News

SILICON-GERMANIUM ELECTRONICS FOR DEEP SPACE

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RESEARCHERS with the Georgia Institute of Technology have developed an approach to space electronics based on silicon-germanium (SiGe) technology.

The $12 million project, called “SiGe Integrated Electronics for Extreme Environments”, ran for 63 months and was funded by NASA.

According to the researchers, the SiGe approach could change how space vehicles and instruments are designed, as it is capable of producing electronics which are highly resistant to both wide temperature variations and space radiation.

A paper on the project findings will appear in December 2010 in IEEE Transactions on Device and Materials Reliability.

At best, most electronics conform to military specifications, functioning across a temperature range of -55°C to +125°C. Electronics in deep space are exposed to far greater temperature ranges, as well as to damaging radiation.

Additionally, electronics used in deep space need to be designed for reduced weight and size, and increased reliability, because of the logistics of getting the equipment into that environment.

SiGe alloys combine silicon with germanium at nanoscale dimensions. The resultant material is robust, tough, fast and flexible.

The researchers say silicon-germanium electronics can function in space without the need for bulky radiation shields or large, power-hungry temperature control devices. This reduces the weight, size, complexity, power and cost of space-based devices.

Specifically, the team used IBM’s 0.5 micron SiGe technology, which is considered a mature technology.

Although IBM had not intended for it to withstand deep-space conditions, the researchers managed to SiGe's natural merits to develop new circuit designs and new approaches to packaging the final circuits to produce an electronic system that could reliably withstand the extreme conditions of space.

NASA says the project means it can start using SiGe technology on actual vehicle designs, based on the advances in understanding as well as the tools provided by the researchers.

The silicon-germanium electronics developed by the extreme environments team has been shown to function reliably throughout the -180°C to +120°C range, which is encountered on the surface of the Moon. It is also highly resistant or immune to various types of radiation.

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