Intelligent Development Platform Makes Power Management Easier for COM-based Mobile Applications

With continuing miniaturization of processor technology, high-tech applications – whether ticket systems, diagnostic computers, or portable test devices – are becoming increasingly mobile. They all need an efficient power supply if this mobility is not to be hindered by tight power restrictions. The time-consuming development of such power supplies can considerably delay the market launch of new products. However, this is where vendors working in the embedded field can provide valuable support. One such product is Kontron MARS, a reference kit for a smart battery system created by embedded computer specialist Kontron. MARS is an acronym that stands for "Mobile Application platform for Rechargeable Systems."
By **Andrea Mayer** , Product Marketing Manager at Kontron

Kontron MARS Mobilizes Computer-on-Module Applications

Last year, Intel's® Atom™ platform – a combination of a highly integrated chipset and an economical processor – gave a real boost to the embedded industry. Computing power was concentrated in a 13 x 14mm² chip that is particularly suitable for use in the embedded computer systems of embedded mobile applications such as mobile ultrasound scanners, game controllers, portable checkout or information systems.

The compact yet powerful processor consumes much less energy than its x86 predecessors, but developers of new mobile applications are regularly confronted with the bothersome, time-consuming task of equipping their mobile ticket system or portable test device with a mobile power supply. That means drafting specifications, sketching circuits, designing layouts, requesting hardware, consulting manuals, testing the system, and so on. Only after racking their brains to create a fully functional system can the developers get to their core business of writing their application-specific software. This is where vendors of embedded computer technology can provide valuable support.

Releasing the Brake on Innovation
Kontron's Mobile Application platform for Rechargeable Systems, or MARS for short, provides exactly this type of support. By making use of ready-made components of proven caliber instead of starting from scratch to completely develop new battery solutions themselves developers can shorten the time to market and improve reliability. But Kontron MARS is not only a hardware module, as one might expect. Rather, it is a reference design package consisting of hardware, software, and associated circuit diagrams that can be used universally for all carrierboards designs.

In principle, Kontron MARS allows developers to add the ready-made layout plans and circuit diagrams for smart battery functionality to their own carrierboard layout using a simple copy and paste procedure. That dramatically improves evaluating hardware, drafting circuit diagrams, and laboriously incorporating the various components needed. The components that are utilized have already been tested and have proven their worth, so developers can count on the mobile power supply operating perfectly.

In addition, there's no need for the application developers to finalize the entire application specific hardware before programming the software that goes with it. With the MARS reference board they can start software development and evaluate it on the development platform. With this development "in-the-loop" they know which compo-

nents are going to be employed and can improve the appropriate programming while the specific hardware is still being configured. The combination of Computer-on-Modules and reference platform for rechargeable systems MARS enables developers to concentrate on their core competencies and save valuable development time.

### A System Providing Guidance to Developers
Kontron's MARS consists of three elements: an evaluation board, various cables to supply power and enable data communication, and the circuit diagrams plus development data that are provided to registered customers. The application platform supports up to two smart batteries. In principle, a developer could simply incorporate the reference platform in his or her own application and start using it right away, but the board included along with the reference kit would probably be rather large for most mobile applications.

The evaluation board is deliberately of this size to provide users with a wide range of function modules from which they can pick what they actually require. Kontron's intention with MARS is to provide as
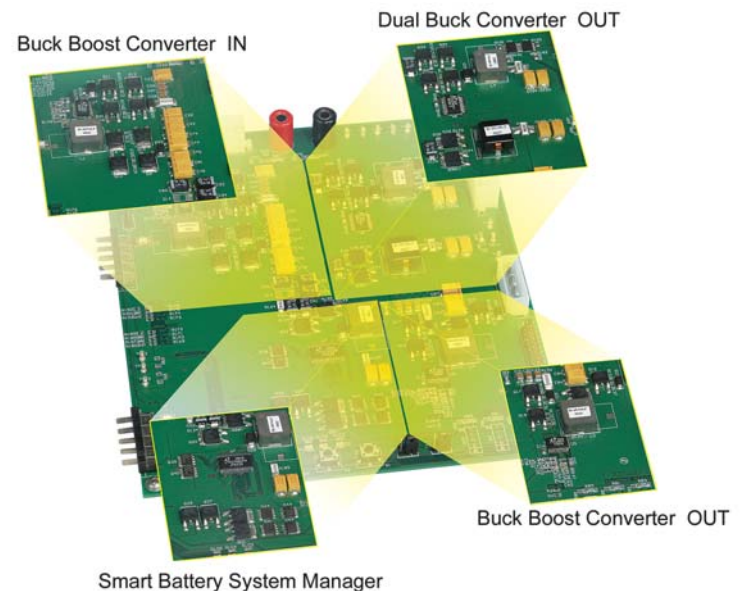
Figure 1 *Kontron MARS has a modular structure and comes with various function units that developers can implement in their applications as needed.*

wide a range of functionality as possible. The modular structure of the reference platform acts as a guide for developers, as it were, enabling them to obtain exactly the solution required for the application as simply as possible.

*MARS
develop platform*
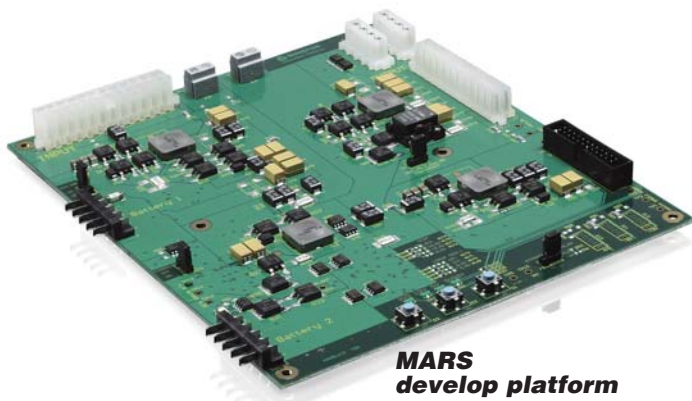
Kontron MARS features four function units that can be used whenever required:

● The buck boost converter IN extends the input voltage range to 5 – 28V$_{DC}$, ensuring a sufficiently high charging voltage and producing an output voltage of up to 19V. This makes it possible to charge any smart battery currently available. If the target system's supply voltage is larger than the required battery's charging voltage, the developer can dispense with this converter or bypass it.

● The buck-boost converter OUT increases the battery output voltage if a backup battery with V$_{min}$ < 12V is used. If the developer will employ a smart battery with a voltage range always over 12V, he can manage without. The same applies if he uses the wide-range input of the Kontron ETXexpress® modules in order to simplify the system design.

● The smart battery system manages the charging and discharging processes of up to 2 smart batteries in parallel or serial operation. Furthermore, it is responsible to provide the smart battery state data via SM-Bus to the carrier board.

● The dual buck converter provides an ATX-compliant power supply. It supplies all necessary voltages for the carrierboard and Computer-on-Module as well as connection options for - 5V and - 12V or + 3.3V via a DC/DC switching controller.

From these function units the developer picks just the ones needed and can leave out the elements not required.

Using Power Intelligently

Kontron MARS supports operation of two smart batteries. Smart batteries feature an integrated microcontroller which provides data such as battery characteristics, current charge/discharge rate and extrapolated remaining capacity via the system management bus. The COM-based system can use this data in programming the target application. This enables helpful functions to be implemented in the mobile application, such as displaying the battery charge status

Figure 2   With the help of Kontron MARS, mobile applications - such as the diagnostic system for automobiles shown here - can be supplied with an uninterrupted flow of power: A fall back battery allows to replace the discharged battery without intermission.

or a signal when the battery needs to be replaced or the device should be docked on the charger.

MARS provides developers a great deal of flexibility with respect to the batteries used by the application. It supports various types of smart batteries for example, i.e., different chemistries. Developers can even incorporate different types of batteries in parallel. The advantage of doing this is that developers are able to leverage the specific properties the batteries have, such as the robustness and

cost advantages of nickel-metal hydride batteries or the high energy density and long storage life of lithium-based batteries (lithium-ion and lithium-polymer).

For instance, an application can draw its main power from a large Li-ion battery and a smaller, low-cost NiMH fall back battery provides the required energy while the Li-ion battery is being replaced. This serial mode means the application could continue to run without having to shut it down first to replace a flat battery. Also MARS can automatically switch from one voltage source to another within just a few microseconds, making it well suited as an uninterruptible power supply. Utilized this way, the smart batteries could easily bridge the period during when an application's main source of power is changed. An example of this is when the line voltage fails or a device is transported to another location without being able to terminate the application (such as in the case of medical apparatus).

Optimized for Mobile Use

If two smart batteries with the same cell configuration are employed in parallel mode, developers can increase battery efficiency by up to 10% compared to serial mode: Since both batteries discharge in parallel at the same time, only half the amount of current is drawn from each battery, as opposed to the discharge that takes place when the batteries are utilized individually in turn. Less power is lost as a result. This is defined by the current flowing and the resistance presented by the battery and power cables. A further positive side

*MARS
Installation ATX*
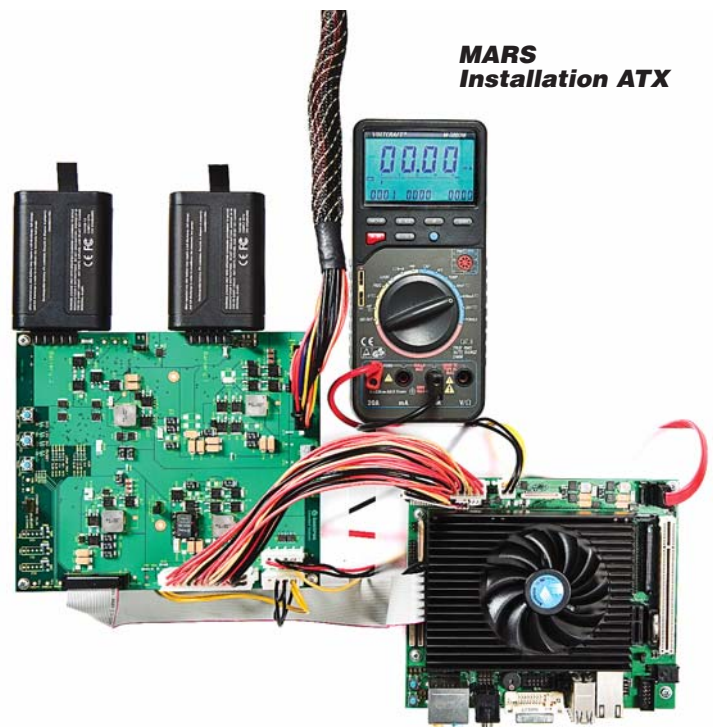
effect is that the batteries do not heat up as much, which further increases efficiency and furthermore their operating life. Also, if the same types of batteries are used, then the charging cycles are considerably shorter. Of course the parallel mode makes it possible to replace the batteries sequentially during operation.
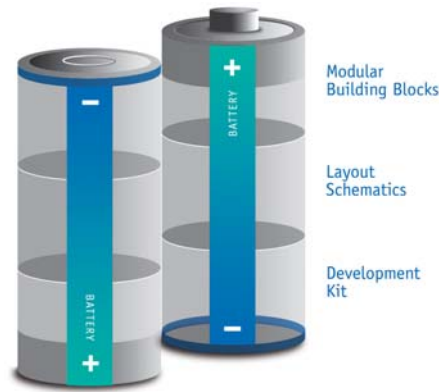
The rules how Kontron MARS manages the Smart Battery System are programmed via an easy to use API. By this a developer additionally can define how MARS provides power to the application in any operating system that supports ACPI (advanced configuration and power interface), for MARS is stored in the ACPI registries provided for the purpose using BIOS in Kontron ETX®, ETXexpress®, microETXexpress® and nanoETXexpress modules.

Back on the Innovative Track

In a nutshell, by providing vendors of embedded technology save developers a great deal of time and effort that the latter can now invest more effectively in application development thanks to the Kontron MARS platform for power management in mobile systems. The choice of ways in which the mobile power system can be used gives them more scope to enrich their applications with additional innovative features.   →

➜ **What the developers say:**

IES GmbH & Co. KG, a highly capable company that has made a name for itself in the field of intelligent embedded system solutions, is one business that makes successful use of the functionality Kontron MARS offers. The company largely serves customers in the manufacturing sector, specifically those in the machine and plant construction market sub-segment. Kontron's smart battery system is utilized for the development of mobile, portable customer service computers run on two rechargeable lithium-ion batteries.

Modular Building Blocks

Layout Schematics

Development Kit

"The solution package provided by MARS consists of software and hardware components that are perfectly tuned to each other, which makes MARS ideal for requirements regarding customers' applications," says Martin Steger, Managing Director of IES. *"Given the technical requirements made in such sophisticated applications, it's a major advantage to be able to draw on proven packages of solutions tailored to the computer platform,"* he adds. Developing a battery management system that meets the high demands of modern PC hardware and users all alone would be relatively time-consuming and, above all, associated with development risks that are difficult to estimate. *"Being such a small software and hardware vendor as we are, we probably wouldn't be able to create applications like these at all if it weren't for Kontron's preliminary work on MARS,"* says Steger. *"And even if we could, overall costs would be so high that the majority of potential customers would be put off from employing these tech-*

nologies." IES can also reduce the development risk involved by using MARS. Aside from this, the company employs the MARS starter kit to obtain proofs of concept that are essential for certain fields of use.

Shorter Time to Develop

Kontron's smart battery system is also used by b-plus GmbH, a specialist in automation, embedded system solutions, and automotive applications. Engineers at the Deggendorf firm use MARS when evaluating nanoETXexpress modules with a view to their integration in mobile applications. *"The standardized hardware and software interfaces save us time-consuming steps in product development, such as the time we'd otherwise need to get the battery and controller to communicate with each other,"* says Bernd Eggl, leader of the Embedded System Solutions team at b-plus. *"Besides that, integration in commonly used operating systems such as Windows already exists, so there's no need for us to program any drivers or test software,"* he explains. *"Another point is that MARS also allows us to check the results in the development phase more easily."* All in all, this means that less effort is required for development and that new products have a shorter time to market.

Kontron MARS - key features at a glance
– Ready to use, easy to integrate Smart Battery System management.
– Less development effort and faster time to market.
– Modular structure allows individual configuration for any application.
– Copy and Paste layouts and routings.
– Application development in the loop.
– Supports up to two Smart Batteries in parallel or serial mode.
– Supports different types of smart batteries for cost efficient designs.
– Wide input voltage range from 5 to 28V for charging and power supply.
– Parallel mode with enhanced battery efficiency and faster recharging cycles.

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p15 ➜ SuperSpeed USB enables well under 90 seconds for most Sync-n-Go applications. Another way to think about this is to consider how much data you can move in that 90 seconds. Table 2 summarizes some key applications:

In summary, any multimedia application that wants to move lots of files or just large files quickly to/from the PC will benefit greatly from SuperSpeed USB. It delivers the bandwidth to satisfy user needs to sync multimedia files with portable consumer products today, and provide the needed headroom to do the same for flash-based products for the next five years.

References
[1] Official announcement on the USB Implementer's Forum (USB-IF) website at: http://www.usb.org/press/press20/2007_09 _17_usb30promotergroup.pdf.

To learn more about USB interface solutions, visit: www.ti.com/interface.

About the Author
Dan Harmon is Product Marketing Manager for USB Products at Texas Instruments. He earned a BSEE from the University of Dayton and a MSEE from the University of Texas in Arlington. You can reach Dan at ti_danharmon@ti.com.

Contact: Irina Marin (irina.marin@ecas.ro)

	Songs / Pictures (4 MB / file)	Standard Definition Movie (6 GB / file)	High Definition Movie (25 GB / file)
USB High-speed *	~ 675	< 50% of a movie	< 11% of a movie
SuperSpeed USB **	~ 6750	~ 4.5 movies	> 1 movie

* Assumed actual data throughput of 25 MBps which is typical of most USB 2.0 high-speed systems

** Assumed actual data throughput of 300 MBps – the goal of the SuperSpeed USB Development effort for mass storage applications

Table 2   *Number of Files that can be moved in 90 Seconds*

Controlled circulation:
Bulgaria
Bosnia & Herzegovnia
Croatia
Hungary
Romania
Serbia & Montenegro
Slovenia
Turkey