Transforming Ideas to Reality

Materials & Integration Thrust: Three Dimensional Monolithic System on a Chip (3DSoC)

3DSoC: Our Approach

- Monolithic 3D Integration
  - Fine-grained integration: logic + memory

Data storage
Memory access
Computing logic
Conventional BEOL vias

RRAM Technology

- Dense on-chip non-volatile memory
  - Simple
  - BEOL compatible
  - Path to 3D RRAM

CNFET Technology

- 90 nm technology node
  - Relaxes technology requirements
  - BEOL compatible
  - Fully complementary

Carbon Nanotube FETs (CNFETs)

- Requires low temperature fabrication
- Challenging with conventional silicon CMOS

Enabling Technologies

- Resistive RAM (RRAM)

CNFETs: Recent Progress

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- Si-compatible; >99.999% purity
- Robust doping: CNFET CMOS
- Immune to metallic CNTs
- Commercial facilities

Roadmap

- Introduce in Foundry
- Finalizing Technology
- Monolithic 3D ICs
  - CNFETs (optimize, transfer, PDK)
  - monolithic 3D fabrication
  - Program + system integration
- 2D CMOS chips
  - stand-up CNFET, RRAM modules
  - demo monolithic 3D ICs
  - develop MPW offering

Team

- RRAM (optimize, transfer, PDK)
- monolithic 3D system design
- evaluation (benchmarking)
- improving CNT material
- high-volume CNT production

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