

Impact of short SET pulse sequence on Electronic Switching in Phase Change Memory arrays

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Electronic switching is the fundamental mechanism of Phase Change Memory governing the transition from the RESET state to the SET state. Up to now various physical models have been proposed in literature and validated on single cell measurements. In this work we electrically characterized a population of 512Kb PCM cells in order to statistically analyze electronic switching phenomenon. Statistics about the formation of the first polycrystalline grain percolation path (shunt) can be extracted from the experimental data and used to provide a deeper insight into the physical nature of this process. In particular, it has been found that a certain delay time (t_d) is necessary in order to form the first shunt between the bottom electrode and the top electrode of the calcogenide element. When this condition occurs, the cell resistance rapidly drops to smaller values. We studied the impact of a sequence of short pulses on the electronic switching behavior and showed that experimental results are in agreement with this model. Results also show that the shunt continues growing in size until another mechanism starts becoming important eventually leading to a saturation condition. We suggest that a thermal runaway mechanism can be responsible for this last effect.