

BATTERY POWER PRODUCTS & TECHNOLOGY

Solutions for OEM Design Engineers, Integrators & Specifiers of Power Management Products

Lithium Technology Corp. Powers Hybrid Electric Supercar



Heinz-Harald Frenzen, an ex-Formula One (F1) racer and champion, and Gumpert Sportwagenmanufaktur GmbH entered a hybrid electric version of its Apollo supercar into this year's Nurburgring 24 hour race, which was held at end of May. The car was powered by a battery solution from Lithium Technology Corp. (LTC). The car was piloted by Mr. Dirk Muller and Mr. Frenzen.

"We are pleased to co-sponsor the first hybrid electric version of the Apollo, produced by Gumpert in Germany, and lend our technology to a movement that increases public awareness of hybrid electric vehicle (HEV) performance and encourages advances in HEV technology," said Dr. Klaus Brandt, CEO of LTC. "LTC believes that Racing plays a significant role in pioneering the use of new technologies, such as lithium ion batteries, and offers the opportunity for us to demonstrate the performance of our batteries under extreme conditions while exhibiting the benefits and usability of our products to traditional car manufacturers."

The hybrid Apollo used a 3.3 liter V8 bi-turbo petrol mill with a 100 kW electric motor. The 9 kWh GAIA battery was made of 90 high power 27 Ah cells connected in series and weighed about 190 kilograms. The battery included an advanced battery management system (BMS) that transmitted

battery performance data via satellite for monitoring and enhance performance control of the technical team. The battery was charged prior to the race and recouped energy from braking during the race, in a mode that resembles a plug-in hybrid electric operation (PHEV).

BATTERY POWER 2008

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Industry News

Portable Rechargeable Battery Association Proposes Changes To United Nations Testing Requirements for Large Format Lithium Ion Batteries

In response to its members' participation in the production of large format lithium-ion batteries for hybrid electric and electric vehicles, the Portable Rechargeable Battery Association (PRBA) has proposed modifications to battery tests contained in the United Nations' Manual of Tests and Criteria. The continued reliance on an outdated testing scheme could stifle development of a new generation of environmentally-friendly products, PRBA warned.

The UN Subcommittee of Experts on the Transport of Dangerous Goods last updated its tests for lithium batteries in 2000, when its primary focus was on small lithium cells and batteries. At that time, no one could have anticipated the significant gains in lithium-ion battery technology, especially the widespread use of large-format batteries by the military and the aerospace, automobile and telecommunications industries. However, the existing set of tests in the UN Manual of Tests and Criteria pose significant technical and financial challenges for large-format battery manufacturers, PRBA said in its filing with the UN.

PRBA's proposal would eliminate the disparities between testing "small" batteries and large format batteries and include new definitions that clarify when battery components, cells, batteries, battery modules and battery assemblies, are subject to the UN testing requirements. Differentiating between these various components is critical to ensuring the UN Manual of Tests and Criteria remain current with industry practices and terminology.

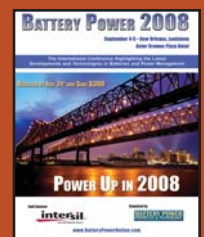
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Powering Life



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Since 1998, Quallion has delivered custom battery solutions for demanding applications. From medical implants to high voltage power supplies, Quallion leads the Lithium ion battery industry in safety, reliability and performance. Drawing upon its unique ties to the Japanese Lithium ion battery market, Quallion now offers new battery solutions to the Heavy Duty Truck Market. Enabling technologies such as the Matrix™ Battery Design, Zero-Volt™ capability and SaFE-LYTE™ offer proven battery solutions that can pass the most aggressive test conditions, including full crush and constant overcharge.

Quallion's Matrix™ Battery System was designed specifically for the vehicle market. The concept is based on matrix arrays of 18650 Li ion cells arranged in series to establish voltage, and strings of cells configured in parallel to establish capacity. The advantage of this approach is nominal use of control electronics and cell redundancy for efficient increases in reliability and survivability. Utilization of commercial grade 18650 cells offers the greatest cost effective solution and the highest variability of chemistry configuration as the cells are interchangeable in the Matrix™.

Quallion was founded by biotechnology entrepreneur and philanthropist Alfred E. Mann and Dr. Hisashi Tsukamoto.



(Top) Quallion's new 48.8V Matrix™ Module (4.2kg) comes in 7.5Ah, 9.5Ah and 12.5Ah configurations.

(Above) This 72Ah matrix-design pack offers as a lead-acid replacement for military applications for high power or high energy.

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New Batteries on the Market

Micro Power Builds IEEE 1725 Battery Pack for PDAs

Micro Power has released two new battery packs that are compliant with IEEE 1725 specification, "Standard for Rechargeable Batteries for Cellular Telephones." One custom battery pack is designed to power a rugged PDA for a leading OEM of data collection equipment, while the other is designed to power a PDA for a leading OEM of rugged notebook computers. Both PDAs utilize a cellular transceiver to transmit both voice and data.



IEEE 1725 adopts a systems approach by addressing the battery envelope from cells to the mobile devices they power, both alone and in concert. The new standard seeks to make cellular phone batteries more robust by setting uniform criteria for their design, production and evaluation. IEEE 1725 encompasses such areas as battery pack electrical and mechanical construction, cell chemistries, packaging, pack and cell controls and overall system considerations. For a mobile device to comply with IEEE 1725, the device manufacturer, the battery pack manufacturer and the cell manufacturer must all fulfill the requirements of the IEEE 1725 specification. Compliance with the IEEE 1725 specification is reviewed and audited by an independent, third party agency that specializes in the certification process. The Cellular Telecommunications Industry Association (CTIA) recently created a compliance program for cell phone and PDA batteries based on IEEE 1725.

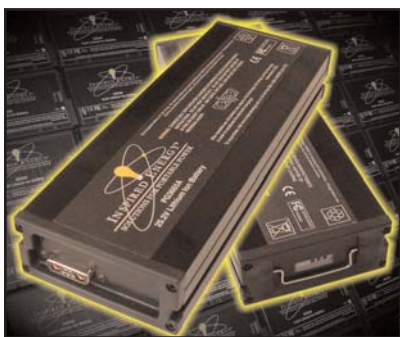
Micro Power builds several IEEE 1725 battery packs. These packs utilize lithium-ion cells that are certified to the IEEE 1725 specification, have the mandatory protection and safety features, utilize a fuel gauge for state-of-charge indication and are enclosed in a custom plastic enclosure.

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Attend Battery Power 2008 and hear "Charging Systems for High-Power Cells," presented by David Nierescher, CTO, Micro Power Electronics.

Inspired Energy Launches a New High Power Density Battery Optimized for use in Robotics Motor Applications

Inspired Energy has launched a new range of high power density smart lithium ion batteries packs; the seven-cell, 25 V, 2.9 Ah, 73 Wh, PG3665A29. Developed primarily with the needs of 24 VDC motor applications in mind, the PG3665 harnesses the



high power density of the latest technology Li-Ion cells to create a compact, rugged, 25 volt lithium ion battery pack with the capability to continuously deliver 20 amps with 30 amp peaks. This makes it well suited for use with 24 VDC motors, which often have high inrush currents at start-up and shut-off.

The PG3665 is designed for use in rugged environments, featuring an aluminum extruded case with molded end-caps that recess the D-sub connector, fuel-gauge window and the stainless, spring-steel pull handle. If required, the battery can be physically located in place by sliding M4 nuts along the included "T-tracks" to bolt it to a chassis. The use of a high-current D-Sub connector with optional screw-mounting posts also enables the use of a cable battery connection, effectively creating a version with "flying leads".

The PG3665 battery can be recharged in-situ using an SMBus-compliant charger, or can be recharged in the "P-series" desktop chargers available from Inspired Energy. These chargers are also designed with rugged applications in mind, featuring the same extruded construction and are available with AC mains cables for USA, UK and European operation.

All Inspired Energy smart rechargeable battery packs feature an on-board microprocessor that provides battery diagnostics, cell monitoring, fuel gauging and enables the communication of this data to the host device. In this battery, the fuel gauge information is communicated to the user either via the SMBus or by the always-on LCD panel on the end of the battery pack.

The creation of new standard smart Li-Ion batteries gives portable device designers a greater choice of off-the-shelf power sources. The costs of testing and certifying a new Li-Ion battery are often higher than the design and tooling costs, so choosing a power source from a portfolio of established products reduces development costs and time to market.

New Alkaline Batteries Launched with Up to 34 Percent Higher Capacity

With improved performance and an updated look, the new range of Panasonic alkaline batteries is designed for the industrial market. Panasonic engineers were able to significantly increase capacities compared to previous models. The performance index, which is usually used for such measurements, for type LR03, depending on the intended use, is on average 34 percent higher than the comparable value. For type LR6 the increase is 27 percent.



The complete range comprises the types 6LR61, LR20, LR14, LR6 and LR03. All types are produced in the Panasonic factory in Belgium, which is certified to the quality standard ISO 9001 as well as the environmental standard ISO 14001. The new batteries are also characterized by continuous, reliable energy supply, little self-discharge, enhanced protection against leakage and improved behavior in lower temperatures.

With their reliability and long-life, the new Panasonic alkaline batteries are particularly suitable for safety-relevant applications, (marine applications in life buoys, in the medical field for blood pressure meters or in smoke detectors).

Lithium Technology Corp. to Launch Advanced New Product Line

Lithium Technology Corp. (LTC) has launched its new product line of high energy density lithium iron phosphate (LiFePO4) cells, the largest cells of their kind in the world. This product line is aimed at answering the need of the electrical vehicle (EV) and the plug in hybrid vehicle (PHEV) markets.

The company's new product line offers cells ranging from 8 Ah to 40 Ah, which joins the existing high power line that offers cells ranging from 6 Ah to 35 Ah. The company's complete portfolio of products includes various cell chemistries and large batteries.

LTC's large format technology allows for the development of safer battery systems with a lower number of cells. The weight of the battery is decreased while performance and safety monitoring capabilities are increased. The battery management system (BMS) precisely monitors fewer cells, keeping them in balance for best performance and preventing damage to the battery due to over voltage, under voltage, over temperature and short circuit.

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Digital Battery Diagnostic Tester from Storage Battery Systems

Storage Battery Systems has introduced the SBS-IBEX, a new technology for emergency power, battery diagnosis and monitoring.

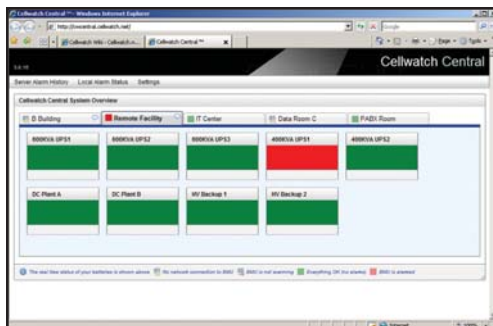
The SBS-IBEX is the first compact and light weight tester for easy on-the road measurements. This unit allows users to diagnose the aging status of any battery easily, but quickly and safely by impedance measuring technology in a floating charge. The hand held tester meets all IEEE standard recommendations for stationary applications such as telecommunications back up power, utility switching power, uninterruptible power systems (UPS) and more. The IBEX is the only diagnostic tester to measure the accurate internal impedance, strap resistance, conductance, voltage and temperature while utilizing the world's first ripple-removing algorithm within three seconds or less during the floating charge.

The IBEX offers results from both impedance and conductance for all types of battery cells. Proprietary technology allows the IBEX to accurately calculate the invert value of conductance while utilizing IBEX's own topology to maintain reading accuracy. The data is saved automatically through contact probes on the battery posts and is able to measure numerous cells quickly.

The IBEX comes with Exmons Pro 2005 diagnostic software. This software is a complete battery management data-base that ensures the proper maintenance and data recording over the life of your investment. Exmons software allows you to trend battery measurement data to detect impending battery failures before a power backup system is affected and with enough advanced time to replace failing batteries.



Cellwatch Central Consolidates Multiple Battery Monitoring Systems on One Screen



Cellwatch has released the Cellwatch Central, a server application that constantly monitors multiple Cellwatch systems over an internal network or across the Internet.

"Until Cellwatch Central," said David Brown, Cellwatch CEO, "corporate and government entities with multiple buildings and multiple battery rooms have had limited options for pulling all their Cellwatch battery monitoring systems together on one

screen. Cellwatch Central is the solution. It pulls together the condition and alarm data from different Cellwatch systems on one server and then provides data to multiple web viewers throughout a network."

Remote users can view and interact with real-time, summary condition data such as alarm status, battery condition and alarm history. Cellwatch Central uses a standard Web browser and consolidates the data on a dedicated desktop or rack mount server PC.

Cellwatch Central is currently undergoing field trials in Europe and will be available for general release in the third quarter of 2008.

Fully Automatic Battery Chargers for Backup Generators, PLC Remote Signaling, Automated Gate Entry Systems and Telecommunications Backup Systems

The ACL series for 12, 24 and 36 volt lead acid battery systems is a line of fully automatic battery chargers from Japlar Group, Inc., that can be left on batteries indefinitely and used with any type lead-acid batteries. They are available in stationary and portable designs. These models have output voltage temperature compensation, output current limiting, reverse polarity and short circuit protection and a low battery voltage start feature that requires 3 VDC. All units are built to UL1012 or UL1236 (approval pending) and the meter-equipped units meet the requirements of the NFPA110 Standard for Emergency and Standby Power Systems 2005. The optional Alarm Control Module



detects and activates Form C relay contacts (2 amps open and closed loop systems) for low battery voltage, high battery voltage, open-circuit between the charger and batteries, AC power loss and battery charger failure.

HES Series 301 Power System

Hoffman Engineered Systems (HES), a manufacturer of power control systems, has introduced a new product certified for use in the medical industry to manage power in mobile applications. The HES series 301 power system is designed to manage 12 volt sealed lead acid batteries most commonly found in mobile medical carts and workstations. It provides comprehensive battery management that allows optimum battery charge and optimum battery life while automatically detecting and avoiding safety issues such as overheating, out gassing and faulty batteries; very important criteria in medical environments. The user's burden is also reduced by using a simple display, either dedicated or through a GUI interface to the system PC, to display key information including time remaining to charge/discharge, rather than traditional green/yellow/red indicators.

The 301 Power System is designed specifically for mobile applications requiring full charge/discharge cycles. The power scheme is significantly different than those used by UPS based systems that remain fully charged awaiting a power loss event. UPS based systems are designed for ensuring the survival of the equipment for a short period of time and to provide a graceful shut down. Fully mobile products require a different design as they must operate as long as possible and provide a graceful shut down when required. The charge time in a mobile product charging system is therefore optimized to provide a complete battery charge in the shortest available time without danger or reduction in life of the battery.

The Series 301 Power System is also designed to allow power to be used directly from the batteries regulated as DC rather than converting it to AC. This eliminates the efficiency loss due to the DC/AC conversion and therefore extends run times significantly. Since the system eliminates the use of AC power directly from the wall, as with UPS based systems, the power is inherently isolated and diminishes many safety concerns.

The Series 301 provides reconditioning of over discharged batteries; a substantial cost saving feature. If a battery is discharged below a threshold voltage, it typically cannot be recharged with a standard charging system. The Series 301 recognizes this state and enters a reconditioning stage to recover capable batteries.

Smart Battery Tester Capable of Remote Operation and Fully Compatible with All SCADA Systems

Natis Communications, a company that specializes in electricity distribution feeder automation, has introduced a new smart battery tester. This Smart Battery Tester is an intelligent battery condition tester capable of being retrofitted into multiple types of equipment where knowledge of the condition of the local battery needs to be known to ensure their safe operation. By periodically imposing a load across the battery and measuring the recovered voltage, the tester can indicate a battery failure if the recovered voltage is below a set level.

A typical duration of the voltage test is approximately two seconds of imposed load followed by a delay of approximately 100 milliseconds and then a series of ten measurements are taken and averaged to determine the recovered voltage reading. If the recovered voltage reading is below the anticipated threshold set by the customer then the unit will signal a failed battery condition. The Smart Battery Tester disables the battery charger unit during the duration of the test and re-enables the battery charger unit once the test is completed.

With this smart battery tester installed, utilities can fully automate battery monitoring from their SCADA centers, thereby making the regular monitoring of remote batteries economically feasible, and thus enabling their quick replacement whenever necessary, helping to reduce outage minutes by pre-empting battery related problems.

The Smart Battery Tester uses an embedded processor to manage the testing cycles and to report the test results and battery condition. The Smart Battery Tester



can be programmed by the customer via selection on the DIP switch. The Dip switch can be used to program the timing or frequency of the test cycles; the acceptable test voltage levels and acceptable test voltage levels.

The unit has three SCADA output points that can be interfaced to an RTU to allow the customer to remotely monitor for battery failure. The first output indicates a battery failure. This alarm will only occur after a battery fails the test routine. If the battery fails the test again after a charging period, then the tester will go into a battery disable mode.

The second output indicates a test in progress. This can be used by the customers SCADA system to monitor testing periods and to determine whether the testing is functioning properly. The third output is a "battery disabled" status indicating that the battery has been disconnected from the load. The unit also has a control function that can be used to initiate a battery test locally at the equipment site; customers can initiate the local battery test using a button located on the face plate of the Smart Battery Tester.

Automotive Battery Monitoring Transducers from LEM Offer Improved Resolution and Offset Errors

LEM S.A. has introduced the HAB 60-S family of current transducers for automotive battery-monitoring applications. These transducers have been designed to measure DC, AC or pulsed currents up to ± 100 A. A new application specific integrated circuit (ASIC) incorporated into the units offers resolution 2.5 times better than previous models and a two-fold improvement in offset error, coupled with a significant reduction in price.

The transducers use open-loop, Hall-effect technology that simplifies both installation and servicing by removing the need to cut the (primary) cable carrying the measured current. They provide a pulse-width modulated (PWM) output signal proportional to the primary current being measured and operate from a unipolar 5 V supply. Temperature measurement capability can be integrated with the addition of a fourth connection pin to the transducer package.

Output resolution of the HAB 60-S transducer is 0.03 A with a linearity of 0.2 percent. Electric offset error is typically 0.075 A across the temperature range from -10°C to 65°C , and 0.15 A across the full range from -40°C to 125°C .

Advanced Charger Series Offers Cutting-Edge Technology to Commercial and Industrial Markets

On Board Solutions has announced a new line of multi-stage commercial and industrial grade battery chargers, the ProTech-C series. Designed for integration into commercial and outdoor products such as scissor lifts, cleaning machines, mobility vehicles and golf carts, the ProTech-C series battery chargers are built to

withstand the abuse and punishment common to these demanding applications, while efficiently delivering power charging and conditioning to OEM battery sources. The ProTech-C series is compatible with all major battery types: absorbed glass mat (AGM), gel and lead acid, and is designed for use in 24 and 36 volt DC applications. With flexible charging capabilities, wide power capacities and rugged construction, the ProTech-C series battery chargers are well suited for OEMs who want quality performance for their products.

With a smart, compact construction, the chargers are both smaller and more efficient than comparable ferro-resonant chargers. A three-stage

charger, the ProTech-C system uses advanced charging algorithms to fully charge batteries while conditioning them, and uses a built-in selectable absorption timer switch, thus greatly extending battery life. For critical protection, the chargers also contain a safety interlock feature that can be configured for open and closed operation. A global AC input with IEC connection allows for worldwide application, and uses a simple plug-and-play cable for charger input and output.

The heavy-duty industrial grade series of battery chargers has fully automatic multi-stage charging to deliver fast charge times, as well as conditioning and built-in float/maintenance mode for safe storage. Designed for 24 and 36 volt systems, the chargers boast an auto-ranging global AC input of 95 VAC to 250 VAC, 50/60 Hz, with a lockable AC input connector option for universal applications. Each charger houses a LED status center providing at-a-glance updates on battery type, charge mode, fault condition and AC power status, and offers external access to three selectable battery charge profiles with conditioning times of two to six hours. Requiring minimal installation time, the ProTech-C has a smart utility design for quick disconnection and comes with an optional conversion kit for portability in seconds. All ProTech-C models feature an interlock inhibit and built-in safety for over voltage, over temperature, over current and reverse polarity. ProTech-C chargers are certified to UL 1564 standards, CE and FCC approved and include a two-year limited warranty.



Cadex Launches the C8000 Advanced Programmable Battery Testing System



Cadex Electronics has released the C8000 Advanced Programmable Battery Testing System. The C8000 is an integrated and flexible platform that enables easy implementation and execution of sophisticated battery test programs. The C8000 offers four independent test channels, tests batteries from 50 mAh to 100 Ah, incorporates pre-programmed tests for the most common applications and enables integration of user-defined protocols. The C8000 system comes standard with battery, digital and PC interface cables and Battery-Lab PC software.

The C8000 features and benefits include testing and analyzing battery performance and characteristics under various scenarios and conditions; building user-defined testing programs for a variety of battery chemistries and types including 5 MBus batteries; and expanding into laboratory system with interface to external peripherals such as thermal chamber, external charger, digital load bank, heating elements, temperature sensors, pressure gauge, cell monitoring and safety circuit control.

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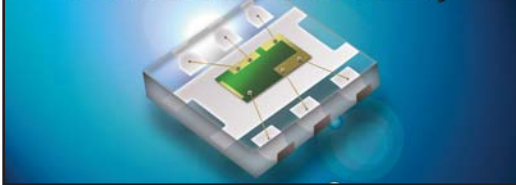
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Industry's Easiest-to-Use Light-to-Digital Sensor ICs Extend Battery Life and Deliver Enhanced Functionality



Light-to-Digital Sensor ICs Extend Battery Life and Deliver Enhanced Functionality

Intersil Corp. has introduced the a light-to-digital sensors, designed to increase battery life and deliver enhanced functionality and performance in mobile, computer and consumer electronic products.

The new ISL29010 and ISL29013 are highly accurate sensors that measure and digitize the value of ambient light and then allow access to that information through a standard I2C interface. This provides a simple way to improve efficiency and functionality in end products by enabling applications to automatically adjust to varying light conditions. Performance advantages include extended battery life from keypad and display dimming in mobile devices as well as increased performance in displays for LCD panels, digital picture frames and digital cameras.

The spectral response of these devices attenuates unwanted IR radiation to provide accurate light measurement even in extreme low-light conditions. This is accomplished by integrating a full light-to-digital solution that includes specially tuned photodiodes to remove all unwanted IR noise, a signed 15-bit integrating ADC that allows for low-light sensitivity and automatic noise cancellation.

The ISL29010 and ISL29013 feature gain selection, giving designers the ability to select the dynamic range and low-light sensitivity that best matches the needs of their application. This software-enabled functionality to choose between low-light sensitivity and wider dynamic range ensures maximum performance as well as flexibility. The ISL29010 and ISL29013 are available now in six-lead ODFN packages (2 mm by 2.1 mm) and are priced at \$1.20 each in 1,000-piece quantities.

BATTERY POWER 2008

Attend Battery Power 2008 and hear "Battery Pack Electronic Design for Lithium Based Products," presented by Michael Coletta, Principal Engineer, Intersil Corp.

Monolithic Linear USB Battery Charger With High Efficiency Buck-Boost and Buck Converters

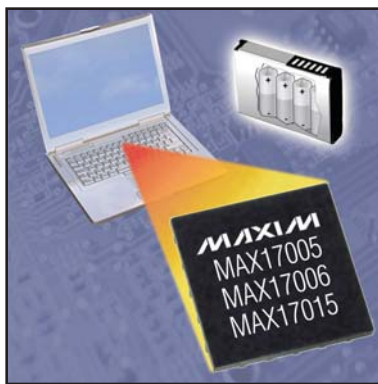
Linear Technology Corp. has unveiled the LTC3558, an efficient, multi-function power management solution for handheld applications. The LTC3558 integrates a stand-alone Li-Ion/polymer battery charger and two high efficiency synchronous regulators, one buck-boost and one buck, and is offered in a 3 mm by 3 mm QFN package. The linear battery charger can deliver up to 950 mA charge current from a wall adapter supply, or up to 500 mA charge current from a USB port. The LTC3558's stand-alone autonomous operation simplifies design, eliminating the need for an external micro-processor for charge termination. Both switching regulators are designed to operate over the Li-Ion/Polymer range of 2.7 V to 4.2 V while delivering output currents up to 400 mA each.

The LTC3558's integrated synchronous buck regulator features 100 percent duty cycle operation, while the buck-boost regulator is capable of regulating its pro-

grammed output voltage (typically 3.3 V) over the entire Li-Ion/polymer operating range. The integrated low RDS(ON) switches enable efficiencies as high as 92 percent, maximizing battery run time. In addition, Burst Mode operation optimizes efficiency at light loads with a quiescent current of 20 uA for the buck-boost and 35 uA for the buck (<1 uA in shutdown for each). The 2.25 MHz switching frequency allows the utilization of tiny low cost capacitors and inductors less than 1 mm in height. Furthermore, the regulators are stable with ceramic output capacitors, achieving very low output voltage ripple.

The LTC3558's battery charger contains a high degree of USB functionality, including 20 percent/100 percent full-scale charge current setting, a SUSP pin for shutdown/enable and four different indication states on the /CHRG pin. The final battery float voltage is accurate to ± 0.5 percent. The charger's patented thermal regulation scheme maximizes the charge rate without the risk of overheating, while the NTC input allows temperature-qualified charging. To preserve battery energy, the LTC3558 draws <3 uA from the battery in suspend mode. The charger is compatible with inputs up to 5.5 V (7 V absolute maximum transient for added robustness).

The LTC3558 is available from stock in a compact low-profile (0.75 mm) 3 mm by 3 mm QFN-20 package. Pricing starts at \$2.35 each for 1,000-piece quantities.



1.2 MHz, High-Performance Battery-Charger ICs Minimize Solution Cost And Size

Maxim Integrated Products has introduced the MAX17005/MAX17006/MAX17015 high-frequency, multi-chemistry battery charger ICs. These devices employ a proprietary, high-frequency, current-mode architecture that reduces the cost and size of external components. Designed to operate at a high, 1.2 MHz switching frequency, these ICs enable the use of a smaller output filter than required by many other battery charger ICs, thus reducing the size of the design and the BOM cost associated with the output filter. Additionally, this family of battery charger ICs allows the use of n-channel power-selection switches instead of the more expensive p-channel power switches used by conventional solutions. Saving both space and cost, the MAX17005/MAX17006/MAX17015 are well suited for notebook computers, tablet PCs and other portable devices with rechargeable batteries.

The MAX17005 charges three to four cells with a cell voltage of 4.2 V to 4.4 V, the MAX17006 charges two to three cells with a cell voltage of 4.2 V to 4.4 V, and the MAX17015 adjusts the charge-voltage setting and number of cells through a feedback resistor-divider at the output. In addition, these devices provide a high-accuracy analog output that is proportional to the adapter current. In the MAX17015, current monitoring remains active to monitor the battery's discharge current when the adapter is absent. All devices provide at least 4 A of charge current with a 20 milliohm sense resistor and overvoltage protection.

The MAX17005/MAX17006/MAX17015 are available in a 4 mm by 4 mm by 0.8 mm, lead-free, 20-pin

TQFN package and are fully specified over the -40°C to 85°C extended-industrial temperature range. Prices start at \$5.66 (1,000-up, FOB USA).

New Battery Charger IC from AnalogicTech Protects Against Faulty Input Voltages

Advanced Analogic Technologies, Inc., a developer of power management semiconductors for mobile consumer electronic devices, has unveiled the AAT3783, a 1 A linear Li-Ion/Polymer battery charger IC with an integrated over-voltage protection (OVP) switch. Designed to charge 4.2 V Li-Ion /Polymer battery cells from either AC or USB inputs, the new charger IC also features a digital thermal management system that maximizes charging efficiency and shortens battery recharge time.

The AAT3783 integrates a charging device, a reverse blocking diode and current sensing circuitry in the same die. It operates off a 4.0 V to 7.5 V input range and supplies a programmable current from 100 mA to 1 A.

To maximize charging current under all operating conditions, the AAT3783 features a special digital thermal management system that measures the internal die temperature and reduces the fast charge current when the device exceeds a preset threshold. This thermal loop control constantly re-evaluates the circuit die temperature and adjusts the fast charge current up or down in small steps until an equilibrium current is reached. Since the thermal loop controls the system charge level, it maximizes charging efficiency by ensuring the charger will use the highest level of constant current in fast charge mode possible for any given ambient temperature condition.

The AA3783 also features over-voltage, over-current, short-circuit and over-temperature circuits, which automatically protect the charging device, control system and battery-under-charge by shutting down the system when a fault occurs. A status monitor output pin is provided which can be used to indicate battery charge status by directly driving an external LED.

Qualified across the -40°C to 85°C temperature range, the AAT3783 is available in a Pb-free, 16-pin TDFN package. The device sells for \$0.95 in 1,000 quantities.

Current-Mode-Controlled Buck-Boost DC-DC Regulator Controller with Ultra-wide Operating Voltage Range

National Semiconductor Corp. has introduced the industry's first emulated current-mode controlled buck-boost DC-DC regulator controller with a best-in-class operating voltage range of 3 V to 75 V for automotive, telecommunications and battery-powered systems. The LM5118 features programmable switching frequency up to 500 kHz, ultra-low shutdown current and smooth transition between buck and buck-boost modes. The LM5118 switching regulator features peak efficiency of 95 percent, positioning it among National's PowerWise family of energy-efficient products.

The simple two-switch configuration enables design engineers to assemble a complete power converter with ultra-wide input voltage range. Operation below 3 V to 75 V makes the LM5118 well-suited for automotive applications such as powering the dashboard display, electronic controls such as anti-lock braking or fuel injection control, and the multitude of microcontrollers used in today's cars. These systems operate from a 12.6 V battery, but with a weak battery during cold crank conditions, the battery voltage could fall momentarily down to 4 V. To ensure seamless control from electronic modules, the system must still operate at 4 V or below. The unique buck-boost control of the LM5118 makes this seamless control possible.

The control method of the LM5118 is based upon

current-mode control utilizing an emulated current ramp. The patented emulated current-mode control technology provides improved line and load transient response and low duty cycle operation that is not achievable with traditional current-mode control.

National's LM5118 switching regulator features all of the functions necessary to implement an efficient buck-boost regulator, using a minimum of external components. The buck-boost topology maintains output voltage regulation when the input voltage is either less than or greater than the output voltage, making the product especially suitable for automotive applications.

The LM5118 operates as a buck regulator when the input voltage is sufficiently greater than the regulated output voltage and gradually transitions to the buck-boost mode as the input voltage approaches the output. This dual-mode approach maintains regulation over a wide range of input voltages with optimal conversion efficiency in the buck mode and a glitch-free output during mode transitions. The LM5118 includes drivers for the high-side buck MOSFET and the low-side boost MOSFET. The emulated current-mode control reduces noise sensitivity of the pulse-width modulation circuit, allowing reliable control of very small duty cycles necessary in high-input voltage applications. Additional protection features include current limit, thermal shutdown and an enable input. Available now, the LM5118 is priced at \$2.92 each in 1,000-unit quantities.

BATTERY POWER 2008

Attend Battery Power 2008 and hear "Dual Mode Converter Maintains Output Regulation Over Wide Input Range," presented by Robert Bell, Applications Engineering Manager, National Semiconductor

ON Semiconductor Introduces Ultra-Small, SOT-963 Packaged, Dual Small Signal MOSFETs for Portable Electronics

ON Semiconductor has introduced three new dual MOSFETs offered in an ultra-small SOT-963 package and optimized for space-constrained portable electronics. Measuring 1.0 mm by 1.0 mm, the SOT-963 offers 30 percent smaller mount area than comparable MOSFET solutions offered in a single SOT-723 package and a 60 percent smaller footprint than SOT-563 devices. With a low vertical clearance of 0.5 mm, the SOT-963 packaged NTUD312x devices satisfy the requirements of the new generation ultra-thin handheld portable devices.

The NTUD312x devices have On-Resistance values rated at 1.5 V gate to source to enable operation at low voltage logic level. NTUD3127C is a 20 V, 200 milliamper (mA) / -180 mA complementary small signal MOSFET. The NTUD3128N is a 20 V, 200 mA Dual N-Channel MOSFET. The NTUD3129P is a -20 V, -180 mA Dual P-Channel MOSFET. Budgetary pricing for these devices is \$ 0.33 per unit in 8,000 unit quantities.

BATTERY POWER 2008

Attend Battery Power 2008 and hear "New Safety Constraints of the Lithium Battery Charge," Bernard Remaury, Application Engineer, ON Semiconductor

Robust, ± 80 Volt Fault-Protected, High-Speed CAN Transceiver Provides Advanced Power Management

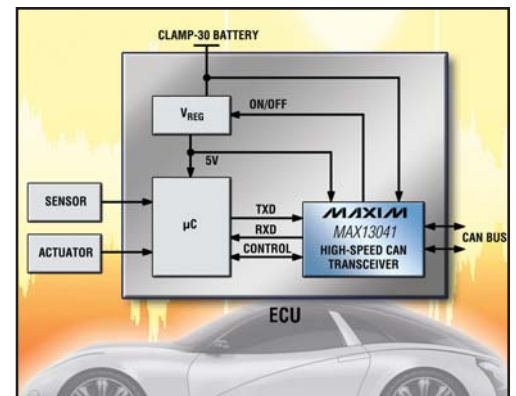
Maxim Integrated Products has introduced the MAX13041 ± 80 V fault-protected, high-speed, automotive CAN transceiver. This device provides an advanced interface between the protocol controller and the physical bus in a controller area network (CAN) node. Advanced power-management features enable this transceiver to minimize power consumption in ECU modules that are permanently supplied by a battery. Additionally, the MAX13041 provides an extended, ± 80 V fault-protected voltage range and ± 12 kV (human body model) ESD protection on the CAN bus lines, making it well suited for robust +12 V/+42 V automotive and truck applications. Primarily intended for high-speed (up to 1 Mbps), automotive CAN applications, it is also well suited for industrial applications.

To minimize current consumption, the MAX13041 features enhanced power management for clamp-30, always-on nodes. Five modes of operation provide different levels of functionality to optimize power consumption. In sleep mode, the ECU is completely powered down, thereby reducing current consumption to 18 microamps (typ). Upon local or CAN bus activity, the MAX13041 enables the on-board voltage regulator, restoring power to the entire clamp-30 node. Wake-up source recognition can be interrogated by the on-board microcontroller.

Designed for harsh operating conditions, this device features enhanced diagnostics and overtemperature protection. Capable of detecting local and remote bus failures, the MAX13041 features fail-safe modes to prevent damage to the device or interference with CAN-bus communication. Seven internal flags are used to indicate various fault conditions; five of these flags are available to the system CAN

controller. The diagnostic features of the MAX13041, combined with its passive behavior in the absence of power, enable the construction of safe and reliable CAN nodes.

The MAX13041 conforms to the ISO 11898-2 specification, and it offers excellent EMC performance and ultra-low power consumption. Available in a lead-free, RoHS-compliant, 14-pin SO package, this device is fully specified over the -40°C to 125°C automotive temperature range. Prices start at \$0.89 (1,000-up, FOB USA).



Battery Power Products & Technology Magazine is Introducing A New Monthly e-Newsletter Dedicated to Battery Manufacturing

The Battery Manufacturing e-Report is designed to provide the latest product announcements, company news, market trends and developments in R&D. The newsletter covers battery manufacturing equipment and systems, chemicals and materials, components and testing systems and services.

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**U.S. Patent 7,279,867 Method for Balancing Cells or Groups of Cells in a Battery Pack*






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From outer space to under the sea to five miles beneath our planet's land surface, SWE designs and assembles high reliability, customer-specific battery packs and chargers.

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BATTERY POWER 2008

September 4-5 • New Orleans, La
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The International Conference Highlighting the
Latest Developments and Technologies in Batteries and Power Management

Battery Power 2008, an international conference highlighting the latest developments and technologies in the battery industry, will be held September 4-5 in the heart of the French Quarter in New Orleans, La.

This sixth annual event will feature presentations on portable, stationary and automotive battery technology, as well as battery manufacturing, materials and research & development. Topics will include new battery designs, emerging technologies, battery materials, power management, charging and testing systems, as well as the latest market trends affecting the industry.

The conference is designed for OEM design engineers, system engineers, technical and management professionals involved in battery powered products and systems, battery manufacturing, battery technology research and development and power management technology.

Our Commitment to You:

Whether this is your first time participating at the Battery Power conferences, or if you have attended in the past, the 2008 event will provide you with the

most up-to-date developments and technologies in the battery and power management market.

What's New for 2008

- Capital Ventures Investment Panel
- Product Demonstrations in the Exhibit Hall
- New Topics on International Regulatory Issues, Advanced Characterization Techniques and Battery Counterfeit Prevention Technology

Register by July 31st and Save \$400!

Full conference pass before July 31st: \$895 After July 31st: \$1,295

Discounts: If two people from your company will be attending the conference, \$300 is deducted from each attendee's registration fee. If three or more attendees will be attending the conference, \$400 is deducted from each attendee's registration fee. Government, military, expo only and one-day passes are also available.

Register online at www.batterypoweronline.com.

Pre-Conference Activities

Kick off your Battery Power 2008 experience early with some exceptional pre-conference activities that will be held on September 3rd.

Habitat for Humanity

Join Battery Power 2008, Battery Power Magazine and the New Orleans Area Habitat for Humanity on September 3rd to help build a house. New Orleans Area Habitat for Humanity (NOAHH) is leading an unprecedented rebuilding effort, as the largest homebuilder in New Orleans.

No experience necessary! Volunteers with all levels of experience are invited to participate. You will receive a small orientation (15 minutes) after you arrive at the work site, which includes a safety meeting. If you have physical limitations or asthma/allergies, you can participate! There are a number of tasks that do not involve strenuous labor. The work day will be 7:30 to 3:15. Battery Power 2008 will arrange transportation from the Astor Crowne Plaza hotel to and from the work site and lunch.

Workshops

Li-Ion Battery Safety, Maintenance, Charging and Fuel Gauging

Presented by Texas Instruments

This half-day workshop will start by covering Li-Ion battery characteristics including self-discharge, useable capacity and battery impedance, Li-Ion battery cell safety and UL testing and Li-Ion battery safety requirements. Basic battery maintenance and transportation will be discussed, as well as Li-Ion battery pack electronics safety and design. Attendees will also learn about front-end safety and power path management charging, which allows charging the battery while powering the system simultaneously.

Developing Flexible Linear and Switching Charger Designs

Presented by Microchip Technology, Inc.

Designing battery systems for portable applications, topology selection and feature set can make or break the success of new products. This four-hour seminar will explain the development of flexible linear and switching charger designs. Embedded charger design and the advantages of certain topologies over others will be discussed, in light of how to meet the many new global standards of today.

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Power 2008
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TIMCAL Graphite & Carbon is the world leader in high tech, high performance solutions based on high quality graphite and carbon. TIMCAL is a member of the IMERYS Group and produces a wide spectrum of synthetic and natural graphite powders, conductive carbon blacks, aqueous dispersions, and other carbon materials that are manufactured under stringent process control conditions from the raw material stage through to the end product. TIMCAL offers a large variety of carbon materials that can be used in modern battery and fuel cell chemistries.

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Intersil Corp.

Intersil Corporation (NASDAQ: ISIL) is a leader in the design and manufacture of high performance analog semi-conductors. The Company's products address three of the industry's fastest growing markets: flat panel displays, handhelds and power management. Intersil products include power management devices for battery management, hot-swap and hot-plug controllers, linear regulators, supervisory ICs, switching DC/DC regulators and power MOSFET drivers; optical storage laser diode drivers; DSL line drivers; video and high performance operational amplifiers; data converters; interface ICs; analog switches and multiplexers; crosspoint switches; voice-over-IP devices; and ICs for military, space and rad-hard applications. For more information about Intersil, visit the Company's web site at www.intersil.com.

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Technology to Prevent Counterfeiting in the Battery Industry
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New Safety Constraints of the Lithium Battery Charge
Bernard Remaury • ON Semiconductor

Implementing Charging Algorithms in Firmware
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Evaluation of Atmospheric Plasma Surface Modification for Continuous Processing of Flexible Battery Components
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International Regulatory Issues
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Understanding Battery Pack Performance Issues
Bor Yann Liaw • Hawaii Natural Energy Institute

New Rechargeable Power Source for Consumer Applications Requiring Typical 1.5 Volt User Replaceable Batteries
Joseph Carcone • PowerGenix

Cathode Materials for Lithium Ion Batteries
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New Non-Metallic High Electron Flow Plastic Materials for Capacitors and Anodes
Keith Donaldson • Engineered Materials, Inc.

Battery Charger Efficiency Standards and Strategies for Improvement
David Gunderson • Micro Power Electronics, Inc.

Battery Pack Electronic Design for Lithium Based Products
Michael Coletta • Intersil

Dual Mode Converter Maintains Output Regulation Over Wide Input Range
Robert Bell • National Semiconductor

Valuable Lessons Learned from Controlled Battery Testing
Gary Rohlke • Sypris Test & Measurement

Advances in Characterization Techniques for Understanding Degradation and Failure Modes in Lithium-Ion Cells
Quinn C. Horn • Exponent, Inc.

Lithium Ion Cell Evaluation - Going Beyond the Manufacturer's Data Sheets
Chris Turner • Nexergy, Inc.

Hotel Information

Battery Power 2008 will be held at the Astor Crowne Plaza located in the heart of the French Quarter. A special room rate of \$169 is available for Battery Power 2008 (mention Webcom Communications).

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Battery Power 2008 Presenter

PowerGenix

PowerGenix is developing and manufacturing patented, nickel-zinc (NiZn) rechargeable batteries that are substantially smaller, lighter and more powerful than other rechargeable batteries on the market today. Our rechargeable Ni-Zn batteries are green, completely safe, contain no toxic materials, non-combustible, and are easily recyclable.

PowerGenix products are sold into transportation (e.g., electric scooters, HEV), consumer AA, cordless power tool, cordless phone, and toy market segments. PowerGenix is headquartered in San Diego, CA with a wholly owned subsidiary in Shenzhen, China.

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Battery Power 2008 Exhibitor

Electro Energy, Inc.

Electro Energy Inc. headquartered in Danbury, CT was founded in 1992 to develop, manufacture, and commercialize high-powered, rechargeable bipolar nickel-metal hydride batteries for use in a wide range of applications. Its Colorado Springs operation supplies aerospace-grade high quality, nickel cadmium batteries and components for satellites, aircraft and other specialty applications. EEI is also developing high-power lithium, rechargeable batteries utilizing the Company's proprietary bi-polar design. The Company has the largest 18650 lithium ion manufacturing facility outside Asia.

Electro Energy, Inc
30 Shelter Rock Road
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mreed@electroenergyinc.com
www.electroenergyinc.com





New Power Supply Offers 100 Watts Convection Cooled

TracoPower has released the TOP-100 series of ultra-compact open-frame power supplies offering 100 watts of power in the industry standard 2 inches by 4 inches footprint with a profile of 1.25 inches. Convection cooled operation make these supplies well suited for high-density applications in industrial, ITE and consumer markets.

The TracoPower TOP-100 series utilizes a state-of-the-art circuit design to achieve extremely high efficiencies in excess of 90 percent that enables convection cooled operation ranging from -25°C to 50°C eliminating the extra cost and space for a dedicated cooling fan. The power losses of the TOP-100 are reduced approximately 50 percent as compared to traditional open frame products, which has a very positive impact on the reliability and lifetime of the product. There are currently seven single output models offering 3.3 / 5 / 12 / 15 / 24 / 48 VDC output voltage and feature universal AC input, EN55022 Class B Emissions, UL/cUL 60950-1 Class II safety approval, CB Report (IEC60950-1) and CE Mark (LVD).

100 Watt Desktop Power Supply in Miniature Package

Bravo Electro Components has introduced the TR100 series of 100 watt high-density desktop power supplies measuring 5.91 by 2.76 by 1.38 inches. These desktop power supplies are well suited for use in portable and OEM applications requiring external power that can



operate on AC input sources from around the globe.

The TR100 series feature 100 watts of power with 10 single output models offering output voltages ranging from 12 to 48 VDC. The

TR100 desktop power supplies feature universal AC (90 to 264 VAC), a three-prong IEC-320 C14 AC inlet, over-voltage protection, over-current protection and short circuit protection.

These supplies are safety certified to UL60950-1/TUV EN60950-1 and bear the CE Mark (low voltage directive) for applications throughout the world with FCC/EN55022 Class B Emissions. For greater flexibility, these supplies may be configured with a wide selection of standard DC output connectors.

SL Power Electronics 75 Watt External Power Supply Meets Energy Star Level IV Requirements

SL Power Electronics has unveiled a new family of 75 watt external switch-mode power supplies that comply with Level IV Energy Star requirements, the highest rating currently attainable. Marketed under the Ault brand name, the PW156 is a single output family available in four voltages up to 75 watts.

The desktop-style Ault PW156 series satisfies a wide range of applications in the industrial, test and measurement, instrumentation, military/aerospace, communications and computer/peripheral market segments. This new product family is available in 12-, 15-, 18- and 24-volt standard models. SL Power Electronics also can

modify any of the standard models to suit unique power or connectivity requirements.

The CE-compliant Ault PW156 meets UL60950-1, TUV/EN60950-1 and IEC60950-1, which reduces OEM time-to-market and ensures that the product can be sold worldwide. The PW156 sells for less than \$29.00 in OEM quantities of 1,000.



Compact 1U High Sine Wave Inverters From Unipower Corp. Provide Up to 2 kVA

Unipower Corp. has announced a new series of rack-mount sine wave inverters that will find wide application in telecom systems. The Scimitar series are 1 U high, 1 kVA and 2 kVA sine wave inverters designed for 19-inch rack systems and capable of producing a 115 or 230 VAC output from a 12, 24 or 48 VDC power source.

Each sine wave inverter provides a low distortion 50 or 60 Hz sine wave produced by a digital signal processor (DSP) controlled power circuit using an advanced high frequency, pulse width modulation (PWM) technique, which achieves efficiency levels as high as 92 percent. An integral static switch allows the user to connect a utility or another AC power source, which can then be automatically switched to the load if the sine wave inverter fails.

Output voltage and frequency can be programmed either from the front panel or via an integral RS232 interface and the unit's digital display provides the user with an instant indication of the inverter's status.

All Unipower Corp. Scimitar sine wave inverter models meet the requirements of all relevant safety standards including UL60950-1, CSA22.2 No. 60950-1 and EN60950-1.



DC/DC Converter with Five Individually Fused Output Terminals for Mobile and Other Heavy-Duty Applications Delivers 300 Watts

Absopulse Electronics has released the BAP 65-5FD-24/12FT series, a 300 W, single-output DC/DC converter. This unit utilizes field-proven topology to provide 12 VDC at 25 A, which is distributed via five individually fused output terminals. This feature ensures that failure on one load will not affect the entire system. Fuses are located externally below the terminal block and are easily accessible. The BAP 65-5FD-24/12FT can be operated from a 24 VDC supply voltage, with a 21 V to 30 VDC operating range. Other input and output configurations are available on request.

Designed for operation in mobile and other rugged environments, the unit is heavily ruggedized and conformal coated and is designed to meet IEC 61373 Categories 1 A & B shock and vibration standards. It also meets EN 55022 Class B EMI. This converter is rated for operation over a -25°C to 50°C temperature range without derating, and is cooled by conduction

via the baseplate to a heatsinking surface and by natural convection.

BAP 65-5FD-24/12FT features full electronic protection on the input and output. This chassis-mount design is optimized for low component count and high efficiency. The use of components with established reliability results in a very high demonstrated MTBF. It is manufactured at our plant under strict quality control. Versions to meet EN 50155 railway specifications and customized designs are also available. The BAP 65-5FD-24/12FT is priced at \$285 at quantities of 100.



30 Amp Half Brick DC-DC Converters Feature 93 Percent Efficiency

Lambda has expanded its line of DC-DC converters with the launch of the new iHG series of 100 W fully isolated, single output, half-brick devices. Providing improved thermal performance, using the industry standard half-brick footprint with no base plate, the modules are well suited for engineers designing low airflow, high temperature, 48 V power architectures, for telecom, wireless, medical, industrial and many other applications. The initial product offering includes 5 V/10 A, 5 V/20 A and 3.3 V/30 A devices, with further products planned.

The single board construction combined with up to 93 percent efficiency delivers a very high level of useable power in convection cooled environments, particularly where airflow rates are low. Furthermore, the all new digital control circuitry bringing a significant component count reduction, as well as improved reliability and lower cost, makes the iHG family well-suited as replacements or upgrades in legacy applications.

The iHG's operate over a wide input range of from 36 V to 75 VDC and feature a wide output voltage adjustment/trim range from about 50 percent to 110 percent of its nominal output voltage. Operating temperatures can range from -40°C to 125°C, measured at the module.

In addition to high efficiency operation, the iHG's low input current consumption in its standby mode (typically only 4.8 mA) demonstrates Lambda's commitment to the "green" environmental issues of concern to all manufacturers today.

The input is fully isolated from the output, up to 1,500 VDC, further adding to the product's versatility by allowing different options for polarity and grounding connectivity. Standard features include fixed frequency operation (for reduced EMI), output trim, remote sense, remote on/off, and auto-recovery of input under voltage, output over current, over temperature and over voltage protection.

All units are RoHS compliant. Safety approvals for Lambda's new iHG family include UL60950 (US and Canada), VDE 0805, CB scheme (IEC950) and CE Mark (EN60950).

BATTERY POWER 2008

Attend Battery Power 2008 and visit Lambda in the Exhibit Hall

Optimizing Power Source Selection In the Design Process

Mari McGowan, Director of Marketing
Ultralife, Commercial Products

Product development teams share many goals, from extending an existing product line to launching completely new products. However, most share a more common, unified goal: to deliver a product or application on-time, within budget and to specification. The logistics for doing so are often complex and can lead to projects within projects within projects. Oftentimes, a key element to reach this goal involves a power solution, or more specifically, a battery or battery/charging power solution.

Most companies who design and manufacture these products or applications do not have the in-house expertise in battery chemistry and technology nor the bandwidth to handle the battery or battery/charger development. In these cases they must locate a power solutions vendor capable of providing not only the right power solution for their project, but a comprehensive review of all the possible options in a very complex landscape of available solutions.

To determine the right vendor, product development teams should find a power solutions provider who can provide both the expertise in their industry or market and demonstrate a robust power development strategy or cycle. Teams must also bring the vendor in as early as possible in the design phase in order to maximize all the design options available, meaning constraints such as a predetermined battery cavity size will not prohibit options from the bucket of possible solutions. Ideally, the OEM finds a long term power solutions partner who has the breadth of expertise and product portfolio to support the OEM over many of its product development efforts. In essence, the power solutions vendor becomes part of an expanded product team for the OEM.

By working with a power solutions vendor early in the design process, the optimum solution can be identified. Not only is this critical to the user experience, but may ultimately determine the product's success or failure. While the benefits derived from early initial involvement of the right power solutions partner can't be overstated, neither can the potential penalties of late involvement, such as higher cost, extended development timelines, sub-optimized performance, or in the end - possible market failure.

An important consideration when evaluating power solutions providers is industry or market experience. Does the vendor possess broad market experience? Do they have application experience in your particular market or other markets with similar demanding performance specifications such as medical, automotive or aviation? While some markets may not have the same performance demands as automotive, for example, a vendor with the ability to meet those stringent requirements will be able to better optimize solutions for less demanding markets, regardless of what they might be.

Along with market experience, the right power solutions vendor should be one with broad battery chemistry expertise. While some potential vendors might focus on their ability to build packs, a true contributing partner to the design team's ultimate solution brings an understanding of the leading battery and charging technologies along with the underlying chemistry that exists down to the cell level. This specific expertise will enable the vendor to produce a solution that is right for the application, not just one that is

right for them to produce. The vendor may even propose a number of solutions, outlining the pros and cons of each. It is here where their true value will be demonstrated as they help you decide on the very best power solution for your product or application.

Regardless of the challenges of the markets involved, the power solutions provider must have a robust product development process or cycle in order to not only provide a quality solution but provide support throughout the entire product design phase. The vendor should be able to provide expertise in battery development, project management, rapid prototyping, test and evaluation and product/application launch support.

In fact, a full-solution power vendor should bring a complete team to each project including application engineers, electrical and mechanical engineers, program managers, quality assurance personnel, manufacturing managers and sales managers. A more experienced vendor allows the product development team to basically outsource the power solution, knowing that the vendor has the knowledge, experience and team to provide complete support toward their goal of launching the product on-time, within budget and to specification.

The first critical stage in a true problem solving approach is the battery development stage. It is here where the vendor must consult with the product development team in order to fully understand the application and its power requirements. Often there will be multiple options to consider and again, an experienced vendor will walk you through each option highlighting the pros and cons of each, and ultimately helping you make the right decision, based on a thorough understanding of your product/application. In addition, a vendor with broad experience in a market may have already developed a solution that could meet the application performance, environmental, regulatory and safety requirements. To take advantage of the savings, it is important to contact the power solutions vendor as soon as possible in the design phase so that already developed solution can be designed-in.

Once a solution has been agreed on, a quality vendor should have the ability to offer prototypes in a timely fashion and the ability to produce low volume runs for the design team to evaluate and test. The vendor should also be able to provide design sample prototypes that will indicate what the final configuration will be. Finally, the power solutions provider should be able to quickly and easily move to low volume manufacturing in order to iron out high volume manufacturing process to ensure a smooth transition to that phase of production.

During the testing and evaluation phase, the power solutions provider will perform the testing necessary to ensure product conformance and safety. It is here where the vendor should test against the requirements put forth by the product development team in order to ensure what they are building meets all defined specifications. In addition to application specifications, the vendor should be able to perform environmental and mechanical tests as well as industry specific tests such as those outlined by medical, automotive or aviation industries.

Finally, a first rate power solutions provider should be able to provide the product development team launch support, which includes a quick transition to high volume manufacturing, supply chain management, shipping/transportation regulation

expertise and even marketing assistance in order to help leverage your product's power solution.

It's also important, in a global market, to choose a battery provider that has a global presence. A vendor with design, manufacturing and support locations around the globe that can further support the product development and launch phase as they can support multi-site manufacturing needs, understand international regulatory and shipping regulations, and can often provide more timely support. In addition, they can work locally with your facilities and teams, regardless of geography, to help bridge typical obstacles of remote locations.

The right power solutions provider will be there with you through the complete design phase, through launch and ultimately through revisions and the entire life cycle of the product. A quality vendor ultimately becomes your partner as you aim to reach all the goals your design team has put forth.

While product design teams have an enormous amount of responsibility on their plates, one thing they can remove with confidence, is the power solution, given they have partnered with the right vendor. The right power solutions provider should have experience in your industry or market, or at the very least, relatable experience such as an understanding of dealing with stringent specifications. A quality vendor should also have a robust power development strategy in order to provide a quality solution and support throughout the entire product design phase, including launch. A thorough review of these questions and concerns with each potential company should enable you to select the right power solutions provider to meet all the goals a demanding product design team sets for itself including delivering a product or application on-time, within budget and to specification.

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Portable Power: *Smaller, Lighter and Affordable*

Jon Eager, Director, OEM Marketing
Energizer

As the technology behind consumer electronic devices continues to evolve and advance, product designers are in a race to make them smaller, lighter and thinner with each new generation.

Industry leaders, like Apple, have raised the bar for designers by developing a stream of thinner, sleeker devices. This influence is being felt in devices that one would not normally consider, such as remote controls. With the advent of very thin LCD and plasma televisions, designers of remote controls are looking to make the remotes thinner, both to match the profile of the televisions and to meet growing consumer expectations for thinner devices.

Along those lines, in order to meet this growing expectation for smaller, lighter and thinner devices, designers need new and innovative power solutions. These designers look to both rechargeable and primary battery solutions to meet their needs. Rechargeable battery solutions enable designers to provide an appropriate solution for devices, such as cell phones and notebook computers, with high energy and power demands where the cost of replacement of a primary battery solution might not be acceptable to the consumer.

Primary battery solutions enable the OEM to significantly lower the cost of the device to meet a lower price point and to address a much larger share of the consumer market. These solutions are also more appropriate in devices where it is inconvenient to recharge the device. Great examples of devices where primary battery solutions offer value to the consumer are flash audio players and Bluetooth headsets. Primary battery makers are focused on bringing new and innovative primary battery solutions to enable smaller, lighter and thinner devices, while at the same time enabling a lower price point.

Another trend driving battery development is the growth in relatively low power devices, such as Bluetooth headsets, noise cancelling headsets, flash audio players, laser pointers, LED penlights, remote controls, remote sensors and medical devices like glucose meters and blood pressure monitors. The common denominator with each of these is that they are single purpose devices, with very little of the "feature creep", or convergence of functions, that increases power and energy needs. Cell phones, for example, have evolved from just a communication device to now include an audio player, a digital camera, GPS functions, and soon, your daytime soap operas. Consequently, the power and energy needs for a cell phone have remained high despite continued improvement in the efficiencies of electronic components.

Lower power devices, by comparison, are also typically microprocessor-based, but generally do not include a large LCD or hard drive, which would increase the power and energy requirements significantly. They also are single function devices. Thus, these devices have a generally stable or decreasing power requirement, with many of them needing 50 mW or lower.

These devices today are powered by a variety of power solutions, including lithium ion rechargeable and AAA alkaline batteries. The rechargeable solutions add significantly to the cost of the devices, and, as mentioned earlier, recharging the device may make it inconvenient to use. On the other hand, the AAA alkaline battery, while providing very good service life, may be a larger solution than the designers would ideally like to use. This has led battery makers, such as Energizer, to work to develop alternative power sources.

One example of this is the AAAA alkaline battery. These batteries, such as Energizer's AAAA, weigh 43 percent less, are 40 percent smaller in volume and are 20 percent thinner than the standard AAA. Plus, compared to lithium ion rechargeable batteries, the AAAA is a lower cost solution for the OEM, while also eliminating the need to recharge. At a 50 mW discharge, which is typical in these lower power devices, the AAAA alkaline battery would provide 11 hours of run time, compared to 28 hours for the AAA alkaline battery.

While consumers are quite familiar with AA and AAA batteries, many might not have had a regular use for the even-smaller AAAA. While a small number of AAAA-powered devices have existed in the market for years, the relatively small number of these devices has led to very low levels of retail availability of the AAAA. Following Energizer's global retail launch of the AAAA in the fall of 2007, more of these relatively low power devices are being designed to use the AAAA, and the retail availability of the AAAA globally is increasing significantly.

Recent research from Energizer shows that in the product segments of Bluetooth headsets, LED flashlights, flash audio players, noise cancelling headsets and remote controls, 17 million AAAA-powered devices are projected to be sold in the U.S. by 2009. Over that same period, more than 15 million devices will be sold in Europe and 13 million in Asia Pacific. This is driven by the increasing awareness of device designers of the AAAA and their acceptance of the AAAA as a strong solution in their devices.

Last year, GN, which partnered with Energizer, launched the world's first AAAA-powered Bluetooth headset, which never needs recharging. The use of the AAAA enabled GN's headset division, Jabra, to design a very small headset with excellent performance at a low price point that would help them reach more of the mass market. Requiring just one AAAA alkaline battery, the Jabra BT2040 provides up to eight hours of talk time and up to six months in stand-by mode. With its built-in sleep mode function, the headset automatically powers down when not used, preserving battery life. It has become an ideal backup headset for cars, enabling drivers to comply with recent Drive & Talk legislation occurring across the globe.

Another new product on the European market, the UEI Zapper, a universal remote control, is powered by two AAAA batteries. The Zapper can be used for a variety of TVs, plasma sets, LCDs and projectors, and can be programmed for use with more than 800 brands. Its small size is enabled by the AAAA battery design and provides UEI with a unique remote control design, which combined with an attractive price, has enabled the Zapper to achieve broad retail distribution and strong sales throughout Europe.

An integral part of providing a new primary battery solution is establishing broad retail distribution globally so that the consumer can easily find a replacement battery. To this end, Energizer is partnering with UEI, Jabra and other OEM's to coordinate the launch of these new devices with the retail distribution launch of the AAAA alkaline batteries to insure that the consumer can easily find the battery at retail. Energizer's strength at retail, combined with strong OEM partners, has made this possible.

These companies are just a sampling of the many that are acknowledging the ever-growing consumer need for smaller, lighter, thinner and more affordable devices. This trend will continue and it is imperative for OEMs and their partners to stay ahead of the curve by working together to design smaller, lighter and thinner devices using new and innovative primary battery solutions.

Contact Energizer at
www.energizer.com.

2008 Battery Manufacturing Annual Resource Guide


Do you want your company to be in front of decision-makers in the battery manufacturing industry?

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WHAT'S NEW THIS YEAR

- SEE PAGE 2



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Richard Nowitz

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Photos courtesy of the New Orleans
Convention and Visitors Bureau



Richard Nowitz

Battery Power 2008, an international conference highlighting the latest developments and technologies in the battery industry, will be held September 4-5 in the heart of the French Quarter in New Orleans, La.

This sixth annual event will feature presentations on portable, stationary and automotive battery technology, as well as battery manufacturing, materials and research & development.

Topics will include new battery designs, emerging technologies, battery materials, power management, charging and testing systems, as well as the latest market trends affecting the industry.

The conference is designed for OEM design engineers, system engineers, technical and management professionals involved in battery powered products and systems, battery manufacturing, battery technology research and development and power management technology.

Our Commitment to You:

Whether this is your first time participating at the Battery Power conferences, or if you have attended in the past, the 2008 event will provide you with the most up-to-date developments and technologies in the battery and power management market.

What's New for 2008

- Capital Ventures Investment Panel
- Product Demonstrations in the Exhibit Hall
- New Topics on:
 - International Regulatory Issues
 - Advanced Characterization Techniques
 - Battery Counterfeit Prevention Technology
 - Expanded Coverage on Power Management

Who Needs to Attend:

- OEM design engineers of portable electronic products and battery-powered systems
- Developers and integrators of rechargeable battery products and systems
- System engineers of standby, backup and uninterruptible power systems
- System integrators, vendors, distributors
- Manufacturers of batteries and battery packs
- IC and chipset providers
- Manufacturers of charging, conditioning, monitoring and testing equipment
- System engineers of electric vehicles
- Product managers seeking new applications, and partnering opportunities
- Charging and testing system component providers
- Specialized energy materials suppliers
- Battery component providers

At a Glance Schedule

Wednesday, September 3rd

- 7:15 - 3:30 Habitat for Humanity Volunteer Day
- 12:00 - 4:00 Exhibitor Set-Up
- 1:00 - 5:00 Pre-Conference Workshops

Thursday, September 4th

- 7:00 Registration Opens
- 8:00 Welcome and Introductions
- 8:05 Keynote Address
- 9:00 Featured Presentation
- 10:00 Networking Break
- Exhibit Hall Opens
- 10:30 Product Demonstrations
- 10:45 General Sessions*
- 12:00 Networking Luncheon
- 1:30 General Sessions*
- 2:45 Networking Break
- 3:00 Product Demonstrations
- 3:15 General Sessions*
- 5:00 Cocktail Reception

Friday, September 5th

- 7:30 Registration Opens
- 8:15 Keynote Address
- 9:15 Featured Presentation
- 10:00 Networking Break
- Exhibit Hall Opens
- 10:15 Product Demonstrations
- 10:30 General Sessions*
- 12:15 Networking Luncheon
- 1:15 General Sessions
- 2:30 Conclusion of Battery Power 2008

* Three Tracks will be Running Simultaneously



Ann Purcell

Important Deadlines

Early Registration
July 31st • Save \$400

Register for Habitat for
Humanity
July 31st

Pre-Conference Workshop
Discounts
August 4th

Hotel Reservations Discount
August 13th

Pre-Conference Workshops



Pre-conference workshops require an additional registration fee.

\$49 before August 4th
\$99 after August 4th

Pre-conference workshops will be held on Wednesday, September 3rd from 1:00 to 5:00.

Li-Ion Battery Safety, Maintenance, Charging and Fuel Gauging *Presented by Texas Instruments*

This half-day workshop will start by covering Li-Ion battery characteristics including self-discharge, useable capacity and battery impedance, Li-Ion battery cell safety and UL testing and Li-Ion battery safety requirements. Basic battery maintenance and transportation will be discussed, as well as Li-Ion battery pack electronics safety and design. Attendees will also learn about front-end safety and power path management charging, which allows charging the battery while powering the system simultaneously. We will present how to charge the battery faster from USB and support USB On-The-Go by using a 3 MHz bidirectional switching charger. Finally, we will review voltage based on coulomb counting fuel gauges and also talk about the system-side fuel gauging techniques and design challenges in battery powered portable devices.

Developing Flexible Linear and Switching Charger Designs *Presented by Microchip Technology, Inc.*

Designing battery systems for portable applications, topology selection and feature set can make or break the success of new products. This four-hour seminar will explain the development of flexible linear and switching charger designs. Embedded charger design and the advantages of certain topologies over others will be discussed, in light of how to meet the many new global standards of today. Attendees will receive the MCP1631 Multi-Chemistry Battery Charger Reference Design, a complete stand-alone, constant-current battery charger for NiMH, NiCd or constant-current/constant-voltage Li-Ion battery packs. With an input voltage range of 5.5 to 16 V, the reference design utilizes Microchip's MCP1631HV high-speed Pulse-Width Modulation (PWM) device and a PIC16F883 microcontroller.

Pre-Conference Event - Habitat for Humanity

Join Battery Power 2008, Battery Power Magazine and the New Orleans Area Habitat for Humanity on September 3rd to help build a house. New Orleans Area Habitat for Humanity (NOAHH) is leading an unprecedented rebuilding effort, as the largest homebuilder in New Orleans.

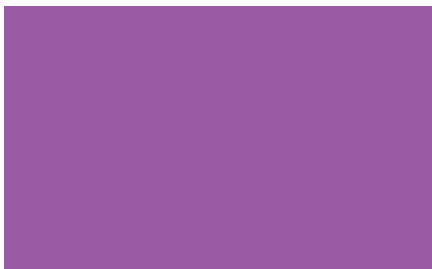
No Experience Necessary! Volunteers with all levels of experience are invited to participate. You will receive a small orientation (15 minutes) after you arrive at the work site, which includes a safety meeting. If you have physical limitations or asthma/allergies, you can participate! There are a number of tasks that do not involve strenuous labor.

The work day will be 7:30 to 3:15. Battery Power 2008 will arrange transportation from the Astor Crowne Plaza hotel to and from the work site and lunch. Volunteers may be asked to donate \$10 to cover expenses.

There are a limited number of volunteering spots. Volunteers will be accepted on a first come basis to registered participants of Battery Power 2008 (attendees, speakers, exhibitors and their friends/family). Deadline to submit volunteer information is July 31 or until the volunteer spots are filled, which ever comes first. If you are interested, please contact Shannon Given at 720-528-3770 ext 104 or shannong@infowebcom.com.

Sponsorship

Would your company like to help sponsor this volunteer activity? Sponsorship will help cover transportation, food and water. All remaining monies will be donated to NOAHH. Contact Jeremy Fleming at 720-528-3770 ext 121 or jeremyf@infowebcom.com.



Thursday, September 4th

8:00 **Welcome and Introductions**

8:05 **Keynote**

Market Trends - Markets, Technologies and Major Players

Increasing demand on energy and energy efficiency continues to drive battery technology innovations in many markets. Hear an overview of key markets, leading technologies and major players in new and improved battery technologies. In particular, three major markets will be covered: consumer electronics, electric vehicles and grid applications. Critical technology and market barriers will be discussed in each of the three areas, and a review of corporate, private and government investments in various battery technologies will also be included.

Ying Wu, Ph.D., Senior Analyst • Lux Research, Inc.

9:00 **Featured Presentation**

Venture Capitalist Investor Panel

This exciting session brings together some of the industry's leading VC investors to provide the audience with their insight and a chance to interact with some of the most knowledgeable investors in the market today. Leading investors are funding fast growing battery companies and here you will find out about their investment criteria and how they go about making investments. Ample time will be made available for audience questions and answers in this panel discussion.

*Richard Baxter, Ardour Capital Investments, LLC
William Lese, Braemar Energy Ventures • Matt Jones, Nth Power
Mark Cox, New Energy Fund, LP • James Kim, CMEA Ventures*

10:00 **Networking Break/Exhibit Hall Opens**

10:30 **Product Demonstrations**

10:45 **General Sessions** (*three tracks running simultaneously*)

Portable Power Track

New Safety Constraints of the Lithium Battery Charge

Following the new high rate requirement from portable devices manufacturers to decrease constant current charge sequence, new systems must be developed to guarantee a good safety level, despite the increasing diversity of the wall adapter performance. At the same time, a new requirement to supply external accessory from a lithium battery pack increases the difficulty to guarantee the same charge and discharge safety level. We will make an application comparison between the previous and the new generations of charge and discharge systems, taking into consideration these new safety requirements.

Bernard Remaury, Application Engineer • ON Semiconductor

Implementing Charging Algorithms in Firmware

Microcontrollers have moved into almost every aspect of power management, from managing point-of-load regulators in blade-server cabinets to monitoring battery charge levels. Many designers tasked with creating the firmware for these systems are not familiar with software development, and are often at a loss as to where to start and how to structure the firmware design. This presentation will demonstrate a simple loop-based design for implementing even the most complicated charging algorithms with simple software state machines. Attendees will leave with a template for developing complex charging algorithms, and experience with tools and processes required for creating reliable firmware systems.

Keith Curtis, Technical Staff Engineer • Microchip Technology, Inc.



Ying Wu is a senior analyst at Lux Research, with 12 years of corporate R&D and entrepreneurial start-up experience in the chemical industry. She leads the Lux Research Alternative Power and Energy Storage Intelligence service, which provides technology monitoring and analysis for alternative power and energy storage technologies.



Bernard Remaury has 10 years experience in the electronic industry. He is currently an application engineer within ON Semiconductor's Low Voltage Power

Management group. His focus is battery management and protections applications for portable power management IC's.



Keith Curtis is the technical staff engineer for Microchip Technology, Inc. In this role, Keith develops training and reference designs for incorporating microcontrollers in

intelligent power supply designs. He also sits on the PMBus development committee, and is chair of the PMBus development tools subcommittee.



Dr. David Shen is currently the CEO of NEXcell Battery Co., Ltd. His battery research fields include rechargeable Li-TiS₂ battery, rechargeable Li-ion battery,

rechargeable Li-ion polymer battery and primary Li-SOCI₂ battery. Dr. Shen has published over 50 articles and presentations in various battery conferences and journals. He also holds three patents in rechargeable battery.



Brian Kuhn is a founder and senior engineer at SmartSpark. Brian handles most testing and design problems on the battery equalizer and remote power technologies. For six years, Brian worked at Purdue University as a research engineer, investigating power electronics based systems.

Dean Perkins serves as president of SouthWest Electronic Energy Group (SWE). Dean has 30 years engineering and management experience, having held positions at Gearhart-Owens, Compaq Computer, and SWE. He has been awarded 12 US and foreign patents, including two for battery charging techniques. Additionally, US Patent applications for a solar panel with integrated high capacity battery, and a fuel gauge for primary batteries are pending.



Jinrong Qian is an applications manager and distinguished member of the technical staff for the Portable Power Battery Management group at Texas Instruments. He

has published more than 40 peer-reviewed power electronics transactions and power management articles, and holds 20 US patents.

Automotive Track

High Rate Ni-MH Battery for Hybrid Electric Vehicle

The Ni-MH battery is being widely used on various high rate applications such as power tools, electric bicycles and hybrid electric vehicles (HEV). Ni-MH battery can be used for electric vehicle applications but due to the high cost of nickel and less energy density than the lithium ion batteries, Ni-MH battery becomes a less possibility candidate for the EV use. However, if a good battery recycling program can be adapted for the EV battery, the cost of Ni-MH battery can be dropped significantly. With the simplicity of the battery packing, less complicate power management system, and high safety factor, the Ni-MH battery may still be a candidate for the EV application. This presentation concentrates on the cell design and manufacturing of the high rate Ni-MH cell for various electric vehicle batteries. The multi-cell battery design and testing results of Ni-MH electric vehicle battery will be presented.

David H. Shen, Ph.D., CEO • NEXcell Battery Co., Ltd.

Performance Improvements of Electric Vehicle Battery Packs with Active Equalization

In the electric vehicle industry, the vehicle battery is the primary factor limiting growth of the market. Present battery technologies do not have as much capacity or lifetime as desired. Improvements are slowly being made but these are only occurring incrementally and for the near term, there is no significant improvement in sight. In order to get the most out of the present battery technologies, proper battery management is paramount. Discover battery management needs of electric vehicles, focusing on equalization to get greater performance from the battery pack including increased capacity and lifetime.

Brian Kuhn, Founder and Senior Engineer • SmartSpark Energy Systems

Power Management Track

Accurate, Low Cost Fuel Gauge for Primary Lithium Batteries

This presentation will discuss a fuel gauge design for primary lithium battery packs that are used in the oil and gas industry for monitoring downhole battery capacity. A unique measurement technique that allows a low cost yet accurate (<5 percent error) measurement of remaining battery capacity will be detailed and laboratory and field data will be presented, which confirms the predicated accuracy of the gauge. The communication protocol for the gauge with its uphole reader will be discussed as well as a description of the PC based software that manages and reads the fuel gauge data. The application of this technique could be expanded to other markets including oceanography and seismic exploration.

Dean Perkins, President • SouthWest Electronic Energy Group

How to Design System-Side Fuel Gauge for Portable Devices

Battery operated portable devices are essential to almost everyone's life today. Determining the remaining battery capacity is just as critical. Previously, many portable devices relied on voltage measurement alone to approximate the remaining battery capacity with a few bar indicators, which is not accurate. A combination of voltage measurement with coulomb counting using the system-side fuel gauge, versus the traditional pack-side fuel gauge, has become much more attractive for this reporting. The system-side fuel gauge can reduce the end users total cost for buying a replacement battery pack when the original battery life has expired. This presentation discusses how to improve fuel gauge accuracy and system-side battery management system design challenges. The real test results using blackberry show that more than 99 percent accuracy can be achieved.

Jinrong Qian, Applications Manager • Texas Instruments

12:00 **Networking Lunch**

1:30 **General Sessions** (*three tracks running simultaneously*)

Battery Manufacturing Track

Cathode Materials for Lithium Ion Batteries

TODA Kogyo is a manufacturer of a wide range of cathode materials for Li-ion batteries. Lithium-nickel-cobalt-aluminum-oxides (NCA), lithium-nickel-cobalt-manganese-oxides (NCM), lithium cobalt oxides (LCO) as well as lithium manganese oxides (LMO) belong to TODA's product portfolio of cathode materials. An overview about the material properties of the current cathode materials will be given. The characteristics of the cathode materials for Li-ion batteries, namely NCA and NCM, are strongly affected by the properties of the applied precursor materials, being nickel hydroxides of different composition. It is shown how the properties of the precursor materials and the cathode materials itself can be modified to meet the current and future needs of the Li-ion battery market.

*Dr. Stefan Malcus, Manager International Technology •
Toda Kogyo Europe GmbH*

New Non-Metallic High Electron Flow Plastic Materials for Capacitors and Anodes

Materials with high electron flow with minimal resistance while minimizing their weight and size is a goal. Coupling with green initiatives and rising metal prices makes an all plastic anode and/or capacitor desirable. Limitations have been the carbon technologies and inherent limitations of the plastic extrusion process. Recent developments have enabled the manufacture of low density polyethylene (LDPE) and other plastic films with resistance levels at 10 and 1 Ohms. The resulting films are able to be produced with variable porosity and variable resistance levels, at various thicknesses, allowing for lightweight, low resistance films to be used in various power applications.

Keith Donaldson, President • Engineered Materials, Inc.

Battery Charging Track

Intelligent Battery Charging Technology

An intelligent battery charging technology has been enhanced to include battery diagnostics and prognostics. Derived from the analysis of a matrix of battery parameters that includes intrinsic electrochemical parameters, diagnostics and prognostics can determine the battery's power, its state of charge (SoC) at the current cycling point and a prediction of its ability to deliver a certain number of cycles. Accurately determining a battery's ability to sustain required energy and power allows battery replacement prior to failure, eliminating unnecessary, unsafe, inconvenient and costly down time while attaining maximum battery life. Practical applications of this technology are highlighted in both the passive and active vehicle battery monitoring systems currently in development.

John James, President and CEO • GEM Power, LLC

Battery Charger Efficiency Standards and Strategies For Improvement

Pressure for efficient use of increasingly limited electric power resources together with ever increasing use of portable, battery operated electronic devices, has prompted interest by both users and government agencies in battery charger efficiency. Charger designers have long been interested in power conversion efficiency because minimizing waste heat is a prime design goal in all but the smallest of chargers. With the increasing popularity of lithium chemistry batteries comes the added restriction of maintaining the cells at less than 45°C during charge for safety and increased cycle life. Excess energy waste during battery charge is not only a bad idea for the environment and poor design practice; it's becoming an international regulatory agency issue as well. This talk will explore the existing and in-development battery efficiency standards and relates these to various battery charger design topologies. It presents methods for analyzing conversion efficiency and strategies for improvement.

David Gunderson, Sr. Electronics Engineer • Micro Power Electronics, Inc.



Exceptional Team Discounts
are Available!

Registration Information is
Detailed on Page 15



John James is president, CEO and managing member of GEM Power, LLC. His corporate responsibilities included sales, marketing and product development, with operational

responsibilities for production, warehousing and distribution, and interfaced with aircraft manufacturers such as Cessna, Beech and Learjet. Prior to his term as president, he was the vice president of Engineering for Teledyne Battery Products.



David Gunderson has more than 30 years of electronic product development experience. He designs charger and battery-protection circuits and develops embedded

software for Micro Power Electronics, Inc. in Redmond, Wash.



Mike Coletta has worked for Intersil for the past ten years in technical marketing and new product development roles. He is currently a principal engineer located in

Irvine, Calif. where he is leading the development of Intersil's next generation battery management and power management products for high voltage battery systems. Mike has several patents in the areas of power management and battery safety circuits.



Bob Bell is the applications engineering manager for the National Semiconductor design center located in Phoenix, Ariz. He has been with National

Semiconductor since September 2001. Products designed include integrated switching regulators, next generation PWM power controllers, gate drivers, hotswap and load share controllers.



Gary Rohlke is the national sales manager for Product Testing Services at Sypris Test & Measurement, a division of Sypris Solutions. In this capacity he is respon-

sible for all product test business development activities. Gary has over 25 years of experience as a test engineer and project manager designing and implementing test systems, test fixtures and test software.

Dr. Bor Yann Liaw directs the



Electrochemical Power Systems Laboratory at the University of Hawaii to conduct research on advanced batteries and (bio)-fuel cells. He has been involved in electric and hybrid vehicle

R&D for the past 12 years, primarily focused on battery testing, model prediction and simulation, and vehicle/battery operation data collection and analysis. He is also a partner in Battery Tech Hawaii LLC, High Power Research Laboratory and Ambient Micro LLC, conducting battery and energy harvesting technology development and commercialization.

Power Management Track

Battery Pack Electronic Design for Lithium Based Products

A wealth of new products for the professional and consumer markets are being developed with high power lithium based battery packs for performance as well as environmental issues. Product developers are working to achieve the lowest cost solutions while customers are demanding higher performance as well as enhanced safety. Take an in depth look into the different battery pack electronics designs that are being developed for several classes of products. We will identify what features should be incorporated in various types of packs based on usage profiles as well as total power provided. A comparison of features and benefits of the various battery pack electronics designs as well as the cost of deployment for these designs will also be discussed.

Michael Coletta, Principal Engineer • Intersil

Dual Mode Converter Maintains Output Regulation Over Wide Input Range

DC to DC power converters employed in battery powered systems must operate over a very wide input voltage range. If the output voltage is very low, a simple buck regulator can be used to efficiently step-down and regulate the output voltage. In many applications the output voltage is greater than the minimum input voltage as the battery discharges. In these applications a buck regulator will drop out of regulation as the input voltage approaches the output voltage. A buck-boost regulator can maintain regulation for input voltages either higher or lower than the output voltage. The challenge is that buck-boost power converters are not as efficient as buck regulators. A new dual mode power converter has been developed whereby the power converter acts as a buck regulator while the input voltage is above the output and as the input voltage approaches the output voltage a gradual transition over to buck-boost mode occurs.

Robert Bell, Applications Engineering Manager • National Semiconductor

2:45 **Networking Break**

3:00 **Product Demonstrations**

3:15 **General Sessions** (*three tracks running simultaneously*)

Battery Testing Track

Valuable Lessons Learned from Controlled Battery Testing

Controlled laboratory testing can tell us about the suitability of a battery and its related subsystems for an intended environment. Questions we seek to answer include: can it be transported safely; does it meet the manufacturer's electrical and environmental specifications and does it meet the regulatory requirements? Answering these questions is important to manage exposure to warranty costs, safety issues, production delays, redesign and rework costs and the quality image of the manufacturer. This presentation will provide a summary of qualification and reliability test methodologies used to validate the design, construction and manufacturing of batteries and subsystems. The presenters will provide examples of test induced failures drawn from the experience of the authors and discuss how design and production considerations can reduce or eliminate these failures.

Gary Rohlke, Product Test Sales Manager • Sypris Test & Measurement

Understanding Battery Pack Performance Issues

Most portable devices, electric hybrid vehicles and energy storage applications require proper configurations of battery packs. Besides typical cell operating and performance issues, there are additional issues related to pack operation. In this presentation, we will discuss how to establish cell baseline behavior via testing and characterization, which is used to model cell performance. We will then discuss how cells in a batch can be characterized to assist us understand their variations and develop criteria to select cells for pack assembly. We will also discuss how these variations comprise to intrinsic imbalance of the pack and how to quantify other factors in the pack control and management.

Dr. Bor Yann Liaw, Electrochemical Power Systems Lab. • Hawaii Natural Energy Institute

Battery Manufacturing Track

Advances in Characterization Techniques for Understanding Degradation and Failure Modes in Lithium-Ion Cells

A novel cross-sectioning technique has been developed that enables direct imaging and characterization of degradation mechanisms inside lithium-ion cells. Unlike conventional techniques that require harvesting of materials from a cell, this cross-sectioning technique preserves the electrode structure and the spatial relationship between the various components in the electrodes. Learn as several examples of these defects and degradation mechanisms are shown. In addition, the applicability of the cross-sectioning technique to failure analysis, design and performance evaluation demonstrated.

Quinn C. Horn, Managing Engineer • Kevin C. White, Senior Engineer • Exponent, Inc.

Lithium Ion Cell Evaluation - Going Beyond the Manufacturer's Data Sheets

A cell manufacturer's data sheets typically give the performance of cells under conditions that encompass the majority of usage conditions that are a reflection of their customer base. For most lithium ion cell manufacturers the largest segment is of course the consumer electronics segment made up largely of the mobile phone and notebook PC OEMs. However, lithium ion is now commonly used in many non-consumer applications that include portable medical devices, power tools, military devices and professional electronics of all types. These applications can have a variety of unique requirements that require testing to verify performance under these conditions. This presentation will show the performance for a variety of lithium ion cells highlighting those that can deliver under unusual conditions.

Chris Turner, Director of Battery Technology • Nexergy, Inc.

Battery Charging Track

Charging Systems for High-Power Cells

High power li-ion batteries support pulses over 100 amps. Taking advantage of the high rate charge/discharge capabilities adds new electrical and mechanical challenges to a traditional charger design. Micro Power will address both electrical and mechanical design considerations/guidelines for designing chargers that can utilize the new capabilities offered by these high power batteries. Topics in this session will include fast charging, power supply selection, electrical contacts and connections, thermal management and prevention of Electromagnetic Interference (EMI).

David Nierescher, CTO • Micro Power Electronics

Optical State of Charge Sensing

Learn the theory and practice of state of charge sensing in lead-acid batteries using a unique fiber optic based approach. This approach senses the index of refraction changes due to electrolyte concentration and demonstrate a direct and linear correlation to electrolyte specific gravity measurements. The principle of operation of these unique fiber optical devices is explained and experimental results are presented. We conclude that this method of sensing provides a substantial increase in simplicity over current methods with undiminished accuracy and increased speed and suitable for real time continuous monitoring of state of charge in battery installations.

Joseph S. Accetta, Founder • JSA Photonics, Inc.

4:30

International Regulatory Issues

International Regulatory requirements impact the design, cost and time-to market of cells and batteries. This presentation will focus on the worldwide regulatory certification of cells and batteries used in the portable consumer market. Discover the legal and market driven requirements in North America, Europe, Asia and other regions. The applicable agencies and test standards will also be highlighted. Time permitting, we will delve into some of the more popular test standards and discuss the actual construction considerations and test methods.

Jody Leber, Program Manager • Motorola Product Testing Services

5:00 Cocktail Reception

Dr. Quinn Horn is a managing engineer in Exponent's mechanical engineering and materials/metallurgy practice. Quinn consults in the area electrochemical engineering including corrosion analysis, battery manufacturing and battery science. In the field of battery technology, his work addresses a broad range of issues including material selection and testing, cell design, cell manufacturing, performance degradation, accelerated life testing and due diligence technology evaluation.



Chris Turner contributes more than 15 years of multi-disciplined battery industry experience to the strategic development of portable power solutions at Nexergy.

For six years, he led battery research and strategic planning in energy technology for Sony Ericsson Mobile Communications USA (SEMC). Chris holds a Degree in Chemistry from the University of South Carolina.



David Nierescher is CTO and was founder of the SelfCHARGE division of Micro Power Electronics. David has designed dozens of chargers over the last decade, is highly regarded in his field and widely known as an innovative designer with numerous patents to his credit.



Joseph Accetta is senior executive engineer/scientist with more than 35 years of experience and broad technical background in electro-optical systems, laser and directed energy and radar remote sensing, sensors, electronic systems and software development. Since 2003 he has been a principal scientist and a member of the research faculty at Georgia Tech Research Institute in Albuquerque, N.M. and manager of the GTRI field office.

Jody Leber is a program manger at Motorola Product Testing Services (MPTS). He has been in the regulatory compliance field for 18 years, and four years specific to batteries and cells. Jody is involved with different standards development bodies and is also a Quality Auditor.

Friday, September 5th



Matthew Larkin is a senior battery consultant with TÜV SÜD. He has been working in regulatory and voluntary compliance for more than 10 years, originally specializing

in product safety testing and Electro-Magnetic Compatibility and is currently responsible for our Battery Certification Business. His key expertise is in Lithium and Lithium-ion battery technologies specifically regarding battery safety and consistency in production.

Steve Powell currently serves as the general manager and director of the Security Solutions business within Kodak's Graphic Communications Group. Here Steve utilizes his business and marketing experience to drive the adoption of proprietary anticounterfeiting solutions to address the product and brand protection needs of customers in printing, packaging, bulk materials and other industry segments.



Bill Shank, vice president of North American sales, is a 24 year sales veteran of the telecommunications industry. He has accountability for the

North American promotion of IdaTech's back-up power solutions. A graduate of Southern Illinois University, Bill derived the foundation of his leadership principles and technical knowledge from ten years of service in the US Navy.



Mark Anderson has been at Toro 13 years, and is responsible for research and development of the Commercial Division of Toro. He works on machines that will

hopefully be in production within two to 10 years. He has had a variety of engineering experiences, most of them in the controls and human interface end of machine design. Mark is a 1979 graduate of North Dakota State University in Fargo.

8:15 Keynote

Turning Up the Heat on Battery Safety: A Guide to Battery Safety Testing

Battery safety is now of paramount importance with good design and consistency in production being vital. Batteries are used more and more in "power hungry" consumer devices such as phones, PDA's media players, toys and power tools. This has placed increasing pressure on manufacturers to reduce the size and weight of battery packs whilst increasing their performance. While these advances in battery technology have satisfied the demands of the consumer; battery safety has started to become an issue especially in relation to Li-ion chemistry. Li-ion provides high power density it does have potential drawbacks such as increased sensitivity to temperature and mechanical shock, a potential issue during air transportation. This presentation will explain and demystify the potentially complex field of battery safety testing and advise on what testing aspects need to be considered and why.

Matthew Larkin, Senior Battery Consultant • TÜV SÜD

9:15 Featured Presentation

Technology to Prevent Counterfeiting in the Battery Industry

The worldwide battery industry is struggling to fend off the growing threat of counterfeits, an epidemic that contributes to an estimated \$500 billion in global trade. As the use of electronic devices soars, the demand for batteries grows rapidly, and so are the problems caused by counterfeiters who are inserting fakes into legitimate sales outlets everywhere. Battery makers need a powerful, robust solution to aggressively deal with the counterfeiting issue. Kodak discusses this worldwide problem and the various needs of brand owners and battery manufacturers, and the high-tech solutions that are being deployed to prevent the rising tide of dangerous fakes.

Steven J. Powell, General Manager and Director, Security Solutions • Eastman Kodak Company

10:00 Networking Break

10:15 Product Demonstrations

10:30 General Sessions (three tracks running simultaneously)

Battery Hybrid Track

Extended Run Backup Power for Critical Communications Networks - Battery/Fuel Cell Combinations

In combination with batteries, fuel cell technology can be used to improve reliability and significantly extend run times at mission critical sites when compared to battery-only configurations. As fuel cell technologies advance, more solutions are developed to combat power outages. Proton Exchange Membrane (PEM) fuel cell systems offer a compelling value proposition to telecommunications carriers and others who require highly reliable critical backup and remote power solutions.

Bill Shank, Vice President of North American Sales • IdaTech

Fuel Cell Integration into a Battery Electric Utility Vehicle

Battery only electric turf vehicle designers struggle with the trade-offs between weight (payload and vehicle), range and cost. Fuel cell technology, along with batteries, offers a range extension solution. Learn about how batteries are still an integral part of a compact, lightweight all electric turf vehicle.

Mark Anderson, Senior R&D Engineer • Toro

Battery Electric Vehicles with Fuel Cell Range Extenders: Cars With CO2 Emissions' Below EU Targets

From 2012 the European Union is introducing punitive new measures designed to reduce emissions from passenger cars. With gas prices as high as \$8 per gallon in the EU, there is major incentive to increase fuel efficiency. Voller Energy Group provides fuel cell systems that run from available fuels. These systems can act as on-board chargers for electric vehicle batteries, extending the range of the vehicle substantially. These vehicles are able to provide a transition from existing ICE and diesel cars to hybrid and electric vehicles (EV's) but with much greater fuel efficiency and lower emissions.

Stephen Voller, CEO • Voller Energy

Battery Manufacturing Track

Laser Welding for Battery Pack Manufacture

Welding for battery pack manufacture has been and continues to be successfully provided by resistance welding technology. However with growing manufacturing volume and diversity for battery packs there are a number of welding applications that are starting to favor laser welding. Laser welding has become a well established manufacturing process backed by industrially proven technology. Laser welding is a non-contact process that has no mechanical contact with the part to be welded. This offers the following benefits: instantaneous welding, the laser can access small or recessed areas, there are no process consumables such as electrodes that need to be maintained, and the laser is geared for flexibility and automation. The basic technology of laser welding will be introduced with examples of battery welding applications.

Geoff Shannon, PhD., Product Manager • Miyachi Unitek Corp

Evaluation of Atmospheric Plasma Surface Modification for Continuous Processing of Flexible Battery Components

The advantages for enabling manufacturing of thin flexible sources of power by roll-to-roll processes are evident. In addition to extremely low production costs, the flexible nature of these devices dramatically enables not only their application within a broader range of stationary and remote devices, but also their integration with other flexible materials. This presentation studies data generated from using atmospheric glow discharge plasma technology as an integrated roll-to-roll or continuous production line process for manufacturing power-generating materials.

Rory A. Wolf, Vice President Business Development • Enercon Industries Corp.

Domestic Manufacturing of Lithium Ion Cells

Electro Energy, Inc. has acquired state-of-the-art Lithium-Ion manufacturing facilities near Gainesville, FL. This fully automated manufacturing plant currently has the capacity to produce over three million cylindrical type Lithium-Ion cells per month, and produce cathode and anode materials for up to five times as many cells. In addition to the conventional cobalt-based 18650 high energy Lithium-Ion cells, EEI has also evaluated the now emerging newer type cathode and anode materials for high-power 18650 and 26650 cells. The actual performance of these newer materials obtained with production-sized cells will be presented and compared.

Tibor Kalnoki-Kis, General Manager • Electro Energy, Inc.

Portable Power Track

Performance Comparison of Lithium Primary Batteries for High Temperature Operation

The lithium oxyhalide primary batteries, lithium/thionyl chloride and lithium/sulfuryl chloride, are noted both for their extremely high energy density and for their performance at temperatures above 100°C. In spite of their superficial similarity, these two chemistries actually perform quite differently across the full range of temperatures. The differences are more pronounced under the constant power and pulsed discharge conditions that are increasingly important in newer applications. In this presentation we will compare the performance of these two cell chemistries over a range of temperatures, with a focus on intelligent design of pulse profiles to maximize battery life during prolonged high temperature exposure.

Arden P. Johnson, R&D Manager • Electrochem Commercial Power

Stephen Voller, CEO, co-founded Voller Energy in 2002 to focus on the manufacturing of portable fuel cell systems for use as battery chargers and mobile generators. Previously, Stephen was managing director of Netscape UK and a sales manager at IBM. Stephen has a degree in Data Processing from the University of Leeds, is a Chartered Engineer. He is a Member of the Institute of Electrical and Electronics Engineers (IEEE), a member of the Parliamentary Renewable and Sustainable Energy Group.



Rory Wolf is currently the vice president of Business Development at Enercon Industries Corp. Mr. Wolf has 26 years of experience within national and international positions in the plastics and paper industries. He has specific experience in polymer-based flexible packaging, surface modification systems, corrugated, point-of-sale display, folding carton and electronic prepress industry segments.



Arden Johnson is the Research & Development manager for Electrochem Commercial Power, a subsidiary of Greatbatch, Inc., a supplier of batteries for implantable medical devices. He has been engaged for the past 18 years in research on primary and secondary lithium batteries, with a special focus on high-energy batteries that operate under extreme conditions.



Jean-Yves Huot has been acting as product manager in Mobile Energy at Timcal for three years. He has been active in development and marketing of battery materials for more than twenty years. He completed his PhD in Chemistry in 1985 and he spent about 18 years as research scientist in Industrial R&D, and a year as consultant in zinc battery and electrochemistry.



Joe Carcone joined PowerGenix in 2006 where his duties include business development, product development and sales implementations for portable power applications. Before joining PowerGenix, he was the vice president of Marketing and Sales for Sanyo Energy Corp.

Dr. Sankar Das Gupta is chairman and CEO of Electrovaya and an internationally recognized scientist in electrochemistry. Sankar has more than 25 years experience in materials engineering and battery science. Dr. Das Gupta received his doctorate from Imperial College, London and is a graduate of Presidency College, India. He serves as an Adjunct Professor in the Faculty of Engineering at the University of Toronto.



Jon Eager is director of OEM Marketing for Energizer Battery Company. Jon develops strategy and tactics for selling Energizer's products and services to OEM device manufacturers. His team also develops insights into portable device and portable power trends, and then translates those insights into new product recommendations and business opportunities.

Key Roles of Carbon Materials in Power Sources

Carbon materials are an essential component in the modern portable and stationary power sources. Chemical inertia and electric conductivity of carbon materials support their extensive use as conductive additive in most primary and rechargeable battery chemistries. Other physico-chemical properties allow carbon materials to play other roles such as active material or principal components or fillers of composite electrodes. The main carbon materials currently used in modern batteries are conductive carbon black and graphite. Their properties and roles will be reviewed and discussed, and trends in development of new carbon materials will be emphasized.

Jean-Yves Huot, PhD, Product Manager, Mobile Energy • Timcal Graphite and Carbon

New Rechargeable Power Source for Consumer Applications Requiring Typical 1.5 Volt User Replaceable Batteries

The theoretical advantages of nickel-zinc batteries have been known for some time. They can be up to 35 percent lighter than conventional nickel-cadmium or nickel-metal hydride batteries and up to 30 percent smaller. However, problems associated with the instability of zinc have hampered their development. PowerGenix has solved the technical problems associated with nickel-zinc batteries, allowing their practical use in a number of applications. Using both a patented electrolyte and a patented electrode composition, PowerGenix has eliminated issues of dendrite formation and shape change of the zinc electrode.

Joseph Carcone, Vice President Business Development • PowerGenix

12:15 **Lunch**

1:15

Battery Hybrid Track

Integrated, Intelligent Lithium Ion SuperPolymer Battery Systems for Ultra-Safe, Long Range ZEVs and PHEVs

A lithium ion SuperPolymer battery systems for ZEV and PHEV applications feature Electrovaya's MN-series chemistry, balanced energy-power optimization and integrated iBMS. The system designs range from 4 kWh to over 100 kWh systems with corresponding 48 V to over 700 V configurations. Applications similarly range across heavy duty, medium duty, passenger, specialty and off-road all electric and plug-in hybrid electric vehicles.

Dr. Sankar Das Gupta, Chairman and CEO • Electrovaya Corp.

Experimental Survey of the Application of Commercial-Graded Lithium Polymer Batteries in Military Systems in Conjunction With Solar Panels and Fuel Cells

Hear the results of an experimental survey into the characteristics of commercial lithium ion and lithium polymer batteries when applied in a range of man portable military radios. The focus is on when the expected load currents varies significantly across the battery's cycle. The study also considers the use of solar panels and fuel cells for in-field replenishment. Several pros and cons will be discussed, but in general the commercial product stood up well in the warmer climates and with a good cost to performance ratio.

Andre Roux • Council for Scientific and Industrial Research DPSS

Portable Power Track

Portable Power: Smaller, Lighter and Affordable

As the technology behind consumer electronic devices continues to evolve and advance, product designers are in a race to make them smaller, lighter and thinner with each new generation. This trend will continue and it is imperative for OEMs and their partners to stay ahead of the curve by working together to design smaller, lighter and thinner devices using new and innovative primary battery solutions.

Jon Eager, Director, OEM Marketing • Energizer

2:30 **Conclusion of Battery Power 2008**

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Visitor Information

Here is a short list of places to visit and area tours.

New Orleans Spirit Tours

Explore the spookier side of New Orleans history by taking either the daily ghost/vampire tour or the nightly cemetery/Voodoo tour.

www.neworleanstours.net

The Historic New Orleans Collection

A historical society museum, which displays temporary exhibits themed on New Orleans and Gulf regional history.

www.hnoc.org

New Orleans Jazz National Historic Park

One of New Orleans' many historical parks, this one focuses on the city's diverse musical history especially the birth of jazz. It features live music performances, lectures and guided walking tours.

www.nps.gov/jazz

Jean Lafitte Swamp & Airboat Tours

You will experience the diverse flora and fauna of the swamp country, including moss-draped cypress trees, snakes, opossums, egrets and alligators!

www.jeanlafitteswamptour.com

The Ogden Museum of Southern Art

An art museum dedicated to past and contemporary art/artists from the American South.

www.ogdenmuseum.org

The National World War II Museum/D-Day Museum

Your first question may be why is there a D-Day museum in New Orleans? The landing craft that brought allied troops to the beaches of Normandy were built here in Southern Louisiana. The museum features interactive exhibits and artifacts from this pivotal moment in history.

www.nationalww2museum.org

Please visit our Web site, *Hotel and Area Information* page, for attractions and tours, as well as listings for dining out, shopping and nightlife.

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Richard Nowitz

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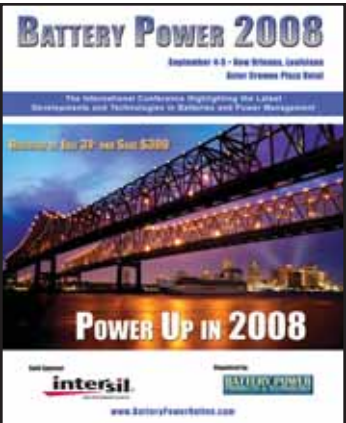


Richard Nowitz

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Circuit Protection Designs For a Mobile World

Matthew Williams, Global Applications Engineering Manager
Tyco Electronics

The mobile functionality of portable media players (PMPs), smart phones, play stations and other battery-powered portable devices offers consumers an increasingly connected lifestyle between their home, office and vehicle. However, this convenience comes with certain risks. Every time these products are connected or disconnected, they may be exposed to circuit damage caused by user error, wrong supply voltages or voltage or current transients.

Protecting mobile devices has become a critical design issue for manufacturers of consumer electronics and general electronics systems, who must meet safety requirements, reduce warranty costs and provide the end-user with a reliable product. This article describes the operation principle of the polymer protected Zener diode and how it can be used to help protect portable devices from damage caused by improper power supplies, overvoltage transients, reverse bias and overcurrent conditions.

Protecting Mobile Devices

The number of cell phones now surpasses the number of people in countries like Australia; and in many countries, including the US, there are more cell phones than land lines. This growth of portable devices not only increases the potential for customer error, but the proliferation of higher power applications leads to increased power demands along with greater risk of inductive spikes and other connection/hot disconnect transients.

The evolution of mobile multimedia equipment from audio-centric devices to video-centric storage devices is also resulting in higher power requirements, higher data transmission rates and smaller circuitry. For example, MP3 players and PMPs, with their ability to download and store music, movies, TV programs and games, are becoming more popular. According to the In-Stat report, "Worldwide Demand Remains Strong for MP3 and Portable Media Players," the continued decline in the cost of incorporating video into portable devices will push shipment growth of video-enabled PMPs by the end of 2008, and will result in video-enabled PMPs outselling audio-only models by 2009. This move to video over audio-centric portable products means higher power charging interfaces (i.e., a recently released USB charging spec raises the interface maximum current from 0.5 to 1.5 A).

In addition to the risk of connecting the wrong power supply, voltage transients can also damage a portable device. Although typical computer power supplies provide regulated lines at 5 V +/- 5 percent, and 12 V +/- 5 percent, under certain circumstances, the voltage at these lines may exceed 5.25 V, and 12.6 V, causing potential damage to the system or unprotected peripherals. Voltage spikes can occur when there is inductance in the power bus, and a rapid change in current occurs.

This change can result from a hot disconnect of a peripheral, an internal system shutdown or other internal power fluctuations. Inductance does not require magnetics, but can also be generated by long cables and other power bus artifacts. The more inductance in the power bus, the worse the voltage spike seen by the peripheral is likely to be. In short, portable consumer electronics exposed to voltages (well in excess of the bus voltage) may require protection to help prevent premature failure.

Circuit Protection Solution

Transient protection is critical when designing peripherals that may be powered off computer buses and automotive power buses. On computer buses, inductively generated voltage spikes can exceed 8 V on the 5 V line and 16 V on the 12 V line, which can damage unprotected peripherals. With the advent of low-cost third party AC to USB converters, and car cigarette lighter-to-USB converters, the potential for transients to be seen on computer buses continues to increase.

Automotive power buses are notoriously dirty. Although they are nominally 12 V, they can range in normal operation from 8 V to 16 V. Still, battery currents can exceed 100 amps and can be stopped instantly via a relay or fuse, gen-

erating large inductive spikes on the bus and increasing voltage by five times or more.

With the growth of high-power electronics content in vehicles, so grows the potential for inductive spikes.

Third party power converters are increasingly common however, and may filter some transients. Testing by Tyco Electronics shows that their transient suppression capability varies widely.

Custom-keyed power connectors are sometimes employed to prevent the use of incorrectly rated or improperly designed power supplies. This solution incurs custom tooling costs though and is not necessarily insulated from the creation of third party adaptors.

In another protection scheme, high voltage capable silicon solutions can be designed to provide a regulated voltage output and overvoltage lockout. The problem with the integrated silicon approach is that there is usually a significant price premium associated with this method.

Traditional clamping diodes represent the simplest protection solution. However, in order to withstand the potential power output of a non-approved charger while still providing resettable protection, this diode must be capable of dissipating nearly all of the power that a non-approved charger could deliver. The resultant protection solution would therefore require both a large diode and significant heat-sinking infrastructure, thus making it an impractical choice.

Through accelerated research in materials science and more efficient design, PPTC (polymeric positive temperature coefficient) device manufacturers are keeping pace with portable equipment challenges by developing



Figure 1. Polymer protected Zener diodes.

Tyco Electronics continued on page 14

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new devices that meet existing performance levels within smaller and more convenient packaging.

An example of how circuit protection device manufacturers are addressing these market demands is by utilizing a polymer protected Zener diode (shown in Figure 1), which offers designers the simplicity of a traditional clamping diode while obviating the need for significant heat sinking. This device not only helps protect sensitive electronics from damage caused by the use of improper power supplies, it also helps pro-

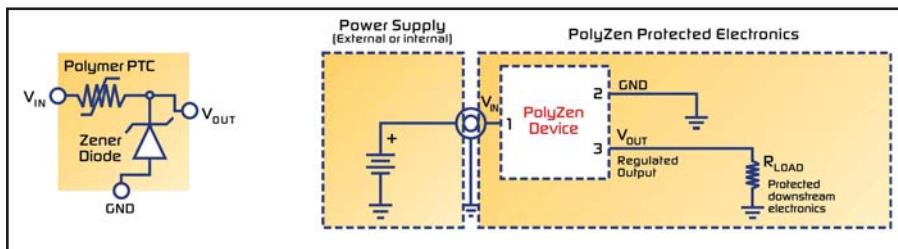


Figure 2. The PolyZen device helps provide input power protection for portable electronics.

vide transient suppression, reverse bias protection and overcurrent protection in a small, single package.

Figure 2 illustrates how the Tyco Electronics PolyZen device integrates a precision, low resistance Zener diode for crisp voltage clamping with a resistively non-linear, PPTC layer. The PPTC layer responds to either diode heating or overcurrent events by transitioning from a low to high resistance state. In the event of a sustained high-power overvoltage condition, the tripped PPTC element limits current and generates voltage drop to help protect both the Zener and the follow on electronics, effectively increasing the diode's power handling capability.

The polymer protected Zener diode is particularly effective at clamping and smoothing inductive voltage spikes. In response to an inductive spike the Zener diode shunts current to ground until the voltage is reduced to the normal operating range. In the case of a wrong voltage power supply, the device clamps the voltage, shunts excess power to ground, and eventually locks out the wrong supply, as shown in Figure 3.

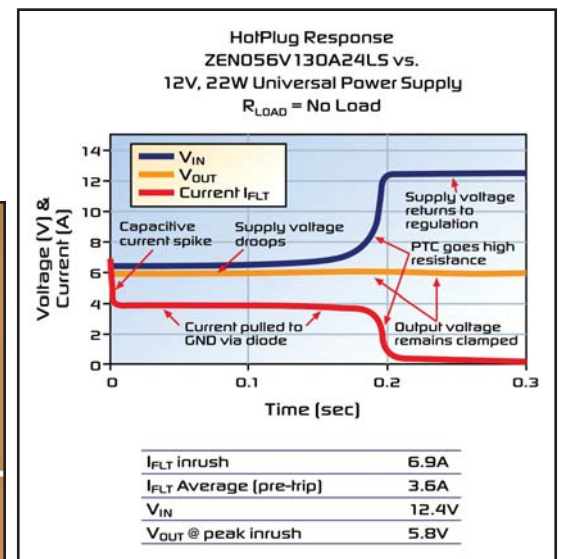


Figure 3. Polymer enhanced Zener diode clamps and smooths inductive voltage spikes.

The relatively flat voltage versus current response of the polymer protected Zener diode helps clamp the output voltage, even when input voltage and source currents vary. Simply put, the polymer enhanced device helps provide coordinated protection with a component that protects like a Zener diode, but is capable of withstanding very high power fault conditions without requiring any special heat sinking structures beyond normal PCB traces.

Conclusion

By integrating polymeric materials with conventional products, PPTC technology has been expanded to a wider range of industries and applications, from automotive navigation systems to smart phones and portable media players. These pioneering designs help support emerging technologies and keep pace with customer needs. New polymer protected Zener diodes can be used to help protect portable devices from damage caused by improper power supplies, overvoltage transients, reverse bias and overcurrent conditions. They also help meet the needs of shrinking mobile designs that require smaller, more reliable circuit protection devices.

Matthew Williams is a Global Applications Engineering Manager for Raychem circuit protection products at Tyco Electronics. He received both his BSEE and BSEC from Phoenix Institute of Technology and has been in the industry since 1984.

Contact Matthew Williams at mattwilliams@tycoelectronics.com or 650-361-2058.

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Alternative Fuels: Need of the Hour

Suba Arunkumar, Industry Analyst
Energy & Power Systems Group

The beginning of the 21st century witnessed a well-established automotive industry with various types of vehicles to benefit mankind. An increased usage of vehicles, however, drained the natural reserves of oil, making it a major economic factor worldwide. Automobiles, one of the major consumers of oil reserves, can reduce the dependency on oil to a significant extent through these alternative fuels. This article focuses on alternative fuels that can power automobiles efficiently, similar to that of conventional vehicles. The most popular alternative fuels are batteries, fuel cells, ultracapacitors and bio-fuels. However, biofuels require gas for blending purposes; it is unlikely to tackle the dependency on gas effectively on a long-term basis.

Batteries go hand-in-hand with automobiles for starting, lighting and ignition purposes. Although in recent years, battery-powered vehicles have been developed successfully and are on the road with zero emission. Normally, lead acid batteries are used in automobiles for auxiliary applications, but when batteries need to power a vehicle, the nickel metal hydride (NiMH) or lithium-ion batteries offer better viability. Surging demand for alternative vehicles lured many battery manufacturers to enter into the automotive battery market, most of them with recent battery chemistries such as lithium-ion and NiMH.

Currently, electric vehicles (EVs) are powered by lead acid and NiMH batteries; however, EVs powered by lithium-ion batteries are in the testing process. The commitment to develop a battery that offers alternative vehicles a performance similar to the conventional vehicle increases through various R&D activities involved in geographic regions such as North America, Europe, Asia Pacific and others. Additionally, government research organizations are taking a step toward this initiative by funding these manufacturers.

Some of the significant and promising technological advancements made to the lithium-ion battery include the nanophosphate technology developed by A123Systems, and the nanostructured lithium titanate spinel oxide electrode developed by Altair Nanotechnologies, Inc. Nanotechnology and thin-film technology offer much to the advancement of lithium-ion chemistry. EVs, powered by batteries, are becoming the trend in the European region, some countries of the Asian region, such as Japan, China, South Korea and some Southeast Asian countries.

Fuel cells have always remained an area of interest in the alternative fuels market. Fuel cell vehicles (FCVs) are similar to battery powered vehicles. Battery EVs use electricity for propulsion from an external source (batteries), while FCVs generate electricity required for propulsion. Although FCVs are in the testing stage, cost factor and affordability remains a challenge. Automakers, fuel cell developers, component suppliers, government agencies and other organizations are working hard to combat this challenge.

Recently, General Motors launched the test fleet of hydrogen-powered fuel cell Equinox SUVs in New York City, Washington D.C and Southern California. Similarly, Honda is having its own fuel cell division launch its FCV. Although fuel cell technology is adapted in forklifts and other high-priced heavy duty vehicles, mass acceptance of this technology is expected to take some time.

Viability of FCVs would be revealed in the next couple of years, and mass acceptance of this technology is likely to take longer. Normally, the proton exchange membrane (PEM) fuel cells are employed in automobiles. This type of fuel cell could offer 100 watts to 500 kW of power that makes it suitable for a wide range of applications. However, the cost of the catalyst plays a major role, making fuel cells expensive. Since platinum is used as a catalyst in many fuel cells, the cost of cells increases dramatically. Research is in progress to develop a catalyst that uses less quantity of platinum and makes fuel cells economically viable.

Ultracapacitors offer high-pulse power capability, fast transient response, high efficiency during charge and discharge cycles and more thermal stability than batteries; full charge is achieved for more than 500,000 cycles. This technology offers an efficiency of 98 percent, while 84 percent is offered by NiMH chemistry. These advantages make ultracapacitors an attractive option in hybrid electric vehicles (HEVs) in the short term, and EVs are in the process of adapting this technology. Ultracapacitors offer high energy within a very short duration, which is ideally suited for acceleration with the electric drive, but they occupy larger size than a battery to hold an equivalent amount of energy. However, physical constraints such as electrode surface area, which increases the size of the ultracapacitor, coupled with low-energy storage capacity, is a major challenge for the utilization of this technology in automobiles. Ultracapacitors have the potential to

replace batteries when major challenges are overcome successfully. Time is required to prove and establish this technology.

Biofuel is another alternative to combat the surging oil crisis. It includes several types of fuels such as biodiesel, biooil, biobutanol and the like. Although biofuels reduce dependency over gas, it still requires gas for blending. Hence, this alternative fuel has limited viability on a long-term basis. Since biofuels have the same properties as their petroleum-based counterparts, these fuels are fully compatible with the existing engine pipelines and fuel pumps. These alternative fuels significantly reduce dependency on gas for a short-term period. Additionally, this blending could reduce the price of fuel for the conventional vehicle, which would effectively ease the burden of vehicle operators.

Although practical implementation of alternative fuels in alternative vehicles would take a few years, the process for change has begun. An increased awareness of these fuels and active participation in developing vehicles powered by these fuels is ongoing across different geographic regions. Many governmental organizations look forward to promoting these fuels, and different governments lean toward organizing promotional campaigns and taking initiatives to create market appeal for these vehicles. This trend is likely to increase, leading to an environment that is driven by zero emissions, environment-friendly vehicles. This measure offers twin advantage of reducing dependency over oil and makes fuels more affordable. Mass production of the discussed alternative fuels would lead to the decline in the pricing structure of the battery and automobile in the long term.

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Maxim to Develop Power-Management and Multimedia Solutions for Intel-Based Mobile Internet Devices (MIDs)

Maxim Integrated Products has entered into a collaboration with Intel Corp. to develop highly integrated power-management and multimedia solutions for Intel-based Mobile Internet Devices (MIDs). Maxim will provide mixed-signal ICs that enable longer battery life and a rich multimedia experience for consumers.

Maxim's collaboration with Intel reflects the company's focus on working with industry leaders to develop leading-edge technology and deliver innovative products. Maxim is a provider in mixed-signal technology and provides differentiation in a wide range of microprocessor-based, portable consumer products.

"Maxim is well poised to support Intel's next-generation needs. We have all the necessary building blocks and components to enable Intel-based MIDs to offer significantly longer battery life and provide a richer multimedia experience than available today," explained Vijay Ullal, group president for Maxim. "Going forward, we plan to optimize those elements to fit in next-generation MIDs."

"Mobile Internet devices represent an emerging and exciting growth segment that can enable consumers to enjoy the best Internet experience in their pockets," said Pankaj Kedia, director of global ecosystem programs for Intel Corp.'s Ultra Mobility Group. "Intel's innovation in low-power technologies, combined with Maxim's experience and capabilities in mixed-signal design, will enable device makers to bring MIDs in ever smaller form factors with longer battery life."

Johnson Controls-Saft and Maxwell Technologies to Collaborate in Development of More Effective Electrodes for Lithium-Ion Hybrid Batteries

Johnson Controls-Saft Advanced Power Solutions and Maxwell Technologies, Inc. have formed a collaboration through which Maxwell will produce lithium-ion battery electrodes for testing and evaluation by Johnson Controls-Saft. The electrodes for Li-Ion battery applications will incorporate Maxwell's proprietary process successfully demonstrated in ultracapacitor applications.

The collaboration will demonstrate optimized performance while reducing energy consumption, solvent recovery and capital investment.

"Our goal is to develop break-through technology on electrode manufacturing to reduce the cost and environmental impact of advanced automotive batteries for hybrid vehicles," said Mary Ann Wright, who leads the Johnson Controls-Saft joint venture and is vice president and general manager of Johnson Controls' hybrid business. "Maxwell has developed a unique manufacturing process that we can leverage through our global leadership in the development and manufacture of lithium-ion automotive batteries."

Through their collaboration, the two companies will evaluate the integration of Maxwell's proprietary electrode process into the mass production of lithium-ion batteries for hybrid vehicles.

"Johnson Controls-Saft is an ideal advanced battery collaborator with which to explore a high-volume application that could create substantial additional value from the patented process Maxwell originally developed to produce carbon powder-based ultracapacitor electrode material," said Maxwell's president and CEO David Schramm.

China Environmental Certification Institution (CEC) Recognizes Boston-Power for Environmental Responsibility

Boston-Power, Inc., a rapidly growing provider of first-to-market portable power solutions, has been recognized by the China Environmental Certification Institution (CEC) for high environmental sustainability standards and responsibility in its manufacturing operations.

In a Beijing ceremony, CEC vice president Li Jian presented the Chinese eco-labeling certificate to Boston-Power Founder and CEO Dr. Christina Lampe-Önnerud. The award acknowledges Boston-Power's efforts to be the first lithium-ion battery manufacturer to acquire the Chinese environmental certification.

"From day one we've been committed to environmental responsibility in every aspect of our operations," said Dr. Lampe-Önnerud. "CEC shares this commitment. Together we have developed a productive partnership that benefits the environment, the people of China, Boston-Power's customers and investors, and our company itself. We gratefully accept the recognition offered by China eco-labeling, and look forward to a continued, mutually beneficial working relationship."

Notably, Boston-Power is also the first rechargeable lithium-ion battery manufacturer to attain "Nordic Ecolabel" certification. Created in 1989 by the Nordic Council of Ministers, the endorsement signifies a company's efforts to create environmentally sustainable products.

Akermin Achieves Record Enzyme Stability for Bioprocessing And Fuel Cells

Akermin, Inc., in conjunction with Saint Louis University, has achieved a record level of three years for enzyme stability in an energy generating biofuel cell electrode. Enzyme stability, or retention of activity, has been a key limitation for expanding the use of enzymes into harsh processes that require high temperature or extremes of pH.

Akermin initiated a long term stability study, in conjunction with Saint Louis

University, for the oxidation of fuel by enzymes. By immobilizing the enzyme at an electrode surface with Akermin's polymer, the enzyme activity has been retained to continuously oxidize the fuel for over three years. For comparison, similar studies have been conducted, and without Akermin's stabilizing technology the enzyme remained active for hours to days. Akermin's long term stability test continues to operate with no statistical decay in performance observed thus far. This demonstration is just one example of how Akermin's immobilization technology enables enzymes to perform beyond their normal capabilities. Further stability can be achieved at elevated temperatures, harsh pH and other extreme conditions that are normally thought to denature enzymes.

Akermin's Stabilized Enzyme Biofuel Cell (SEBC) technology immobilizes and stabilizes enzymes in a conductive polymer matrix and allows them to convert renewable organic fuels into electricity, a process which is inherently more efficient than conventional methods of portable power generation. The stability afforded by Akermin's enzyme immobilization polymers, measured in years compared to days for other biofuel cell technology, enables the first truly commercial viability for this type of power supply. Using high energy content fuels such as methanol or glycerol, Akermin's Stabilized Enzyme Biofuel Cells (SEBC) are more environmentally-friendly and last longer than any existing fuel cell, delivering lower cost per Watt hour over their lifetime.

Texas Instruments Acquires Commergy Technologies for Energy-Saving Power Supply Innovation

Texas Instruments, Inc. (TI) has acquired Ireland-based Commergy Technologies, Ltd., a power supply reference design provider that specializes in energy efficient and compact architectures. The acquisition allows TI to broaden its focus on improving energy efficiency in today's end-equipment designs, especially in the areas of AC adapters and high-power-density computing and server systems.

"Adding Commergy's products and expertise in power conversion technology gives us a tremendous advantage when solving our customers' complex energy requirements and critical power design challenges," said Art George, senior vice president for TI's High Performance Analog division. "New acquisitions such as this continue to enhance our portfolio of analog products that allow our customers to quickly adapt to the ever-changing computing and communications markets."

Dr. George Young, chief executive and technology officer of Commergy, said, "Combining our talent, technology and products with TI's manufacturing capabilities and power management business will give equipment designers quicker access to products that solve any energy management issue."

Commergy, based in Cork, Ireland, provides easy-to-implement standard and customized reference designs for applications in the notebook, PC, server and communications markets. The company develops extremely high-efficiency power supply solutions, such as those for notebook adapters, that meet and exceed the latest Energy Star and Climate Savers Computing Initiative recommendations for PCs. Commergy has expertise in several design areas, such as planar magnetics, power factor correction (PFC), power topology design, thermal management, EMC design and high-power density design.

BATTERY POWER 2008

Attend Battery Power 2008 and hear "How to Design System-Side Fuel Gauge for Portable Devices," presented by Jinrong Qian, Applications Manager, Texas Instruments

Pure Energy Visions Corp. and Powercast Corp. Sign Memorandum of Understanding for Unique Wireless Power System

Pure Energy Visions Corp. and Powercast Corp. have signed a memorandum of understanding (MOU) to jointly work together to develop and market a unique wireless power system that combines Powercast's remote power technology and Pure Energy's rechargeable alkaline battery technology.

Powercast is in the business of the development and commercialization of wireless power technologies. Powercast's remote power technology is designed for low power applications that make use of radio frequency (RF) energy. The RF energy is broadcast from a device called a Powercaster module that plugs into the wall. Under the MOU, Pure Energy and Powercast will work together to integrate Powercast's patented receiver technology (Powerharvester Module) and Pure Energy's rechargeable alkaline technology into a variety of portable electric devices. When the device, such as a computer mouse, is in range of the Powercaster, the receiver converts the radio waves into DC energy that charges the battery and in turn powers the device. In examples such as a wireless computer mouse, the product would last for several years without requiring new batteries. This wireless technology is well suited for applications such as wireless data terminals, wireless keyboards/mice, flashlights, lighting, MP3 players, phones, remote controls, toys, wireless headsets, medical devices and industrial/military devices.

Following extensive lab and field testing using several battery technologies, Powercast concluded that Pure Energy's rechargeable alkaline battery technology is a well suited rechargeable battery for Powercast's Remote Power Technology. Using two AA Pure Energy rechargeable alkaline batteries and their remote power technology, Powercast successfully operated a temperature/humidity sensor at the Pittsburgh Zoo & PPG Aquarium for the duration of a one year test, as compared to using single-use alkaline batteries which were required to be replaced every few weeks.

"We are very excited at the compatibility of Pure Energy's Rechargeable Alkaline battery technology with Powercast wireless power capabilities, as it applies to a wide range of consumer and commercial electronic power applications," said John Shearer, CEO and founder of Powercast. "These two technologies are very complementary in the ability to provide a highly differentiated rechargeable power solution."

New Nexergy Structure Created to Gain Market Advantage in Development and Delivery of Battery Packs And Chargers

Nexergy, Inc., a manufacturer of battery packs and chargers, has created the battery industry's only dedicated facility focused on portable power design innovation. The new facility, located in Denver, Colo., is part of a new organizational structure established to accelerate and streamline the company's design innovation and production functions.

The company has created two functional units, with one unit dedicated to all aspects of product design and technology improvement and the second unit focused on providing a positive customer experience in the supply of batteries and chargers from initial order to on-time delivery.

"Our focus as a company is to create innovative portable power designs for our OEM customers within their time requirements and then hand those designs off to a manufacturing organization that delivers defect-free products on time, anywhere in the world our customers need them," explained Nexergy's president and CEO Phil Glandon. "Now, our most creative design engineers can focus on advanced battery technology innovation, and our manufacturing team can focus on daily customer fulfillment tasks in a way that drives efficiency and value for the customer and doesn't take away time or resources from our innovation team."

The decision to create the new structure came after the January 2008 merger of Nexergy, Inc. and ElectriTek AVT. Glandon said his company's deep engineering base and expanding customer roster provide the resources to support the new structure.

BATTERY POWER 2008

Attend Battery Power 2008 and hear "Lithium Ion Cell Evaluation - Going Beyond the Manufacturer's Data Sheets," presented by Chris Turner, Director of Battery Technology Nexergy, Inc.

Ener1, Inc. Raises \$29.7 Million of Equity Capital Through Warrant Exercise

Ener1, Inc., an energy storage solutions company, has raised \$29.7 million through the recent exercise of common stock warrants at an exercise price of \$5.25 per share. The warrants were

issued in November 2007 as part of an equity placement totaling \$32 million. Holders of the warrants received a total of 5.6 million shares of Ener1, Inc. common stock. Total shares outstanding, post dilutive issuance now stands at 110 million. The additional \$29.7 million increases Ener1's cash position on its balance sheet to approximately \$42.5 million.

"As anticipated, all of the institutional investors that participated in the November 2007 financing exercised their warrants," said Charles Gassenheimer, Chairman of Ener1, Inc. "The only investor that did not exercise its warrants was a family trust that already has a substantial investment in Ener1. We are pleased with the results of the November financing round, and believe that this provides us the foundation for growth and certainty, in an uncertain capital markets environment. Additionally, we intend this to be the last form of private financing, and should any capital need to be raised, it will be in the form of public financing. We also now have access to a \$7 million equipment lease facility that will help finance our plant expansion in Indianapolis and increase our financial flexibility."

Nissan and NEC Joint Venture to Mass Produce Advanced Li-Ion Batteries

Nissan Motor Co., Ltd., NEC Corp. and its subsidiary NEC TOKIN Corp., have announced a joint-venture company called Automotive Energy Supply Corp. (AESC).

AESC will focus on the development and mass production of advanced lithium-ion batteries for a wide range of automotive applications from hybrids, electric vehicles to fuel-cell vehicles. NEC and NEC TOKIN bring their expertise in cell-technology and electrode production, while Nissan will contribute from its long experience in real-world vehicle application.

AESC will invest \$114.6 million over a three-year period in a manufacturing facility to be located at Nissan's Zama facility in Kanagawa Prefecture and operational by 2009. Production capacity will be at

Industry News continued on page 18



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65,000 units with initial start-up capacity to begin at 13,000 units a year.

To support AESC's production demand, NEC TOKIN will invest \$105.1 million over the next three years at its NEC Sagami Plant in Kanagawa Prefecture, to mass produce lithium-manganese electrodes by 2009.

AESC will market its battery products to potential customers in the automotive industry worldwide. It aims to become a leader in battery technology by producing batteries that offer superior performance, reliability, safety, versatility and cost competitiveness.

The high-performance lithium-ion batteries employ a compact laminated configuration which delivers twice the electric power compared to conventional nickel-metal hydride batteries with a cylindrical configuration. Based on on-going vehicle field tests, AESC's batteries have been validated to be safe, demonstrating high-performance qualities, on average runs of more than 100,000 km.

The first commercial application for AESC's li-ion batteries is destined for forklifts for small business operators in 2009. This will be followed by Nissan's electric vehicle, to be introduced in the US and Japan, as well as Nissan's original hybrid vehicle in 2010. By 2012, Nissan has announced its plans to mass-market electric vehicles to consumers globally, which will boost demand for batteries significantly.

Phoenix Mars Lander Touches Down Safely Near North Polar Ice Cap Powered by Advanced Yardney Li-Ion Batteries

After cruising for almost 10 months since its launch from Earth, NASA's Phoenix Mars Lander has made a safe landing on the Red Planet. Phoenix relies on advanced Lithium-ion batteries from Yardney Technical Products, Inc., based in Pawcatuck, Conn.

The Phoenix batteries will provide power at night when there is no sunlight for the solar panels to convert to electricity. They can also be used any time when a task requires more power than the primary power source can deliver.

The Phoenix spacecraft was developed for NASA's Jet Propulsion Laboratory by prime contractor Lockheed Martin. The mission is led by the University of Arizona. Yardney had originally won a contract from Lockheed Martin in 1998 to develop a battery for a similar lander under NASA's Mars Surveyor Program that had been planned for a 2001 launch. That battery development effort was completed successfully under the cognizance and support of a NASA-Air

Force consortium, using battery chemistry developed by JPL and transferred to Yardney. The mission, however, was cancelled for unrelated reasons and never flew. The current spacecraft, Phoenix, used the original Mars Surveyor Lander as its starting point, with Yardney again selected to provide the critical batteries.

In the meantime, NASA also had Yardney develop lithium-ion batteries for the Spirit Mars Exploration Rover (MER) and its twin, Opportunity. Launched in 2003 and landing in January 2004, they have been extremely successful, permitting missions exploring Mars that had been planned to last only three-months to instead be extended to well over four years, and still counting.

Sanyo and Volkswagen Agree to Co-Develop Next Generation Lithium-Ion HEV Battery Systems

Sanyo Electric Co., Ltd. and German automaker Volkswagen Group have agreed to start co-development of next generation Lithium-ion (Li-ion) battery systems for hybrid electric vehicles (HEV).

Responding to societal environmental protection concerns and surging oil prices, Sanyo has strengthened its business and development of high performance rechargeable batteries for the rapidly-expanding HEV market. Sanyo has already provided Nickel Metal Hydride (Ni-MH) HEV batteries for Ford and Honda.

Also, in January 2006, Sanyo and Volkswagen agreed to co-develop next generation Ni-MH systems. Those efforts are still continuing today.

With this agreement on the co-development of efficient, high-performance Li-ion HEV battery systems as well as co-development of Ni-MH HEV battery systems, Sanyo will continue building a strong partnership with Volkswagen, working in cooperation to accelerate the development and commercialization of higher-performance HEV battery systems, globally.

Continental Invests in Enax to Expand Own Li-Ion Technology

The international automotive supplier Continental has acquired shares in the Japanese lithium-ion specialist Enax. Enax develops and produces high-energy and high-performance lithium-ion cells for hybrid and electrical vehicle batteries. The two partners have agreed upon an exclusive cooperative venture for the development of lithium-ion cells especially for future hybrid and electric drives in automobiles. Continental acquires a 16 percent holding in Enax. Together, the two intend to improve safety, service life and performance of lithium-ion batteries even further.

"In line with our evaluation criteria, Enax offers the broadest range of know-how in high-performance lithium-ion cells, regarding the cell materials as well as cell design," said

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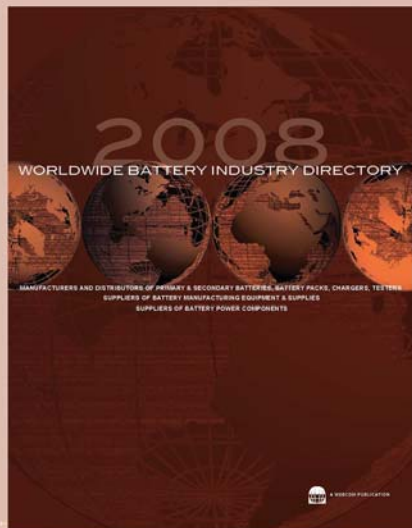
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Continental Executive Board member Dr. Karl-Thomas Neumann.

As an independent think tank, Enax can already provide more than 10 years of experience in the field of lithium-ion cells for automotive applications, including cell technology and the chemical composition in particular. "With this cooperation, we are pooling our innovative strength and creating the technological basis for high-performance energy storage devices of the next generation," explains Jorg Grotendorst, head of Continental's Hybrid business unit. Grotendorst will in the future be a member of the Board of Directors of Enax.

Continental will launch first-time volume production of a high-performance lithium-ion battery for the Mercedes S 400 BlueHYBRID at the end of this year.

Irvine Sensors Developing Battery Replacement Technology

Irvine Sensors Corp. is developing a proprietary micro-electromechanical system (MEMS) device usable for portable power generating units that could replace batteries. Dubbed the Microcombuster(TM) power supply by Irvine Sensors, the heart of the system under development is a miniature internal combustion device that burns lighter fluid or other common combustibles and is reusable. The Microcombuster is projected to have significantly greater energy density than Lithium-Ion batteries in a comparable size and form factor. The Irvine Sensors development program is focused on potential military applications and is supported by various government agencies. With the increasing reliance on portable electronic equipment by modern military forces, battery supply and replacement is a major logistics and economic challenge. It is estimated that a US soldier expends about one AA battery per hour in combat. In the government's fiscal 2003 and 2004, approximately \$425 million was spent on batteries for use by individual soldiers.

If development milestones are successfully achieved, Irvine Sensors expects to have pre-production prototypes of the Microcombuster suitable for military applications before the end of 2009. Deployment for military uses is expected to result in economics suitable for widespread commercial application.

John Carson, Irvine Sensors' CEO said, "Throw-away batteries are a major source of environmental waste and current reusable ones are inefficient. The Microcombuster addresses both of those concerns and puts us on the threshold of some major market opportunities."

VIASPACE Wins Global Distributorship for HYB Premium Lithium Ion Batteries

VIASPACE, Inc. has signed an agreement to globally distribute the rechargeable lithium ion batteries produced by HYB Battery Co. Ltd, a technology leader in China. HYB, founded in 1999, produces high-quality, yet low-cost batteries. HYB batteries are used in a wide range of portable electronic applications, a \$6 billion market sector, including notebook computers, digital video and still cameras, GPS devices and mobile phones. In addition, HYB also produces high discharge rate batteries for power tools, uninterruptible power supplies and light electric vehicles. HYB high quality has been audited and certified by 12 major customers. Its current customer list includes industry leaders such as Samsung, Tyco, Garmin, Philips, VARTA, Foxconn, and CelExpert.


HYB Battery Co. Ltd.'s 500,000 m² manu-

facturing facility is located in Shenzhen, China. With 1600 employees and modern automated equipment, HYB's current capacity is 300,000 pieces per day. Production capacity is scheduled to double in the next 12 months. HYB has extensive quality and safety control procedures. They are ISO 9001 and 14001 certified, and their products are approved by Underwriters Laboratories (UL), CE marked and RoHS compliant. HYB produces cylindrical cells in the standard 18650, 14430 and other sizes. They have 20 different sizes of prismatic cells, and high-capacity cells with energy storage capacities ranging from 8 to 80 amp hours.

VIASPACE CEO Carl Kukkonen said, "HYB has the precision batteries needed for demanding applications that require highest uniformity and quality, such as such as notebook computers and cell phones HYB already has batteries in commercial digital video and still cameras, cordless phones and portable GPS sys-

tems. We will represent HYB in their existing market sectors, and develop new business in high-power applications such as power tools, electric bicycles and scooters, where we see market projections of a 400 percent increase in sales in the next two years. The VIASPACE Energy business unit focuses on alternative energy and portable power solutions. HYB adds great new rechargeable battery product line that complements our current battery and fuel cell products. HYB manufactures high quality batteries with an excellent safety record, and they sell them at a substantially lower cost than their Japanese and Korean competitors that currently dominate this \$6 billion marketplace."

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PulseTech Products Corp. Introduces a Green Message with Line-up of Environmentally Responsible Products

Long before it was fashionable for companies to proclaim "Green is Good" messaging, PulseTech Products Corp. was busy improving the performance and extending the life cycles of millions of batteries for both the military and private sector consumers with its exclusive line of products.

PulseTech Products Corp. is an early adopter of a corporate Green Product Policy by keeping typical lead-acid based batteries for autos, light and heavy trucks, SUVs, small boats, recreation vehicles, construction and power sports equipment performing long past expected life cycles and out of the waste stream, landfills and smelters.

Based on statistics gained from 2007 annual shipment figures and a national recycling rate study performed by a trade industry organization, battery manufacturers shipped 117 million batteries to market in the US and Canada during 2007. During the course of the study period, an average 99 million worn-out, non-operational, defective and/or discharged batteries were recycled annually at smelter facilities within North America.

In dollars and cents, the retail figure for new batteries shipped annually amount

to an estimated \$4.8 billion while those batteries going out-of-service as alleged defective batteries and sent to the smelters are valued at an estimated \$145 million.

Nearly \$96 million of that \$145 million are batteries that were abused or damaged and in large part capable of remaining in service through proper maintenance, charging and conditioning. As a result of sending these alleged defective batteries to the smelter prematurely, the environment and consumers pay dearly. Wasted natural resources carry a large cost today and into the future.

According to PulseTech vice president of Sales and Marketing Smokey White, PulseTech products, if used regularly, could save consumers a conservative amount of nearly \$100 million annually.

White said regular battery maintenance is a true Green advantage for consumers, and can now be fully implemented in every household through PulseTech's simple "plug and play" technology.

"That's money in their pockets, and money that can go towards savings or other more important family purchases," said White, whose company has patented a unique PULSE technology, which administered through various PulseTech products breaks down sulfation buildup and substantially improves a battery's ability to accept, store and release energy, thus extending battery life.

As a battery ages through use or sits unused for periods of time, lead sulfate crystals enlarge and can build up excessively to the point where they create a physical barrier across the surface of the plate. Before long, this build-up can become so dense that a battery is no longer able to accept or release energy.

Added to the typical car battery stress is a plethora of gadgets and onboard systems that sap power and shorten battery life. Add-on electronics like iPods and navigation systems, found in many newer model cars, for example, are pulling power from that same 12-volt battery.

"By helping keep plates clean through PULSE Technology, the battery works harder than ever thought possible," said White. "It maintains a greater reserve capacity, will recharge faster and release more of its stored energy."

White said with more energy available, battery output is maximized between charges, and electronic accessories work better.

EnerDel and Think Global Demonstrate Operational Battery Pack in Think City Vehicle

EnerDel has installed and demonstrated a fully functional lithium-ion battery pack in a Think City electric vehicle at its manufacturing facility in Indianapolis. The integration of the battery pack into a Think City EV was completed ahead of the schedule previously announced by EnerDel. The successful completion of this milestone indicates that EnerDel is on schedule to meet the year-end timetable for volume production under its supply agreement with Think Global of Oslo, Norway.

EnerDel delivered three functional 27 kWh lithium-ion battery packs to Think Global earlier this year for testing. Both companies are working to meet the scheduled roll-out of pre-production units over the next three months.

"This is a very exciting program to be involved in, with an aggressive time to market schedule," commented EnerDel CEO Ulrik Grape. "Our collaboration with Think to develop a battery solution for the leading electric vehicle worldwide, the Think City, has been rewarding. A lot of work remains both in terms of testing and evaluation, but we anticipate that we will be able to meet the schedule set by our supply agreement to begin production of integrated battery packs by the end of this year."

"We are very pleased with the progress EnerDel and Think have made on the lithium-ion battery solution for the Think City vehicle," said Think Global CEO Jan-Olaf Willums. "EnerDel has achieved an important milestone and met our expectations so far. We are confident that the project is on schedule to introduce the EnerDel battery in production vehicles by the end of the year."

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7-10 - 43rd Power Sources Conference, Philadelphia, Pa.

14-16 - Advanced Capacitors World Summit 2008, San Diego, Calif.

September

4-5 - Battery Power 2008, New Orleans, La. Contact Webcom Communications at 720-528-3770 or at www.BatteryPowerOnline.com

14-18 - Intelec 2008, San Diego, Calif.

23-26 - 11th European Lead Battery Conference, Warsaw, Poland

October

8-10 - Batteries 2008, French Riviera

November

5-6 - Remote 2008 Conference & Expo, Atlanta, Ga.

December

1-5, MRS Fall, Boston, Mass.

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MIT Student Ingenuity Plus High-Tech Batteries Yields Advanced All-Electric Porsche

Nancy Stauffer
MIT Energy Initiative

With a click and a hum, the sleek Porsche 914 pulled away from the curb while onlookers watched anxiously and the passenger gazed down at a laptop plugged into the dashboard.

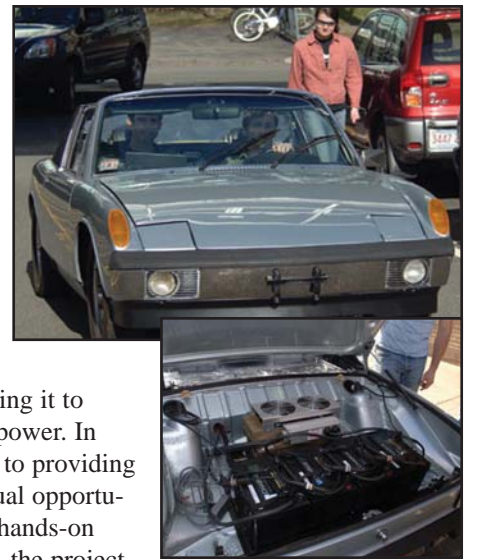
Why the drama? Once powered by a conventional gasoline engine, the 1976 Porsche now operates on 18 high-tech batteries, the result of work by dedicated MIT students and their mentors. Converting the car to an advanced electric vehicle is an achievement in itself and serves to demonstrate the viability of the technology. But for the students, the real fun starts now.

Craig Wildman, mechanical engineering graduate student, said, "Now we get to take data while we're driving. We can record everything that happens on a laptop,

come back and change parameters, and test drive it again."

With the Porsche as a test platform, the students can monitor conditions in the car while looking for ways to increase efficiency, performance and range, and to bring down costs.

The Porsche was donated two years ago by Professor Yang Shao-Horn of mechanical engineering and the Electrochemical Energy Laboratory, who with her husband, Quinn Horn, bought it on eBay and made it available to students interested in converting it to



electric power. In addition to providing an unusual opportunity for hands-on learning, the project will ultimately yield information valuable to Shao-Horn's research on advanced batteries.

"In the laboratory we work on materials to make batteries safer, last longer and have higher energy," she said. "But we are also interested in gaining a good perspective on the system. What's involved in building an electric vehicle, and what's required of the batteries?"

The student project took off last year when Valence Technology, Inc. donated 18 lithium phosphate rechargeable batteries valued at \$2,030 each, plus a battery-management system. The team began by removing the original engine, exhaust lines and fuel tank and installing an electric motor and motor controller, the batteries and battery-management system, a battery charger and various smaller components. Each of the batteries is equipped with a built-in computer that monitors its conditions, ideal for the data-gathering task.

However, getting all the computers to communicate with one another and with the battery-management system, a separate computer, proved a challenge. While the students had made great strides with a commercial converter kit, they ultimately had to scrap it because it was designed to handle 12 conventional lead-acid batteries rather than 18 lithium ion batteries. They subsequently redesigned the wiring and reprogrammed both the motor controller and the battery controller.

The two test drives thus far have been confined to MIT parking lots, so serious data-gathering is yet to come. In the meantime, Irene Berry, team leader and a graduate student in mechanical engineering and the Technology and Policy Program, has done some performance estimates with a vehicle-modeling computer program. She found that the Porsche should have a top speed of up to 100 miles per hour with an estimated range of 130 miles before the batteries need recharging, a task achieved by plugging it into a wall socket for about five hours. The car should consume about 185 watt-hours per mile of electricity, the equivalent of about 65 miles per gallon of gasoline.

What's next for the electric Porsche? One idea is to modify how the batteries are wired together. "We should be able to change our range and performance characteristics very easily," said Josh Siegel, a freshman who has been restoring cars in imaginative ways since he was 14. The students are also thinking about developing conversion guidelines that will enable others to do what they've done, without the fuss.

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