

# TI Breakthrough in Battery Management Accurately Calculates Remaining Capacity over Life of Battery



**Building on extensive research and development in battery management, Texas Instruments Incorporated (TI) today announced a unique "gas gauge" technology that calculates remaining capacity in lithium-based battery packs with up to 99 percent accuracy throughout the entire life of a battery. The new Impedance Track™ technology allows designers and users of portable medical, industrial appliances and notebooks to prolong battery use and always know the exact amount of potential energy left inside the battery.**

"Portable devices continually rely on an accurate reading of remaining battery capacity, so the system won't lose data or worse, suddenly shut down during operation. Because current battery measurement solutions do not calculate impedance as a battery ages, the resulting error rate may be over 50 percent after a few months of use," said Dave Heacock, vice president of TI's portable power management. "Impedance Track lets end-users and designers realize the energy potential of their batteries, and effectively maintain the most accurate measurement possible over the life of the battery."

## **Taking Battery Gas Gauge Technology to the Next Level**

TI's innovative Impedance Track technology precisely gauges changes in impedance, or resistance caused by battery age, temperature and cycle patterns, to accurately predict run-time of two-, three- and four-cell battery packs. The technology, which sits inside TI's Flash-based bq20z8x gas gauge chipset, analyzes precise state of charge when a battery pack is in a relaxed state by correlating between a battery pack's open circuit voltage and the current state of charge and temperature.

An exact "starting position" is determined for instant state of charge, and total capacity is calculated from the amount of capacity that exists - eliminating the need for a full charge and discharge cycle. For certain applications such as heart defibrillators or back-up battery packs used in telecom systems that never fully charge and discharge, Impedance Track will ensure instant and accurate capacity information on a continual basis.

## **Plug and Play Battery Design**

Impedance Track relies on a dynamic modeling algorithm to learn how much a battery has degraded through age, temperature or usage, and then correlates typical chemical properties of the anode/cathode system in the battery's cell - no matter what brand of battery cell used. In fact, Impedance Track

allows for the mixing of different manufacturers' cells in a single pack, providing flexibility and continuity of supply. Many of today's gas gauge integrated circuit technologies depend on static and unreliable modeling techniques that require the creation of large databases in order to measure each attribute of hundreds of available battery parameters. The patent-pending Impedance Track technology significantly reduces development and implementation set-up time required by original equipment designers and manufacturers to ensure proper characterization because those databases are no longer necessary.

### **Multi-Cell Gas Gauge Chipset Family with Impedance Track**

The two-chip bq20z8x gas gauge reports capacity information to the system host controller over a system management bus (SMBus) interface. A host controller, such as a TMS320C55x™ digital signal processor, manages remaining battery power to extend system run time. The bq20z8x chipset also features TI's protection analog front end (AFE) chip, the bq29312, with integrated 3.3-V, 25-mA linear dropout (LDO) regulator.

### **Accurate Gas Gauge Technology for the Future**

Initially targeting applications with multi-cell, lithium-based battery packs, Impedance Track also is capable of supporting other types of battery chemistries, such as nickel-metal hydride (NiMH) or nickel-cadmium (NiCD). In addition, TI plans to target single-cell Li-Ion powered applications, such as smart phones, digital still cameras and PDAs.

### **Available Today**

The bq20z8x gas gauge chipset with Impedance Track is sampling today from TI and its authorized distributors. Volume production is scheduled for fourth quarter 2004. The chipset is packaged in a 38-pin thin shrink small outline package (TSSOP), and the bq29312 in a 24-pin TSSOP package. Suggested resale pricing in 1,000 piece quantities is \$4.35 each for the bq20z8x and \$1.20 each for the bq29312. A second-level protection IC, the bq29400 is also available from TI in an eight-pin DCT package priced at \$0.42 each in quantities of 1,000 units. Evaluation modules of the bq20z8x, complete reference designs, application notes and technical documentation are available through [power.ti.com](http://power.ti.com).

### **Leading Portfolio of Battery and Power Management IC Technology**

Leveraging its high-performance analog system expertise and manufacturing capabilities, TI is the leading provider of battery management and power conversion semiconductor technology to portable design manufacturers and battery pack manufacturers. A majority of today's notebook computers contain TI's battery management technology; and to date, TI has shipped tens of millions of advanced battery gauge ICs to wireless handset, PDA, portable medical and industrial design manufacturers.

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