 percent system cost reduction per watt. It also enables the designer to realize a smaller form factor for the system. In addition, Infineon is also demonstrating a 1500 W power factor correction design, which achieves 99 percent efficiency with a 99mΩ CoolMOS CS power transistor, an industry record.

The silicon limit

The ideal high-voltage switch (MOSFET) for use in a power supply should have no resistance in its “on state”, when it conducts electricity. Conversely, in its “off state”, it should block an infinitely high voltage and prevent any electricity from flowing through it. In reality, this proves to be impossible. Doubling the voltage blocking capability typically leads to an increase in the on-state resistance by a factor of five – a physical law often referred to as the silicon limit for performance.

Infineon’s researchers overcame this fundamental barrier by clever design of their high-voltage CoolMOS switch family. “To come as close as possible to zero resistance we add more and more charge in the device for current conduction,” said Dr. Gerald Deboy, head of technical marketing for high-voltage discrete devices at Infineon Technologies, who led the development team. “This charge is then counterbalanced by

exactly the same amount of charge of the opposite type. The two charges are separated locally in the device by a very refined technology. In the end, we get a pattern with very fine pitch. The finer the pitch can be made, the lower the on-state resistance will be. With every CoolMOS generation, we increase the fineness of the pitch, moving ever closer to the zero resistance point without losing voltage blocking capability."

Additional technical details about the CoolMOS CS Server series

The CoolMOS CS Server series offers the lowest on-state resistance in every package at 600 V voltage blocking capability. This allows designers to lower the conduction losses of power supply designs, which increases efficiency. Higher efficiency allows the designer to have a smaller form factor for the system, or to increase the output power of the system without changing anything in the thermal management, directly driving down system costs per watt. The benefit of low conduction losses comes with very fast switching speed, which in turn will largely reduce switching losses of the system. This fast switching speed can be used to return from complex resonant power supply architectures to simple, easy-to-design hard-switching AC/DC supply topologies. Additionally, the new CoolMOS CS Server series requires very low gate-drive power, allowing the use of low power standard gate drivers and ICs. The overall result will be less-expensive, more compact systems, due to the reduction in size and cost of passive components.