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Battery-based power supplies can be used in a broad range of applications for different reasons. From the customer needing low noise power supplies for sensing equipment, to the customer willing to drive a magneto or piezo-mechanism from an autonomous power supply in embedded applications, Cedrat Technologies can design power supplies using high quality lithium-polymer batteries.

Fig. 1: 3.7V, 2000mAh, lithium-polymer battery cell.

OBJECTIVE

The use of battery-based power supplies is a smart solution to solve issues such as the need for:

- Systems with autonomous energy source
- High power density and efficiency
- Reduced size and weight
- Low noise
- Specific supply voltages

The targeted applications are mainly the embedded applications, where it is mandatory to have autonomous power supplies. Low power voltage levels can be provided to supply a low-power board such as a conditioning electronic or a digital controller. High power voltage levels can also be provided if it is required to supply a power amplifier for a piezo-actuator for instance. For noise sensitive electronics and components, it is also interesting to use battery-based power supplies which allow avoiding the noise carried by the power grid. For instance, this is used for high resolution and precision sensing equipments such as accelerometers, 3-D localizing in medical environment.

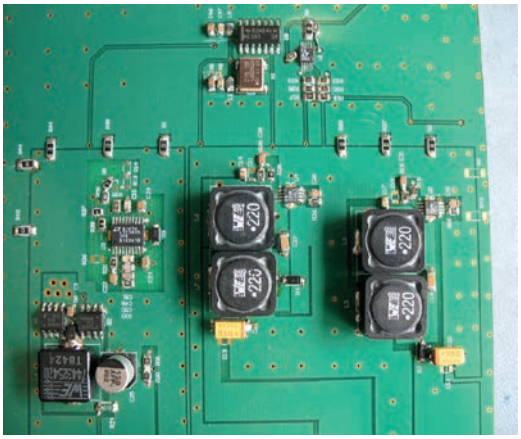

Fig. 2: Synchronized DC/DC converters for generating different voltage levels from a battery source.

TECHNOLOGY

The power supplies are based on 3.7V (typical) lithium-polymer cells which provide an unregulated output voltage, those batteries correspond to the energy storage of the supply. The lithiumpolymer technology is the most efficient battery technology; it is able to provide high power in a reduced package and for a reduced weight. The cells can be arranged in serial or parallel depending on the need for voltage, current, and operation time. This allows fitting easily with the customer's needs, simply by changing the cells configuration.

The supply features a smart charge circuit for the lithium polymer battery cells, which protects the battery cells from overload and over-temperature during charge sequence. The charging circuit is able to operate from a simple AC/DC converter connected to the grid.

The regulated voltage levels are generated from the battery power source using DC/DC converters, which can decrease, elevate, or invert the input voltage from the batteries. This means that almost any output voltage can be built from the battery source, using those specific topologies. The DC/DC converters exhibit very high

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efficiency of more than 80% in average, which is a great advantage to increase the operation time of the system. In order to avoid intermodulation noise when several DC/DC converters are used on a same board, CEDRAT TECHNOLOGIES uses an external synchronization technique to have the same clock for all converters. This approach significantly reduces the resulting noise of the power supply and keeps the benefits of low noise converters.

EXAMPLE OF APPLICATIONS

As an example, the application of an autonomous piezo-mechanism in closed-loop is taken to illustrate the concept. The supply will be required to provide low-power and high-power signals to the voltage amplifier for piezo-actuator, and to the UC45 digital controller and SG75 conditioner.

With 4 cells in serial configuration, the battery will be able to deliver a maximum continuous power of 30W, for an operation time of 1 hour, i.e. the energy storage capability is 30Wh. This allows powering the UC45, SG75, and LA75 boards with an 110mA current output on the actuator at 150V. If the system is used for quasi-static positioning, the amplifier is not frequently used, and the system could operate autonomously up to 7h. Other battery cells could be placed in parallel to obtain more operation time or more current.

PERFORMANCE OF THE BATTERY-BASED POWER SUPPLIES

REFERENCES	UNIT	SPECIFICATION	COMMENTS
Max.continuous battery output power	W	[7.4 ; 90]	From 1 to 12 cells
Energy storage capability	Wh	[7.4 ; 90]	From 1 to 12 cells
DC/DC converters outpu voltage span	V	[-200 ; +200]	
DC/DC conversion topologies		Step-up, step-down, SEPIC, inverter	The topology used depends on the range of voltage generated
DC/DC conversion efficiency	%	75% - 95%	Depends on the topology
Min. volume	dm3	0.2	1 cell with charge and DC/DC conversion board
Min. weight	g	200	
Max. volume	dm3	0.5	12 cells with charge and DC/DC conversion board
Max weight	g	900	