Success of 45 nm Node Technology for MuGFET, a Next-Generation Transistor

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ATDF, Inc. with assistance from HPL Technologies, Inc. of San Jose, has **successfully demonstrated process capability at the** 45 nm technology **node for a multi-gate field effect** transistor **(**MuGFET**)**, an advanced semiconductor device that eventually could replace conventional CMOS transistors.

ATDF, which has been working at the 45 nm node and below for more than a year, achieved the demonstration as part of a custom development program involving a device maker, a university, and equipment, substrate and materials suppliers. The semiconductor was produced in a record turn time with assistance from the TestChip division of HPL, which combined its flexible and efficient test chip creation infrastructure and project management techniques to help meet an aggressive reticle design delivery.

The demonstration completes the first phase of the ATDF's effort to identify manufacturing problems associated with MuGFET fabrication on silicon. Additional program phases will address manufacturing issues, such as threshold voltage (V t) rolloff, that emerged in experiments leading to the demonstration.

“This achievement demonstrates the collaborative strength of ATDF development programs,” said Juergen Woehl, ATDF general manager. “Each participant brought their unique strengths to the project, and each company was able to participate where they brought the most value to the program.”

The test chip required an entirely new device topology and special analog device design considerations. “HPL met our challenge of a three-week delivery for a difficult new MuGFET test chip,” said Michael Gostkowski, an ATDF senior project manager. The MuGFET development program is a collaboration between ATDF and select integrated device manufacturers (IDMs). With the successful completion of the first phase, the test chip is now available from ATDF for any company needing access to this process technology.

With nearly a decade of experience with leaders in the semiconductor industry, HPL's successes have included over 150 CMOS and 125 analog and mixed signal projects. “Customers have recognized that using HPL methodology, tools and IP for process technology development and manufacturing monitoring is both faster and more cost-effective than using existing methods,” stated Cary Vandenberg, HPL's CEO. “We are pleased to be able to support ATDF with their advanced process development challenges.”

Compared to classical CMOS devices, MuGFETs are viewed as alternatives necessary to keep pace with Moore's Law and the requirements of the International Technology Roadmap for Semiconductors (ITRS). If proven manufacturable, MuGFETs could be introduced into manufacturing within several years, although integration schemes remain to be developed.

The MuGFET work is part of a set of custom development programs that the ATDF has established for stimulating development activities with industry customers. These new programs allow the ATDF to act as an independent broker to bring together interested parties to solve customer development issues . Each ATDF program is defined by the customer, who outlines the program's scope, deliverables, and intellectual property (IP) ownership. These custom programs allow the ATDF to ensure customer confidentiality for process development,

device data, and other program details.