RECENT DEVELOPMENTS IN THE USE OF FLEXIBLE PRINTED CIRCUIT BOARDS IN IMPLANTABLE DEVICES

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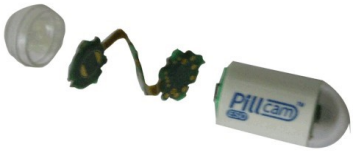
GROWTH IN IMPLANTABLES

Implantable devices are not new. The pacemaker, for example, has been around for more than 50 years. Today, similar devices can be made at 3% of the size and a fraction of the weight. There are many neurological and cardiovascular diseases that can be best managed using implantable devices, reducing the need for medications.



MINIATURIZATION

Advancements in Microelectromechanical Systems (MEMS) and Integrated Circuits (IC) are at the forefront of next generation implantable devices, providing engineers with not only smaller potential footprints but also improved performance and new sensing and treatment capabilities.

WIRELESS COMMUNICATIONS CAPABILITIES

Improvements in wireless communication and computation for implantable devices are keeping pace with the advancements being made throughout the electronics industry. The real challenge for the medical industry is not so much the availability of technology, but of obtaining that technology at a higher level of reliability.

THE FUTURE OF IMPLANTABLE DEVICES AND FLEXIBLE PCB'S

Researchers will focus on the challenges of biocompatibility, battery recharging hurdles, shielding issues and other enhancements to human comfort. The future is filled with devices that contour to the body's parts in a way that increases user comfort, easy of implantation and subsequent device management. Flexible PCBs are perfect for these applications.

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ABOUT ELTEK

Partnering with Eltek early in your product development cycle will couple innovation with the best in reliability and product durability for both life cycle and environmental considerations. We look forward to the opportunity to demonstrate the benefits of an early design cycle partnership. Our expertise will help you achieve your product objectives.

APPLICATIONS FOR IMPLANTABLE DEVICES ARE RAPIDLY EXPANDING AND CHANGING THE MEDICAL DEVICE WORLD

Over the past 50 years, life expectancy has been steadily increasing. The aging population therefore has steadily increased both in number and mean age. **There are many neurological and cardiovascular diseases that can be best managed using implantable devices, reducing the need for medications.** The key challenges for implantable medical devices are how to support low energy consumption, stable performance, and continued miniaturization.

Implantable devices are not new. The pacemaker, as an example, has been around for more than 50 years. The early devices were cumbersome, with short battery life, so when the battery was low, the device had to be removed and replaced, putting a burden not only on the patient but also on medical services and the managed care system.

Today these same devices are less than 3% of the size and weigh only a fraction of the former weight, as seen in the photos below. But the real revolution in the technology is not the size reduction, but the fact that today's tiny implantable devices are not only leadless, but can be wirelessly monitored reducing check-up frequencies.

The Evolution of Pacemaker Technology

1958

1960

1986

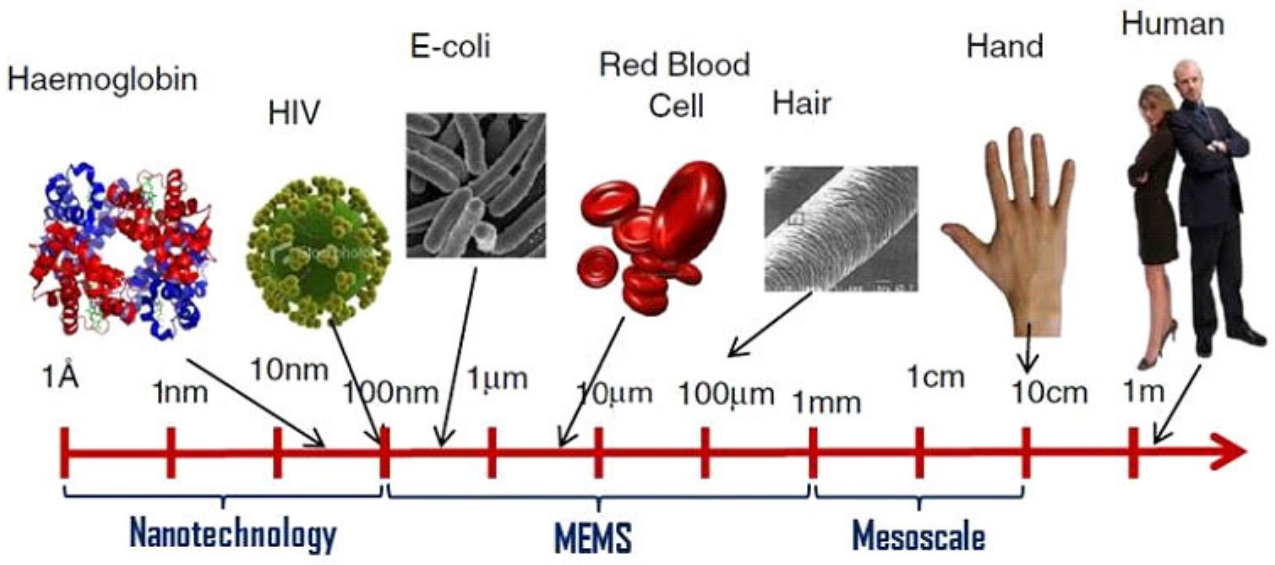
2008

MINIATURIZATION OF IMPLANTABLE DEVICES: ADVANCES & CHALLENGES

Like all electronic devices, implantable medical devices are dependent on advances in semiconductor technology, which drives the interposer and printed circuit board platforms. Advancements in Microelectromechanical Systems (MEMS) and Integrated Circuits (IC) are at the forefront of next generation implantable devices, providing engineers with not only smaller potential footprints but also improved performance and new sensing and treatment capabilities.

The electronics industry in support of implantable medical devices faces some unique challenges that have not been bridged previously. Solving these challenges will require the ability to resolve complicated issues such as biocompatibility and address the rigorous need for extended and uninterrupted reliability in these products.

Unlike your mobile phone or even your computer, that have planned obsolescence, an implanted medical device needs to have the potential for an infinite, uninterrupted life. So, as we push for miniaturization of the electronic core of the device, we are also continuously reviewing and revising material sets and processes to ensure that the next generation products have both improved functionality and reliability.



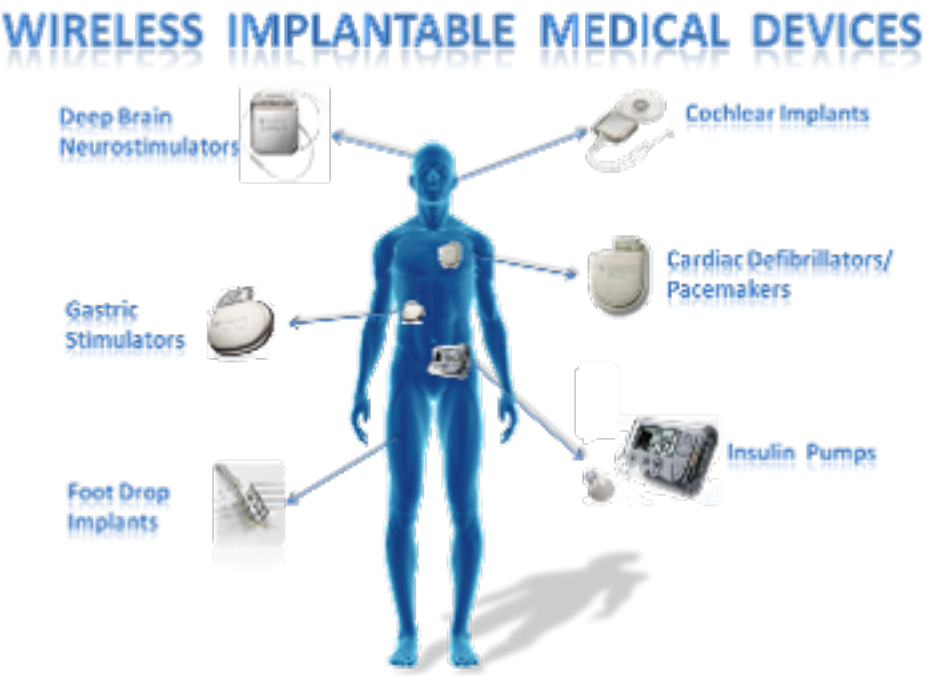
The size range of MEMS technology today.

IMPROVEMENTS IN WIRELESS COMMUNICATIONS CAPABILITIES

Most of the improvements in wireless communication and computation for implantable devices follow advances being made in the hand-held, wearable, and computing industries. As mentioned before, **the real challenge for medical industry is not necessarily one of technology availability but more one of obtaining that technology along with higher reliability.** The requirements for commercial products like a mobile phone are much less stringent than for an implantable, life-supporting device and, as we know, implantables will continue to drive electronics into smaller footprints that allow for more analysis and computing capabilities than are needed for many non-medical hand-held devices.

The electronics industry is addressing long term reliability assurances through a combination of materials review and simulated life testing using techniques to predictively model the product's reliability through the life cycle. These types of tests, along with EMC and EMI testing are the basis of primary material set selection and construction screenings. Once these hurdles are addressed, DFM analysis also plays a critical role in ensuring the products long term reliability.

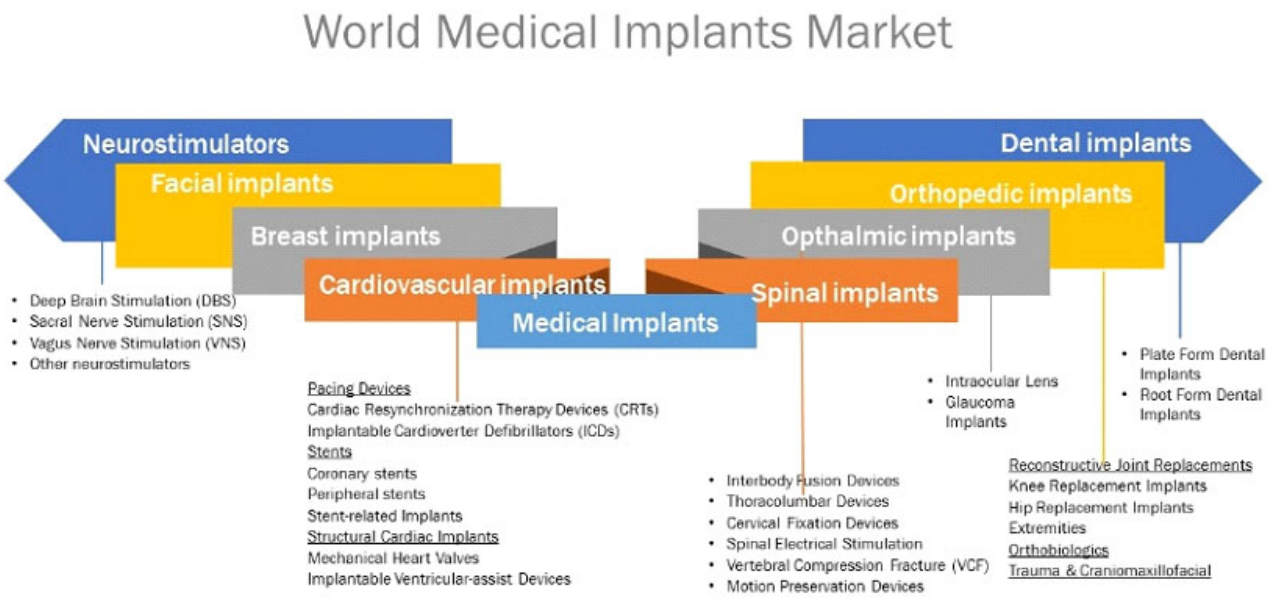
For a medical device company, choosing the right partner from the start of any program will help reduce time to market and provide the best possible design and material set, resulting in a robust product that can meet the technical and environmental design demands.



Source: MIT Research, IMD Shield: Securing Implantable Medical Devices

THE FUTURE OF IMPLANTABLE DEVICES AND FLEXIBLE PRINTED CIRCUIT BOARDS

The proliferation of implantable devices will continue as new applications are developed. How we design and implement these tiny electronic life enhancers is changing too, as **researchers focus on the challenges of biocompatibility, battery recharging hurdles, shielding issues and other enhancements to human comfort.**

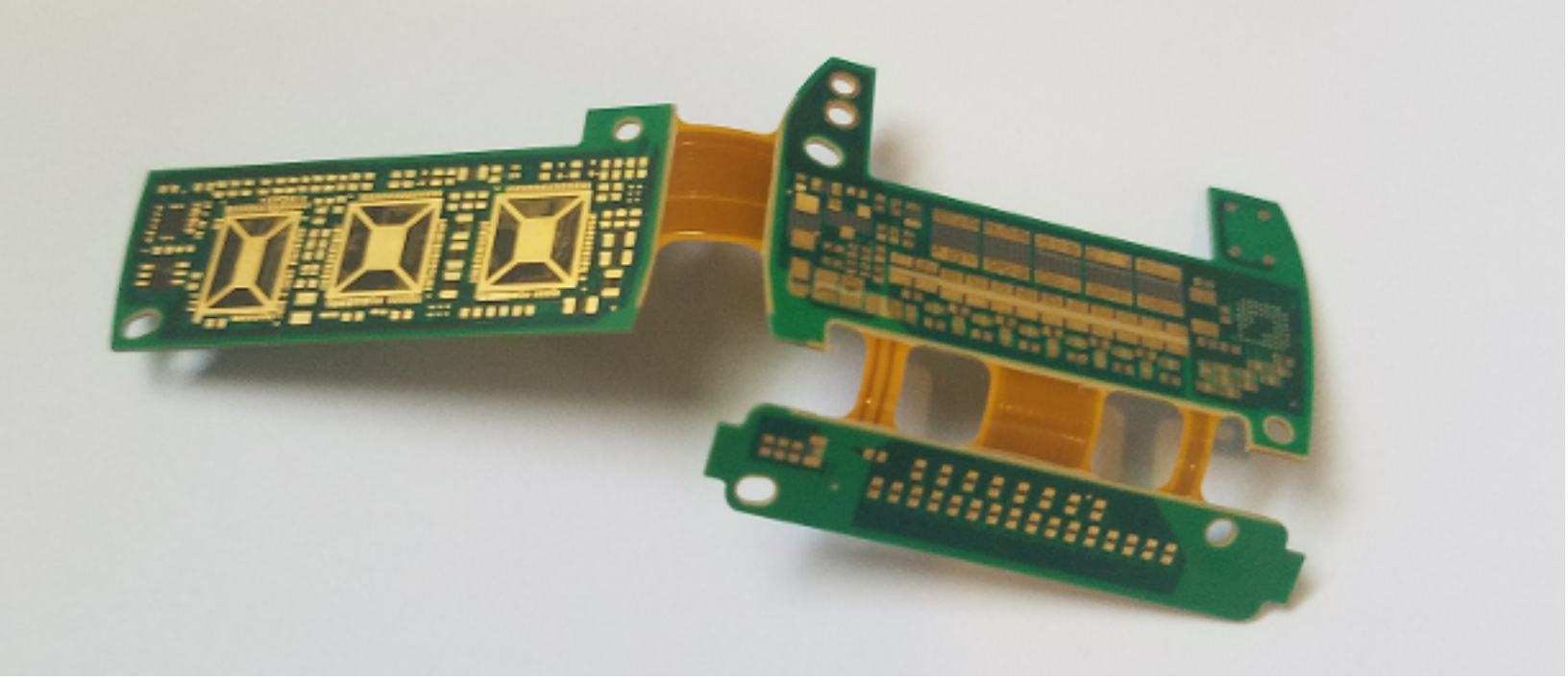


Source: Allied Market Research, World Medical Implants Market Segmentation

Flexible circuits have been enablers for implantable devices for 50 years. Bodies bend and flexible circuits can bend with the body, reducing limitations in range of motion or implantation location. The future is filled with devices that contour to the body's parts in a way that increases user comfort, ease of implantation and subsequent device management.

There are a few key reasons that flexible circuits are ideal for use in implantable devices but the most compelling is their ability for dynamic flexing – thousands of flexes over the life of product – without affecting product function or reliability. Flex circuits have had a long, positive track record in medical devices, with over 40 years of implanted service. The long-term reliability of the materials used in these constructions are well known.

Flexible circuit materials are thin, light weight and use non-reinforced plastics to allow designers the ability to increase circuit density, reduce overall size while increasing functionality and reducing weight. Many of these materials are bio-compatible as well.



ABOUT ELTEK

Eltek has been in the printed circuit board business since 1970 and has been at the forefront of implantable medical device products since our inception. As a world leading supplier for flex, rigid-flex and high-density interconnect (HDI) platforms, Eltek is the supplier of choice for many large OEM / ODM medical device companies.

Eltek's experience, high quality processing and focus on long-term reliability are a clear fit for the medical industry. Our strategy for product success begins early in the design phase of a new product. We invest heavily in both R&D and advanced equipment to keep our manufacturing processes at the leading edge of today's technological development. Our approach provides our customer with innovative, cost effective and reliable solutions for their most challenging designs.

Miniaturization: Our R&D teams press relentlessly at limiting factors, such as line width and spacing, and material sets to continue to drive forward in miniaturization efforts while holding to the highest standards of quality and reliability for our products.

Wireless Communications Capabilities: Eltek invests heavily in R&D and has product expertise specifically related to the printed circuit solutions needed to meet the wireless challenges of implantable medical devices. In addition to specific expertise in flex and rigid-flex design, Eltek has worked with numerous projects that require radio frequency (RF) materials to improve communication performance. EMI and EMC shielding expertise coupled with RF materials know-how makes Eltek a leader in design assistance for wireless medical devices.

Partnering with Eltek early in your product development cycle will couple innovation with best-in-class reliability and product durability for both life cycle and environmental considerations. We look forward to the opportunity to demonstrate the benefits of an early design cycle partnership. **Eltek's expertise will bring your products to life.**

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