

Higher capacity in a smaller space is driving development in the consumer market, but power management will remain a constant frustration.

By Neil Tyler

The consumer electronics market continues to be driven by smart phones, UHD TVs, wearable devices and virtual reality (VR). But while the smartphone continues to dominate and VR appears to be approaching a tipping point, with new devices being unveiled this year, it is the wearable market that is seeing rapid growth. It should be noted, though, that many consumer technologies are perceived as having moved beyond what is described as the 'hype cycle' and are no longer viewed as technical novelties or gadgets.

While some analysts argue that

the value it will provide. Too many recent devices have tended to focus on the aesthetic without having a clear purpose," he argues.

Fullagar goes on to suggest that too many wearables work in isolation. He says that a 'system' approach, where the device is considered as part of a much bigger 'Internet of Things world', would create much greater potential.

He argues that the 'flood' of wearable devices of the past few years demands continuous use, which puts added pressure on designs in terms of their usability and, critically, their power management.

Power, first and

the wearable market remains in an exploratory phase and cannot be viewed, as yet, as a large scale consumer market, 2016 is being heralded by many as the year in which this market could be about to enter into a period of rapid expansion and scalability. Figures from IDC suggest demand could grow by as much as 44% this year, with global device shipments hitting around 111million units.

People are beginning to embrace wearable technology in their day to day life and, as such, a much broader range of products is being developed.

According to Peter Fullagar, head of innovation at design consultancy Kinneir Dufort, the successful wearable device will be the one that addresses a specific customer need. "The clearer the user need, the better

"For the market to achieve real growth, wearables will have to address a number of technical constraints, from smaller devices to longer wearing times."

Florian Feckl, an applications engineer with Texas Instruments, speaking at last month's Wearable Technology Show in London, agreed. "While we are able to bring greater functionality into smaller devices, power management remains a problem. Battery and power management remain a constant frustration in this market space.

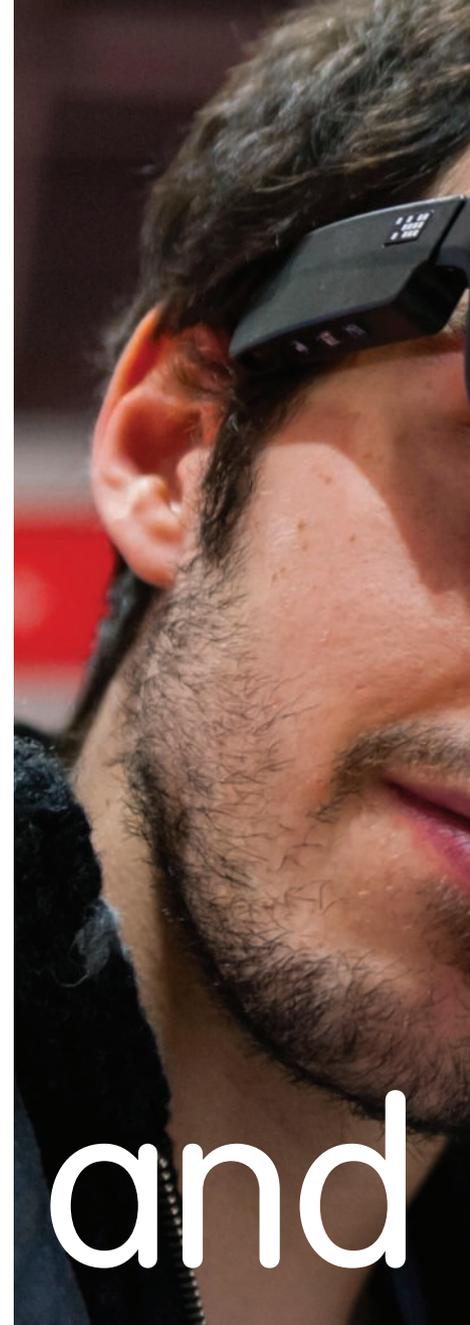
"We need to bring more intelligence into the systems we develop, ensuring they go into sleep mode when there is nothing to do and are active when they need to be. Our aim has to be to optimise chips towards lower power consumption and longer run times."

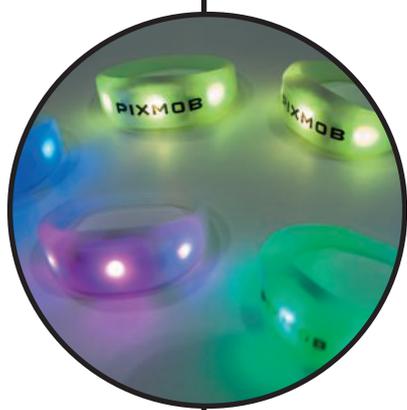
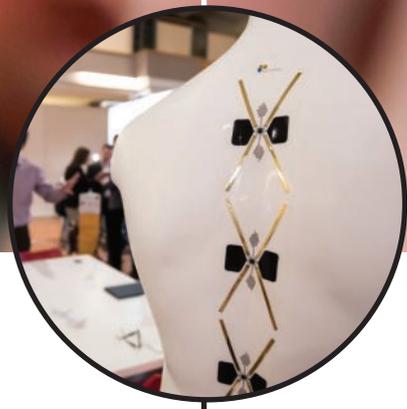
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Matt Tyler

Consumers are looking for more sophisticated gadgets and the rise of the connected world is driving the adoption of portable and wearable electronics. However, demand is being greatly influenced by the battery life of the device. Power management units are therefore becoming more important as they can improve battery life significantly.

According to Matt Tyler, director of strategic business development with On Semiconductor: "The proliferation of battery powered devices that need to be charged quickly from virtually any protocol is more critical than ever. There are rapidly emerging fast charge and wireless charge standards – the AirFuel Alliance for example – and having small and highly efficient power solutions is now more important than ever."





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IDT has, for example, introduced a 5W wireless power reference kit that can provide plug-and-play capability for engineers who are looking to design wireless charging into their devices.

“We need to make wireless charging more accessible to the mass market,” argues Sailesh Chittipeddi, IDT’s chief technology officer.

“The next generation of battery management solutions will have adaptive charge and discharge algorithms that extend run time, as well as the number of charge/discharge cycles,” says Tyler. “They will bring these innovations while being compatible with virtually any charge protocol.”

According to Tyler, On Semi is working on a variety of new technologies to make battery management ‘more intelligent.’

“While we have long watched as application processors have rapidly grown in processing power and capability, it has come at a price,” explains Tyler, “and, sadly, that is power consumption.”

Device power management

When it comes to designing a wearable device, power management still has a long way to go, according to Tyler. He takes the example of a wearable fitness tracker and highlights the selection of components from an advanced Bluetooth Low Energy (BLE) network controller, providing connectivity, to a low power MCU and then a power management IC.

“All provide great numbers on their datasheets – until you use them,” he suggests.

“Take the network controller. It will

consume 2 to 5µA when sitting there doing nothing but waiting for its internal timer to issue an interrupt. When you do wake it up to check for motion or 'sniff' for RF, it will then consume up to 8mA, depending on the activity.

"Then, even worse, the advanced power management IC that offered sub microamp power consumption has to wake up and it chews up 2 to 3mA when it has to power everything up. Now your device is consuming up to 6mA, just thinking about what the application needs to do next. This is the disappointing end of a chain of technical evolutions made without really considering the total solution."

What sort of technology can improve this?

According to Tyler, and as already highlighted by Feckl, the design should look at taking an approach described as distributed intelligence.

"If your battery manager (charge, discharge, fuel gauge, primary power rail generation) had the ability to be programmed to also take care of these wake/sleep cycles, how much power could you save?

"Naturally, a conventional MCU core is not the answer. An ultra low power MCU can manage these basic supervisory functions while holding the network controller in reset.

"It can check for motion from the accelerometer, manage timing for wake up, sniff for RF cycles and keep track of the battery's relative state of charge. If you look at the network controller datasheet, you will find the reset recovery time is nearly identical to the time needed to wake up from sleep, so the end user will never know the difference.

"Instead of a steady state power consumption of 3 to 6µA, you can reduce that to 2 to 3µA, depending on the BLE controller. That is almost half the power. Even better, all of those network controller wake up cycles can be avoided, so up to 8mA can be saved on most cycles."

That is not a trivial amount of power and, as Tyler suggests, it is something that can both reduce the form factor but make a device

'operate for longer and charge in a fraction of the time'.

According to Chittipeddi, IDT has been working on the concept of intelligent power with a host PMIC which integrates a 32bit MCU and a DPU over several years.

"We are developing a range of intelligent battery management as well as digital power solutions to address different market niches.

"With respect to integrating wireless power with rapid charging capabilities, we are already in several of the leading smart phone vendors. Our wireless power devices incorporate a 32bit MCU that improves flexibility and programmability to work with other key features required for various applications.

"We are also looking at integrating several 'smart-power management' features, together with wireless power to enhance the integrated battery-management capabilities of our products."

As processors scale down in dimension and operate at lower voltages at very high switching frequencies and sensors become smaller, intelligence and smart power management become key prerequisites in any control function,

"Ever increasing 'green power' requirements can also be expected to drive the need for continued innovation when it comes to intelligent power management," suggests Chittipeddi.

Battery technology

When it comes to battery technology for portable electronics products, the related challenges of space and weight reduction are just as important – smaller devices that are thinner, lighter and sleeker need to be powered.

But when it comes to battery development, it is the chemistry and not the electronics that determines the pace of size reduction.

Innovation in battery technology is focused on addressing the demand for higher capacity in a smaller space.

OEMs have struggled to reduce the size of traditional lithium-ion batteries, especially when it comes to devices

that are smaller than mobile phones. These batteries are difficult to handle and are often prone to shock and vibration.

VARTA Microbattery has developed the CoinPower range of batteries, which features a rechargeable lithium-ion battery in a cell form suitable for use in devices such as wireless headsets. Supporting circuitry does not have to be placed near to the battery so designers have more freedom in terms of optimising the board layout and the mechanical design.

Consumer device manufacturers are continually looking for higher capacity in ever smaller spaces and this is a trend that is unlikely to slow.

In response, VARTA is now developing a new generation of CoinPower. Due to be launched in the second half of 2016, it will provide higher capacity and energy density – as much as 20%, according to the company's product manager Matthias Dorsch. "It has been achieved by improvements to the battery chemistry, electrode design and production techniques."

Innovation in power management and in battery design help to drive the consumer electronics market, but future developments may not be limited as current designs are.

"When it comes to traditional electronic devices, their size will be fixed, which will define the battery size and the technology used," explains Jussi Takaneva, head of industrial, multimedia and distribution with JAE Europe.

"However, when it comes to wearable technology, ultimately the whole body could be harnessed, providing significantly more space. We could also see greater use of energy harvesting, such as body temperature and kinetic energy generated by the body itself."

In the next five years, the market for wearable devices and the use of personal data is set to expand rapidly, but the winning developments are likely to be those that can drive better total power consumption, rather than, as Tyler suggests, "chasing a specific line item in a datasheet."

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Sailesh Chittipeddi