

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 leads to power mobilization. Mobile, handheld products can be tethered or untethered to access power. The challenge when a medical device becomes miniaturized and untethered is powering it. Portable devices. As an example, each generation of handheld surgical tools (such as saws, drill, staplers and endoscopes) offers smaller products to give surgeons better flexibility during procedure. "One of the most useful innovations in the battery industry for miniature devices is lithium-polymer cells. Lithium-polymer cells use the same similar cathode and anode material as traditional lithium-ion cells found in laptop computers. The electrical performance is comparable between similar sized lithium-ion and lithium-polymer batteries. But the external packaging of a lithium-polymer battery is flexible, foil-type polymer laminate, making the lithium-polymer battery lighter. Unlike the metal packaging

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 packed in very thin configurations, as thin as 3 or 4 mm....Miniature medical devices that have minimal space available for a battery can benefit from the many small lithium-polymer battery configurations available.

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[Robert Stanton, Omnetics](#) [5]



[5]"The medical industry has experienced a rapid increase in the use of digital in items such as catheters, defibrillators and monitors, and as a result, medical equipment is sending and receiving more electrical signals than ever before. This has led to an increase in size and complexity of the associated connector and cable harnesses. Moreover, planning for the sterilization or disposal of parts of the system exposed to the patient was also difficult. To reduce these problems, integrated connector and cable systems have become prevalent. "Micro and nano miniature high-rel connectors can be molded directly into medical equipment. Connector insulators are first assembled with pins or sockets that have been pre-wired and have solder lugs on the back. Mechanical assembly drawings are used to size and specify the internal dimensions of the housings, handles, and probes that will contain the connectors. Injection over-molding processes complete the final step of fabrication to form the final assembly.

"Such connectors are finding applications in laser tools, probes, sensors, catheters, optical inspection devices and even robotic instruments. Other uses include bone conduction hearing aids where the connector

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Published on Electronic Component News (<http://www.ecnmag.com>)

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 r integrated connectors to enable quick too head replacement."

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