Brainstorm - Medical Electronics

The trend toward miniaturizing medical electronics devices also brings with it a number of challenges. In this month's edition of Brainstorm, we ask industry experts in the medical electronics market what they believe to be the most critical of these challenges and what current and developing technology is available to help the designer meet those challenges.

Steve Kennelly, Microchip Technology Inc **[1].**

[2]"...Size is always an important design consideration, but in the case of medical devices, physical size is frequently linked to function.

"Consider implanted devices, such as pacemakers. A smaller implant gives a surgeon more flexibility in where it can be placed, which can simplify routing of connection leads and hence reduce the complexity of the surgical procedure. Size also affects the function of portable medical electronic devices. A patient is far more likely to use their glucometer, insulin pump or oxygen concentrator if it’s unobtrusive and easy to carry. Finally, devices like electrocardiograms and automated defibrillators are transitioning from the confines of the hospital to home use.

"All of these categories of devices share challenges with regard to size constraints. A major challenge has to do with the power supply. In implanted devices, the battery may account for more than half of the total device

Jeffery VanZwol, Micro Power **[3]**

[3]"Miniaturization typically l
mobilization. Mobile, handheld products c
tethered or untethered to access power. T
challenge when a medical device become
miniaturized and untethered is powering t
devices. As an example, each generation
surgical tools (such as saws, drill, staplers
endoscopes) offers smaller products to en
surgeons better flexibility during procedu
"One of the most useful innovations in the
battery industry for miniature devices is li
polymer cells. Lithium-polymer cells use t
similar cathode and anode material as
traditional lithium-ion cells found in laptop
electrical performance is comparable betw
similar sized lithium-ion and lithium-polym
batteries. But the external packaging of a
lithium–polymer battery is flexible, foil-typ
polymer laminate, making the lithium-pol
battery lighter. Unlike the metal packagin

volume. To shrink these devices, the designer has to reduce the power requirements. This challenge is compounded by the trend for devices to contain more processing capability. Bigger microcontrollers (MCUs), more memory and faster clock speeds all call for more power. "...By selecting an MCU that is designed for low-power operation, designers can access an array of capabilities to reduce the size of the required battery."
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Matt Harrison, Texas Instruments **[4]**

[4]
"..Advancements in electronics are enabling medical device companies to develop innovative and cost-efficient solutions for a higher quality of life. As doctors and medical device companies strive to deliver higher performance and greater portability and compactness while demanding the highest quality, precision and performance, the role of semiconductors is becoming more apparent.
"This need for greater portability brings with it design challenges for both the form factor of the medical device and for the electronics inside. A key challenge for medical device companies is to achieve two goals which are often in tension: the goal of low power consumption and that of high performance. To achieve these goals it is paramount to implement the appropriate signal chain, such as battery and power management, data interface and system microcontroller or digital signal processor (DSP). Beyond those requirements, makers of portable medical devices increasingly require some means of remote connectivity, making data range another key care-about.
"New generations of portable medical electronic devices are putting medical support exactly where it's needed, when it's needed. To make

in cylindrical or prismatic lithium-ion cells laminate exterior allows the cell to be pac in very thin configurations, as thin as 3 or mm....Miniature medical devices that hav minimal space available for a battery can benefit from the many small lithium-polyr battery configurations available.
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Robert Stanton, Omnetics [5]

[5]"The medical industry has rapid increase in the use of digital in item as catheters, defibrillators and monitors, a result, medical equipment is sending an receiving more electrical signals than eve before. This has led to an increase in size complexity of the associated connector an cable harnesses. Moreover, planning for t sterilization or disposal of parts of the sys exposed to the patient was also difficult. T reduce these problems, integrated conne and cable systems have become prevalen "Micro and nano miniature high-rel conne can be molded directly into medical equip Connector insulators are first assembled w pins or sockets that have been pre-wired have solder lugs on the back. Mechanical assembly drawings are used to size and s the internal dimensions of the housings, handles, and probes that will contain the connectors. Injection over-molding proces complete the final step of fabrication to fo final assembly.
"Such connectors are finding applications laser tools, probes, sensors, catheters, op inspection devices and even robotic instruments. Other uses include bone conduction hearing aids where the conne

this happen, medical device companies must couple the right infrastructure outside of the electronics with the right semiconductor solutions inside.
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must be lightweight, small and easy to m
Surgical tools and ultrasound equipment
integrated connectors to enable quick too
head replacement."
Read More... [5]

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