

## Accurate program simulation of TANOS charge trapping devices

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*Abstract*—This publication investigates the program simulation of charge trapping memory devices in detail. Three different aspects of the simulation are highlighted which have a major impact on program behavior in trap based memories. The analysis is done by a comparison between measurement and simulations. These are based on an amphoteric trap model. It is shown that the program-slope is influenced significantly when the trap capture cross section is altered. This effect is based on the resulting change in the trap efficiency and the fly-through current. The electron injection current through the bottom oxide dominates the program characteristics. Therefore, the program behavior is analyzed in simulations by adaptation of the tunneling injection mechanism. It is presented that the bottom oxide to storage nitride energy band offset has a strong influence on the simulated characteristics and the comparability to measurement results. The consideration of the tunneling injection point in the silicon nitride is an important aspect concerning thin bottom oxides or low program voltages, when modified Fowler-Nordheim tunneling conditions are present. The proposed modifications allow a simulation of various stacks with good agreement to measurements without changing basic parameters. The results provide deeper insight into the mechanisms dominating the program behavior in charge trapping memory devices.