Compact Modeling of a PCRAM Cell

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Context

Phase Change RAM: very promising non-volatile memory
- good scalability + high programming velocity

Compact model
- Static part: reading the cell thanks to I/V
- Dynamic part: programming set and reset

Behavioral compact model

Included Effects
- Temperature derivation from thermal impedance
- Amorphous phase (reset)
  - quenching time
  - snap back
  - resistance
- Crystallization (set)
  - resistance (can be not ohmic)

Assumptions
- Threshold voltage constant
- No partial set and reset
- Two access resistances

DC results
For reading the cell

Prove the validity and the accuracy of the developed model

Input pulse

Derivation of the temperature of the cell

Memory node

Memory node (Mout) equals 1 for crystalline state and 0 for amorphous one

PCRAM resistance derivation

The model fit well with measurements, run under Eldo simulator

Further improvements: crystallisation time and partial set and reset

Data: Servalli, IEDM 2009

Measurements

Model

TME TCR

Memory node

Voltage (V)

Current (µA)