# Power control design key to realizing InfiniBand℠ benefits

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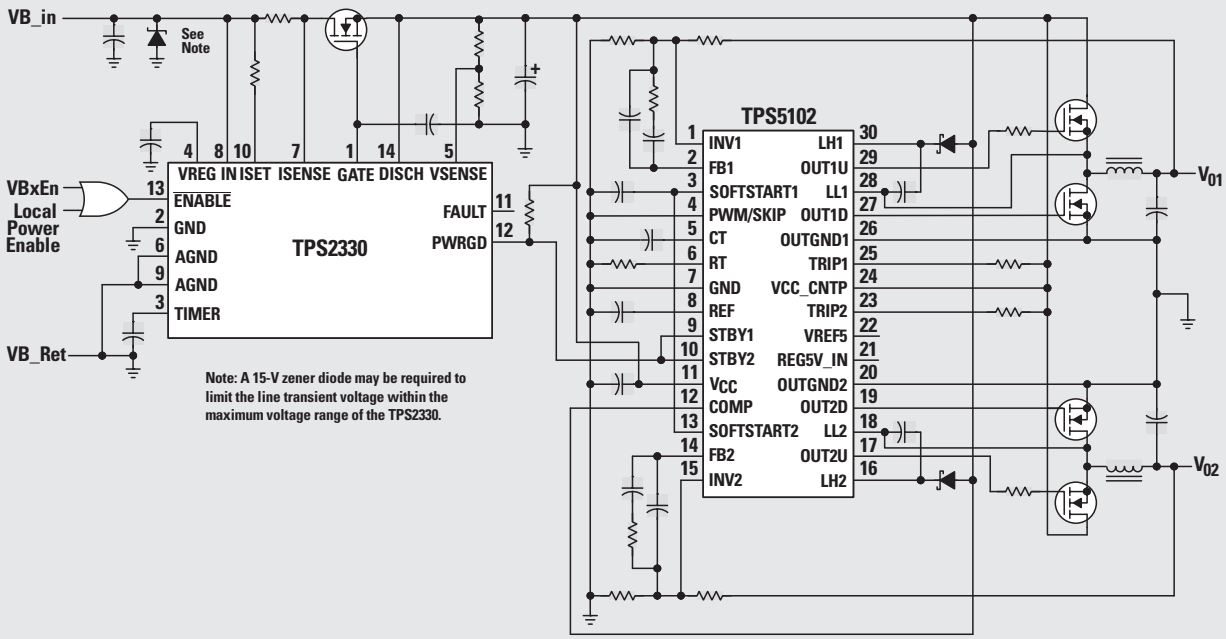
The InfiniBand technology is a modularly scalable switched-fabric architecture. It currently uses a 2.5-Gbit/sec bidirectional serial point-to-point interface whose roadmap extends from 500 Mbit/sec out to 6 Gbit/sec, with auto-speed sensing. It was defined to solve many of the problems seen in the parallel interconnects of today's servers and system area networks; and a great deal of time and effort has gone into defining the digital interface and control structure. However, the details of implementing appropriate power control have been left up to the designer.

From a power perspective, InfiniBand is a true hot-plug implementation. Power is not only applied to the main system during module insertion and removal but is also present at the connector. This is not true for compact PCI, PCIx, PCMCIA or most other hot-plug applications. The fact that this is a truly hot-swappable socket creates significant hurdles and places several limitations on the power interface designers. There is a need to manage and optimize inrush currents, system voltage droops, and module and backplane capacitance. The designer also needs to determine the level of fault protection required in both the system and the module.

The InfiniBand specification defines two power connections for the modules. The first is bulk power. It is a 12-V (±2 V), 2.5-A supply that is intended for all of the major functions of the module. The second is auxiliary power. It is a 5-V (±5%), 260-mA supply intended for standby or configuration modes of operation, but it can be implemented as the only supply required by the card for operation. Due to its low power, the auxiliary power rail is a rather straightforward implementation, especially since the card is always allowed to draw power from it. On the other hand, the bulk power rail can provide up to 50 W to a module, depending on the module's size and power configuration. Along with this, there are several modes of operation where the bulk power load on the card must be turned off.

In order for the bulk power hot-swap power management (HSPM) solution to be effective, it must have logic level controls and reporting capabilities. It is important for the

**Figure 1. InfiniBand bulk power solution**



HSPM to control the rise times of the power FETs in the circuit, limit current to the load, and report overloaded conditions to the system. In order to maintain a clean and stable power rail on the card, considerable capacitance may be required. This means that the HSPM selected must be able to turn on into a highly capacitive load and manage the di/dt demand characteristics of the circuit.

Managing the 12-V bulk power rail during the hot insertion and removal of modules is, however, only half of the solution. As most circuitry no longer runs at 12 V, it will be necessary to efficiently regulate 12 V down to 3.3 V, 1.8 V, or whatever other voltages the card requires. The switching regulator topology selected may add to the bulk capacitance required in the module and may also demand specific voltage ramp rates or enabling sequences for proper operation.

Of the various options for InfiniBand bulk power management, one solution that takes into consideration all of the hurdles and requirements mentioned uses an HSPM, such as TPS2330, and a power supply controller, such as TPS5102 (see Figure 1). With minimum external circuitry other than discretes, a truly effective solution is possible. The TPS2330 HSPM is designed to manage voltage rails with a nominal value from 2.7 V to 13.5 V. Its gate pins implement a voltage ramp drive topology, which provides a very graceful turn-on for the external FETs. It also has an integrated adjustable circuit breaker and a Power Good reporting function for system status updates. The TPS5102 is a high-efficiency, dual-output power controller. Its topology requires minimal input and output capacitance, and its operating frequency reduces the size requirements of other external components. It has several system control features that benefit InfiniBand, such as independent standby and soft-start configurations.

## Related Web sites

**www.ti.com/sc/docs/products/analog/tps2330.html**
**www.ti.com/sc/docs/products/analog/tps5102.html**

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