PROJECT PROFILE

T503: Novel packaging technologies for highly integrated micromodules for next generation telecom and automotive products (HI-MICRO)

PACKAGING

Partners:

Robert Bosch
Chalmers University of Technology
EPCOS
Ericsson
STMicroelectronics

Project leader:

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Key project dates:

Start: April 2001
End: June 2004

Countries involved:

Austria
Germany
Italy
Sweden

Microelectronic component platforms driving the new breed of sophisticated automotive systems and future generations of mobile phones, destined to invade world markets over the next few years, will look very different to today's designs. These 'micromodules' will have to be more reliable and less expensive, but today's high-volume manufacturing techniques cannot deliver such components at the required specification and price. The MEDEA+ HI-MICRO project is therefore pulling together a world-class team from the microwave and automotive electronics industries to rectify this and ensure that Europe leads the way in the design and volume manufacture of a new breed of more rugged integrated circuit.

New packaging technologies are needed to support future generations of multimedia mobile communication networks, as well as new automotive applications such as near-distance radar vision systems, placed around the car to improve safety.

A mass market for micro- and millimetre-wave applications is evolving rapidly. Products such as point-to-point, and point-to-multipoint, millimetre-wave radios already exist. But automotive radars for anti-collision and cruise control applications, industrial sensors and 60 GHz based wireless local area networks (LANs) will need to be produced in the very near future.

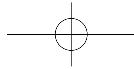
Beating the competition

According to forecasts published by research organisations such as ABI, Frost & Sullivan and Strategies Unlimited, millimetre-wave products for the telecommunications and automotive markets are going to become a massive worldwide market worth billions of euro in the near future. Quite a number of Japanese and US players – leaders in the production of key components for these product families – have already lined up to grab this major market opportunity. Delphi and TRW, Fujitsu-TEN, Matsushita, Murata and Tyco-Electronics M/A-COM lead the way in automotive radar. Harris, Lucent and NEC are forces to be reckoned with in the design and supply of telecommunications components. DMC, Harris, Nortel and PCOM are strong in microwave communication. Delphi and Denso dominate car electronics. And four European manufacturers – Alcatel Microelectronics, Bosch, Infineon and STMicroelectronics – can be found amongst the top ten semiconductor suppliers to the automotive market.

The results of the MEDEA+ T503 HI-MICRO project should therefore help place European infrastructure and automotive electronics system houses as well as module, component and semiconductor suppliers, and manufacturing technology service providers in a much healthier competitive position. It will enable them to take advantage of the opportunities these emerging telecommunications and automotive markets offer to industry and to society, by creating new jobs and securing employment throughout Europe over the next decade.

Creating a new micro generation

The HI-MICRO project is developing new ways of designing the next generation of



micromodule-based mass production platforms for mobile telecommunications and automotive products, using more reliable components based on highly integrated monolithic microwave integrated circuits (MMICs) and multilayer substrates. It is analysing how they might be produced at low cost and developing the appropriate tools.

These micromodules combine both silicon germanium (SiGe) and gallium arsenide (GaAs) based highly integrated MMICs with wafer scale packaging methods using either bare chip assembly (flip-chip or CSP), or ball grid array (BGA) technology. At the semiconductor level, SiGe technology is being used to demonstrate highly integrated solutions for multichip modules (MCMs) in the 20 to 30 GHz frequency range. GaAs technology is being used for higher frequency applications – such as 60 GHz wireless LANs.

Microelectronic components are being studied for use in future telecommunications and automotive applications. Because this family of miniaturised packages is being put together in a new way, the usual well-established procedures that make detailed physical analyses of the modules to test how quickly they fail can no longer be used. So new analytical tools and techniques are being developed to spot early signs of degradation and predict how failures might occur in this new generation of telecommunications and automotive component packages.

This analysis involves systematically simulating how components degrade and ultimately fail under different stress conditions. It is providing project partners with a good understanding of the packages' behaviour, and creating the basis for a reliable risk assessment methodology to establish reliable mean time between failure (MTBF) rates for the new components. The most promising technical approaches that appear reliable will form the basis for forthcoming commercial applications.

Pooling expertise

The MEDEA+ HI-MICRO project benefits from close co-operation between participating companies, which are pooling their design and production know-how. The semiconductor partners have been concentrating their activities on developing consumer applications for the rapidly expanding worldwide telecommunications market. So most of the high performance devices developed are based on space-saving package technologies that would be equally suitable as part of the new breed of car components.

However, growth in the semiconductor market has been governed by the needs of consumer electronics rather than the much tougher demands of the automobile industry, which requires a much higher standard of quality and reliability. MEDEA+ support made it possible to bring together partners from the whole value chain and to merge the experiences from both the telecommunications and automotive industries and work together on adequate procedures for the use of such devices in automotive electronics. Such an approach is only possible in a multinational framework because this wide range of expertise is not available within limited national resources.

High volume products

The HI-MICRO consortium consists of two system suppliers – Ericsson from the telecommunications industry and Robert Bosch from the automotive side – with module-component supplier EPCOS, semiconductor manufacturer STMicroelectronics and Chalmers University with specific know-how in electromagnetic/mechanical simulation. The objective is the development and production of mass-market products based on micromodule platforms including micro- and millimetre-wave MCMs for both 3G and 4G multimedia mobile telecommunications equipment (Ericsson's area of capability) as well as 2G automotive radar sensors where Robert Bosch has particular expertise. A new breed of analytical tools will be developed within the project to achieve a high standard of quality assurance for these components, as well as establishing a reliable failure analysis system that will also be used to make sure Bosch's automotive electronics production is of the highest quality possible.

Reaping the rewards

The results of this MEDEA+ project should boost the partners' know-how by helping them develop innovative and highly reliable electronic car and telecommunications component packages. It will also help them compete on the world stage more effectively.

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