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AnalogDialogue

# RAQ Issue 208: How to Design a Simple, Uninterruptible Power Supply with Supercapacitors

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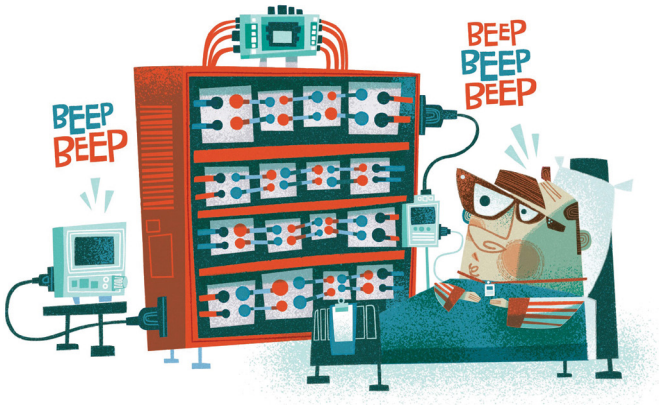
## Question:

How can you more easily ensure a continuous, reliable power supply in power-critical applications?




## Answer:

In many applications, it is important for the supply voltage to be continuously available no matter what the circumstances. This isn't always easy to ensure. A new concept can provide an optimal solution for an uninterruptible power supply with an extremely compact design.

There are several applications in which an uninterruptible power supply is needed. One example is the RAID systems for redundant data storage, which must be protected so that no data is lost in the event of a power failure at an inconvenient time such as during data backup activity. Systems with real-time clocks also must be supplied continuously with power. This can come from a battery or another backup solution. Other applications are telemetry applications in the automotive sector and systems for administering medications—for example, controlled insulin pumps used in the healthcare sector.

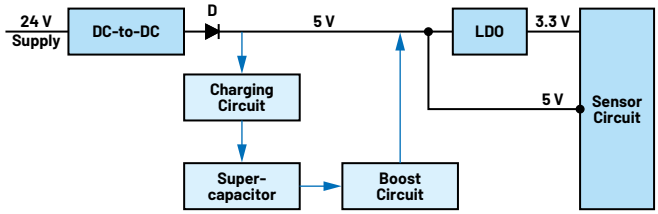



*Figure 1. A typical application for an uninterruptible power supply.*

Figure 1 shows a typical industrial application for an uninterruptible power supply. Here, an industrial sensor is supplied with power. The reliability of the system mainly depends on the power supply of this sensor. A linear charge regulator IC is used to charge a supercapacitor when there is available system voltage. If the system voltage drops, the energy from the energy storage system is raised to the required supply voltage level with a boost regulator. This system works well but is difficult to implement because many different energy converters are needed. Also, in many applications, it is important that no energy flows from the energy storage system back to the power supply (pictured in Figure 1). As shown in Figure 1, the supercapacitor should only power the sensor circuit and not any other electronics that may be attached to the 24 V line (shown on the left of Figure 1). The energy storage system is normally designed to supply the local load and not the complete system attached to the 24 V supply voltage. This makes Diode D in Figure 1 necessary.

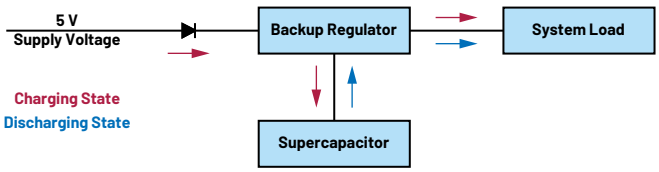



*Figure 2. The Continua backup concept with numerous integrated system functions.*

Figure 2 shows a new concept supported by the MAX38889 from Analog Devices. It is a highly integrated backup solution called Continua™ for power rails up to 5 V. A single IC with a few passive external components is all that is required. The MAX38889 has an integrated half bridge, operated alternately in highly efficient buck and boost modes.

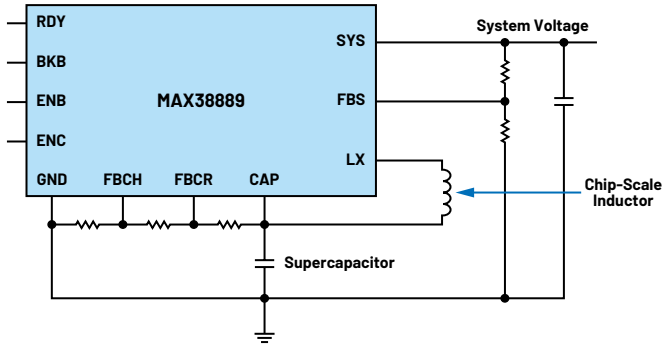



*Figure 3. An implementation with a tiny Continua backup solution with a MAX38889 from ADI.*

Figure 3 shows a complete, operable circuit. The logic and the power switches are all integrated, so just a small external chip-scale inductor and a few backup capacitors are required, apart from the supercapacitor.

The integrated high-side power switch is executed with the True Shutdown™ technology from ADI. As a result, the system voltage can be separated from the CAP voltage so that no current flows from the CAP to the system if the CAP voltage is ever higher.

While there are plenty of backup solutions for various voltage and current ranges on the market, the MAX38889 Continua is a unique backup solution with a compact design that can easily be added to the 5 V or 3.3 V supply line with minimal development and implementation effort. This solution also has a high conversion efficiency of up to 94% in charging and discharging modes to minimize the size and the cost of the energy storage.

## About the Author

Frederik Dostal is a power management expert with more than 20 years of experience in this industry. After his studies of microelectronics at the University of Erlangen, Germany, he joined National Semiconductor in 2001, where he worked as a field applications engineer, gaining a lot of experience in implementing power management solutions in customer projects. During his time at National, he also spent four years in Phoenix, Arizona (U.S.A.), working on switch-mode power supplies as an applications engineer. In 2009, he joined Analog Devices, where since then he held a variety of positions working for the product line and European technical support, and currently brings in his broad design and application knowledge as a power management expert. Frederik works in the ADI office in Munich, Germany.