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Protect Yourself From The Dangers Of Knockoff Battery Packs

In recent years, the news of individual battery incidents such as cell-phone and laptop fires has been eclipsed by factory fires and large recalls of lithium-ion (Li-ion) cells. Several large, well-known Li-ion cell suppliers have been affected. The most notable event was the recall of Sony batteries in 2005. Panasonic and, more recently, LG Chemical have had fires affecting their Li-ion manufacturing volume as well.

While these factors present challenges for the Li-ion supply chain, the field failures of individual batteries result in the potential for serious injuries, and the continuing growth of handheld devices has spawned a healthy selection of aftermarket battery pack suppliers. Counterfeit batteries have become increasingly common and popular with consumers. Globally, more than 5 million counterfeit cell-phone batteries have been confiscated and destroyed by law enforcement officials.

IN THE NEWS

The unregulated supply represents a huge safety issue. In November 2007, *The Korean Times* reported on the death of an excavation worker. The cause of death was suspected to be a cell-phone battery explosion. The cell phone was found in the worker's shirt pocket with the battery melted, and the worker's chest was burned.

This incident was remarkably similar to an event in China reported by *The Register* in July 2007 where a welder died when his ribs were broken after an apparent cell-phone explosion. According to the article, "a Beijing spokesman for Motorola said it was 'highly unlikely' that the company's product was to blame and 'questioned whether the man was using a fake Motorola cell phone or battery.'" Seemingly random battery fires are often attributed to aftermarket or "fake" batteries.

Battery packs are no longer a simple configuration of cells. They are carefully engineered products with many safety features. The main components of a battery pack include the cells, which are the primary energy source, the printed-circuit board, which provides the intelligence of the system with features such as the fuel gauge and protection circuitry, the plastic enclosure, external contacts, and insulation.

Standards from several sources outline the safety features that battery packs need in great detail. The most significant are the IEEE 1625 and 1725 standards for laptop and cell-phone batteries, respectively. Imitation battery packs often lack one or more of these safety features. Typical violations include:

- The use of substandard or unqualified cells
- Mismatched components on circuit boards that may not provide adequate performance
- Lack of a current/voltage or thermal protection circuit
- Lack of accommodation for normal cell swelling over time
- Nonexistent or obstructed gas vents
- Bad welds or solder joints

COMBATING COUNTERFEITERS

It is important to protect yourself as a consumer against the dangers of knockoff battery packs. As an electronic design engineer, it also is your responsibility to protect your company from aftermarket packs. Fortunately, many options are available to design-in protection against aftermarket batteries.

The most obvious is the form of the packaging and connectors, but this approach can be circumvented by simple measurements. And once a counterfeit or clone is available, the original manufacturer would have to change the form factor, which isn't a trivial task.

Labeling such as stickers, certification markings, and holograms are another possibility. Good, cheap scanners and color copiers make these methods easy to reproduce, though. Web-based registration is another idea, but it creates an inconvenience for the user.

A challenge/response between the battery and the device is a more secure approach. It requires a secret shared between the host and the battery, random input, and an algorithm for generating an output that is difficult to predict. Selection of the correct authentication technique is about understanding the tradeoffs to be made.

The design community must not neglect the danger of counterfeit batteries. Imitation or aftermarket batteries have resulted in public-relations issues for portable equipment manufacturers because these counterfeits usually lack the quality of the original battery. Single-cell lithium battery packs for cell phones have received most of the media scrutiny.

However, multicell lithium packs are more complex and have many more points of failure. Also, safety is more a concern in industrial, military, and medical equipment when reliability and safety intertwine.

The quantifiable impact of imitation battery packs on the original equipment manufacturer includes increased safety risks for customers, greater product returns due to non-performing batteries, reduced customer satisfaction, and reduced revenue for batteries supplied by the original manufacturer. The intangible qualitative impact is the negative effect on the device manufacturer's brand-name equity.

ROBIN SARAH TICHY has a doctorate of philosophy from the University of Texas for her work in solid-oxide fuel cells. Look for additional Power Design columns from her in print and online.