



Novel Devices and the Roadmap

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Talk focuses on logic and memory technologies forecasted by ITRS to be in manufacturing in 15 years. Mostly from ITRS PIDS Chapter.

Logic:

- Technology versions: (1) High Performance, (2) Low Operating (Dynamic) Power, (3) Low Standby Power, and (4) III-V/Ge.
- No scaling limit seen yet even for Si (up to 2026).
- Power is the limiting factor, not speed. Speed requirement is relaxed from circuit perspectives.
- Alternative channel III-V/Ge offers lower power with similar speed.
- Low V_{dd} near end of roadmap posts noise/variability challenges.
- Series resistance can be a practical factor/limitation.

DRAM:

- Capacitor scaling increasingly difficult. High-K means thicker dielectric which consumes area.
- $4F^2$ is the limit for cell size.
- Need disruptive replacement solution for 1T-1C.

NVM:

- Device versions: 3-terminal (charge-based) floating-gate and charge-trapping FETs. 2-terminal (non-charge-based) FeRAM, MRAM, STT-MRAM, and PCRAM.
- Trend is moving from 3-terminal FET to 2-terminal devices, and 3-D.
- Efficient selection device to be developed.