



# On your marks

**H**igh availability systems are becoming more widely used. Obvious examples include server systems and other high end computer installations. But there are also many applications in the telecommunications and networking sectors.

Providing and protecting the power supply to these systems is an important part of the design process. One of the traditional ways of accomplishing this is ORing – preserving the redundant bus in the event of a power source fault.

The standard approach to ORing is to use diodes. It's a simple solution, but it does have a number of drawbacks. Apart from being bulky, the technique is not very efficient, which means a lot of heat can be generated. This in turn brings thermal management – heatsinks or fans – on to the design agenda. But diodes are a simple solution to another problem: reverse current.

Another approach is so called active ORing. In this method, a mosfet and controller are applied, bringing a huge jump in efficiency and a consequent reduction in the need for thermal management. Along with greater efficiency, active ORing solutions generally come in high density surface mount formats. However, the mosfet controller must have a rapid response if there is a fault.

Carl Smith, director of strategic marketing and business development for Picor, explained: "The problem is that, when you turn on a mosfet, current can flow in both directions. You therefore need to be able to turn the mosfet off very quickly in order to prevent exposure to the fault."

Picor is a fabless power

*ORing systems keep redundant power supplies ready to spring into action.*

*By Graham Pitcher.*

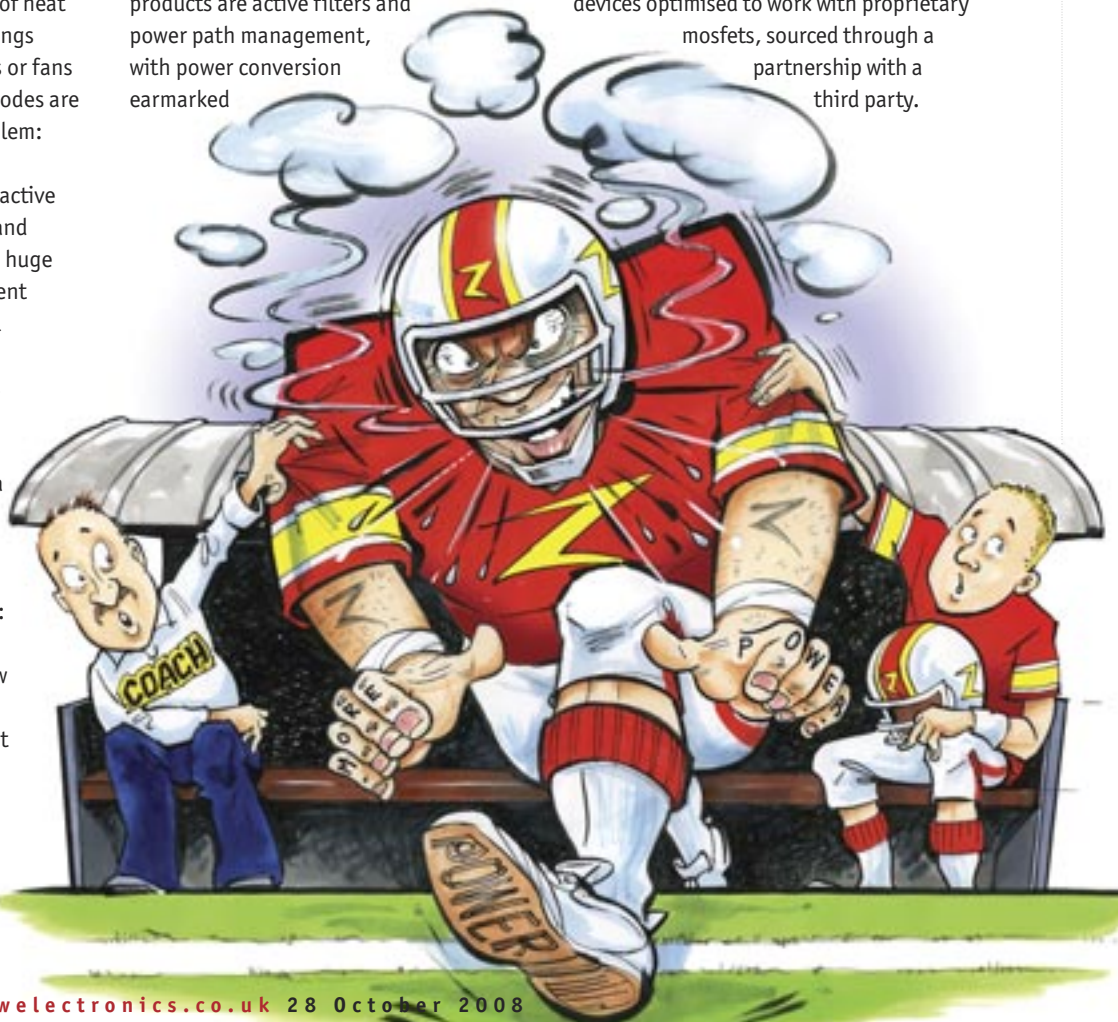
management product developer and a wholly owned subsidiary of Vicor. According to Smith: "We've been developing power silicon for use in Vicor's products for some time. We're now developing the Picor brand and are launching a range of products." Amongst the target market for these emerging products are active filters and power path management, with power conversion earmarked

as a market for the future.

Smith points to a number of ORing methodologies (see figure 1), including redundant systems, N+1 current sharing systems and low side redundant. And Picor is introducing products to address these under the family name Cool-ORing.

According to Smith: "We can supply discrete controller ics as well as integrated solutions. Which selection is made depends on the requirements and the customer's design expertise. But we do bring flexibility to the problem."

The controller integrated into some of the Cool-ORing devices is capable of powering industry standard mosfets, while the integrated solutions are high density devices optimised to work with proprietary mosfets, sourced through a partnership with a third party.





Picor notes the discrete devices in the Cool-ORing family can work with a range of bus voltages, whilst providing fast dynamic response to input power source failures. And the devices are scalable for high currents.

Integrated solutions, meanwhile, are small – measuring 5 x 7mm – occupying up to 70% less space than other solutions. Again, a range of bus voltages can be handled and the same scalability for currents is provided.

The PI2001 is designed to work with single or paralleled n-channel mosfets and on either the high or low sides of a redundant power system.

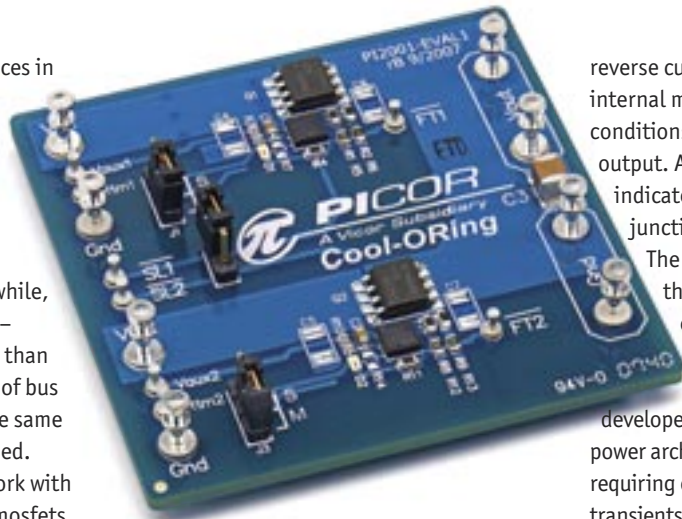
By placing an n-channel mosfet with a low on resistance in the conduction path, the device reduces the power dissipation significantly compared with a conventional diode. But, as noted above, the controller needs to react quickly to input source failures in order to avoid reverse current.

Gate voltage

According to Picor, once the gate voltage falls below the gate threshold, the mosfet is off and the body diode will be reversed biased, preventing reverse current flow and forward voltage droop.

Smith noted: "There are also programmable features that monitor other system parameters, such as over and under voltage. And in some systems where there are temporary reverse currents, you can blank some of this."

The PI2001 – supplied in a choice of 3



x 3mm 10lead tdfn or 8pin soic packages – integrates a high speed low offset voltage differential amplifier to measure accurately the difference between the sense positive and sense negative pins. The amplifier's output is connected to three comparators: reverse; forward; and forward over current. Of these, the reverse comparator is said to be the most important, looking for the negative voltage caused by reverse current.

The PI2001 is complemented by three further devices: the 8V, 24A PI2121, 15V, 15A PI2123 and the 30V, 12V PI2125 – all fully active ORing solutions. The parts, which come in 5 x 7mm land grid arrays, feature mosfets with a typical on state resistance of 1.5mOhm, 3mOhm and 5.5mOhm respectively. Each product can be paralleled to address higher current requirements through a master/slave feature.

All three devices detect normal forward, excessive forward, light load and

reverse current flow through their internal mosfets and report fault conditions via an active low fault flag output. A temperature sensing function indicates a fault if the maximum junction temperature exceeds 160°C.

The under- and overvoltage thresholds are programmable via external resistor dividers.

A further active ORing controller ic, the PI2003, has been developed for use in -48V redundant power architectures. Suitable for systems requiring operation during input voltage transients up to 100V for 100ms, the device's low quiescent current enables low loss biasing directly from the -48V rail.

Full function active ORing

The PI2122 is a complete full function active ORing solution with a circuit breaker feature. Integrating a high speed mosfet controller and a low on state resistance mosfet, the part comes in the 5 x 7mm land grid array format.

This part is intended for use in redundant power system architectures and is suited for bus voltages of less than 5V, but where added protection is needed when faults occur.

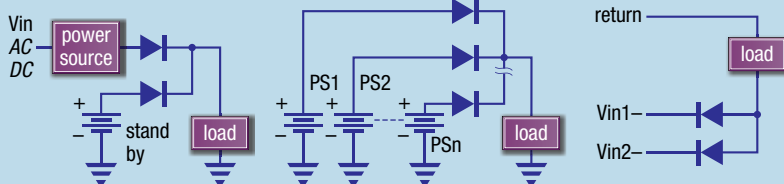
Rated at 7V, 12A, the device integrates back to back mosfets for high efficiency, providing fast dynamic response to input power source and output load problems. According to Picor, the reaction times are 140ns and 170ns respectively.

Evaluation boards (see picture above) are available for each product. For example, the PI2001-EVAL1 board allows users to explore the basic characteristics of the PI2001.

The board is configured to accept two independent power supplies through two active ORing channels, which are then combined to produce a redundant power output.

Each channel, which can handle up to 20A, has a PI2001 controller and an n-channel mosfet. For currents of more than 20A, the two channels on the board can be paralleled in a master/slave arrangement or linked with a second evaluation board. ■

Figure 1: ORing applications



redundant systems two voltage sources. the main source supplies the full load current when available

current sharing systems: n+1 when one source drops off, the remaining sources compensate for the lost source

low side redundant application the source with higher voltage will supply the current