Z-RAM
Zero Capacitor RAM

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Introduction

- Volatile memory

- SRAM: Fast but Big
- DRAM: Small but Complex

Z-RAM: Speed of SRAM & Density of DRAM
Developer Of Z-RAM

- Developer of Z-RAM
- ISi was the winner of IEEE Spectrum’s 2007 award.

- License to make large on-chip cache memories in future μp designs
- To replacing SRAM

- License to make stand alone IC’s for primary memory
- To replace DRAM
Features Of Z-RAM

- Zero Capacitor DRAM
  - No capacitor in its memory cell
  - Cell consists single transistor
- Capacitance is stored in FB of SOI wafer itself
Writing & Reading Operation

- Write: Triggering the Bipolar transistor
- Excess majority carrier stores in the floating body
- Read: Senses the bipolar current through the transistor
Structure of memory cell

- **Z-RAM**: Single MOS transistor
- **DRAM**: MOS transistor & a Capacitor
- **SRAM**: 6 MOS transistors
Sensing

- Storage of charge: floating body of transistor
- Read: Triggering the intrinsic bipolar

- Storage of charge: separate capacitor structure
- Read: Charge sharing between Capacitor & Base Line Capacitance
Applications of Z-RAM

- Stand alone memory device
- In SiP (System-in-package)
- Embedded in μp or graphics chips
Merits

- High Data Retention time
  - Due to large amount charge
- High Read/Write speed
  - Approx 3nS
- Consumes very low Power
- Highly Scalable
  - Size of Test chips
    - 1st 90nm
    - Finally 35nm
- Low cost
  - Reduces total Die Area
- Manufacturing is simple
Demerits

- It isn’t fast enough to replace SRAM in L1 cache
- L1 cache need very high speed
- Six transistors are used in a memory bit cell of SRAM
Future Scopes

- **Z-RAM Gen 2**
  - Stores more charges in memory bit cell
    - So increase in data retention time
  - Increase in speed of data read & write
  - Ultra low Power consumption
    - Read power reduced by 75%
    - Write power reduced by 80%
  - It can replaces the SRAM in L1 cache
    - High speed than SRAM
Conclusion

- Ultra dense memory technology
- Best of all previous memories
  - Speed
  - Density
  - Simplicity