

## **Backgrounder: Wearable Electronics Fashionable Technology of the Future**

To ask questions is always the driving force of research, and an important question has been occupying the developers at Infineon for a long time: What can be done to make our daily lives even more comfortable? It is well known that semiconductor devices are useful for a lot of possibilities in this respect. But how can these technological achievements be, quite literally, brought even closer to people? At Infineon, among the thousands of people searching for answers there is an ambitious team in Corporate Research, Emerging Technologies. This group is on the trail of possibilities to combine advanced technologies and textiles in a meaningful manner. The solution is “wearables” or “smart clothing”, i.e. innovative textiles with sewn-in or woven-in electronic components.

Clothing has attracted the attention of other researchers in chip technology: It is like a second skin to us, everybody has it, and everybody needs it – almost around the clock. Clothing means fashion and fun, but also protection and safety for the people who wear it. To enhance these characteristics by leveraging the technical possibilities of microelectronics promises a significant added value to the user.

### **Development focuses on value and comfort**

There are many ideas and visions of how to make everyday life easier for everyone. It is not just for convenience and communication, but also for people in poor health, senior citizens and competitive athletes. For example:

- Fall sensors in combination with the GSM network (Global System for Mobile Communication) or Bluetooth could quickly call for help if people requiring assistance have an accident in the street or at home – this could significantly help older people enrich their lives by gaining back some independence and self-confidence.
- Thermogenerators that convert body heat into electrical power could help put an end to the use of cumbersome batteries. For example, the experimental thermogenerator from the Infineon lab already produces enough power to operate a digital watch or pulse meter. This could enable athletes to monitor their vitals while training. A combined GSM/GPS chip (Global Positioning System) in the jacket would allow worrying

parents to locate their children. And homemakers would surely welcome a chip in the sweater that tells the washing-machine to select the proper temperature.

### **Playful and serious applications**

Another possible application, demonstrated in functional form now, is an MP3 player firmly embedded in a jacket – ironing- and washer-proof – with the keypad in the sleeve, a chip and a compartment for the battery and the memory card in front and the earplug jack close to the collar. The prototype will be shown for the first time at Avantex in Frankfurt, a special show of the clothing industry for high-tech textiles; however, it will be sewn into fashionable clothing.

The technologies used in the entertainment “wearables” – the electrically conductive fabric strips and ironing-proof contact pads – also provide opportunities for medical electronics. They offer the major advantage that they can eliminate the need to link up the patients via cables. Sensors and power supplies embedded in textile band aids would make it much easier for the nursing staff to care for their patients who would be more independent from stationary medical equipment. At the same time, the physician would still be able to monitor all important measurements.

### **High-tech visions coming true**

Prototypes of these ideas exist now, in April 2002. The collection of the first MP3 “wearables” was designed by students of the German Master School of Fashion in Munich. This work began as the Emerging Technologies team of Infineon spent two years searching for and finding answers to many questions. For example: How can chips be packaged to withstand repeated washing? How can fine wires be woven into the fabric so that they cannot be felt while remaining electrically conductive? How can very small keyboards be built that smoothly flow with the fabric? And how can this all be made compatible with the methods and processes used in the textile industry?

Once the technical questions are answered, it takes even more to ensure that futuristic clothes will really be accepted by people in the future. After all, each of these applications must still prove its feasibility. Technology must keep its promises and also be cost-effective to stand a real chance to succeed in the market. That's how visions of the future can come true today.