

RC DELAY: THE INTERCONNECT CHALLENGE

WHAT IS RC DELAY?

R resistance — the difficulty a current has in passing through a conducting material.

C capacitance — the degree to which an insulating material holds a charge.

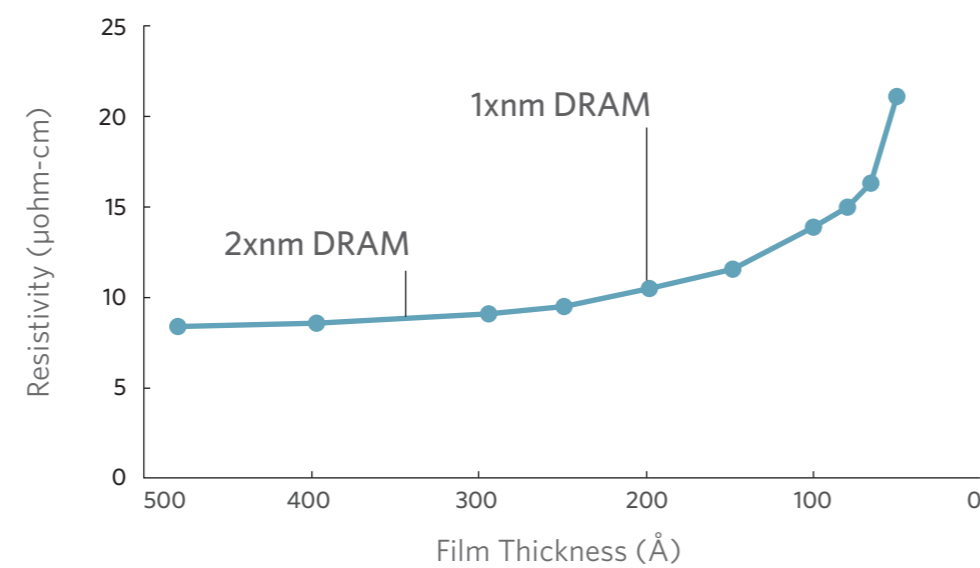
DELAY slowness of signal speed through circuit wiring as a result of R and C

CONTRIBUTORS

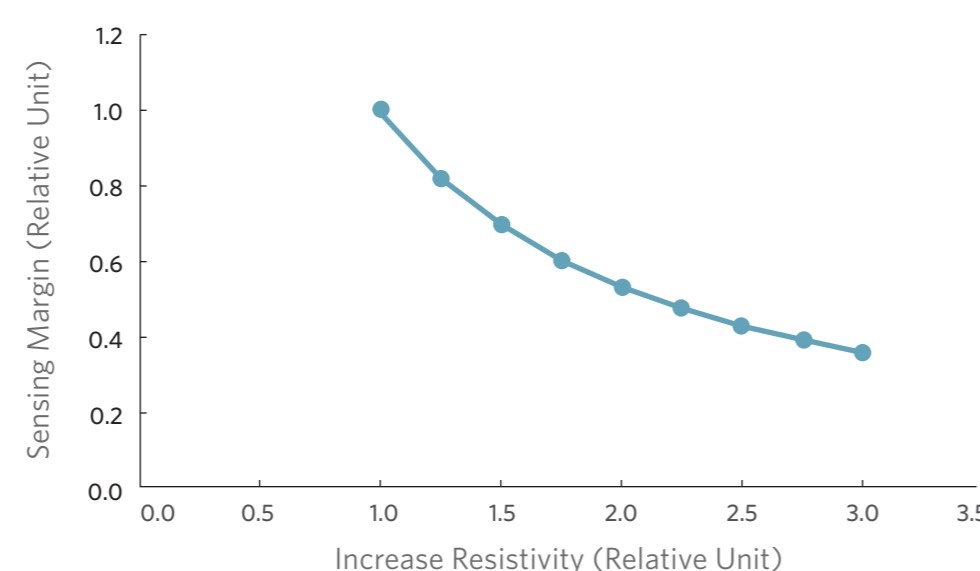
- Resistance driven by shrinking conductor dimensions and increased electron scattering from grain boundaries and impurities
- Challenges in fabricating low-resistivity metal/semiconductor interfaces
- Materials limits to achieving ultra-low capacitance insulators

WHY MUST RC DELAY BE RESOLVED?

- Increases exponentially at 1xnm nodes
- Impedes future scaling
- Slows performance (e.g., data retrieval from memory)



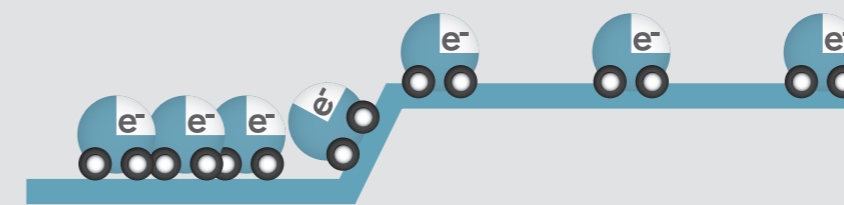
Resistance increases significantly as metal bitlines shrink.



DRAM sensitivity to bitline signals decreases as resistance increases.

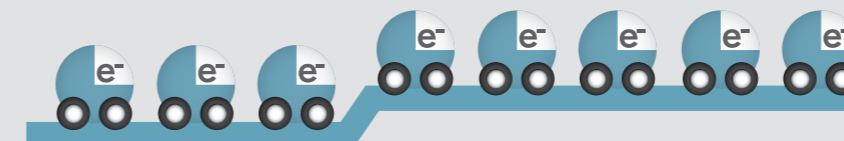
HOW CAN MATERIALS ENGINEERING REDUCE RC DELAY?

CURRENT TECHNOLOGY



Insufficient silicide coverage slows charge transfer from the active region to circuit wiring.

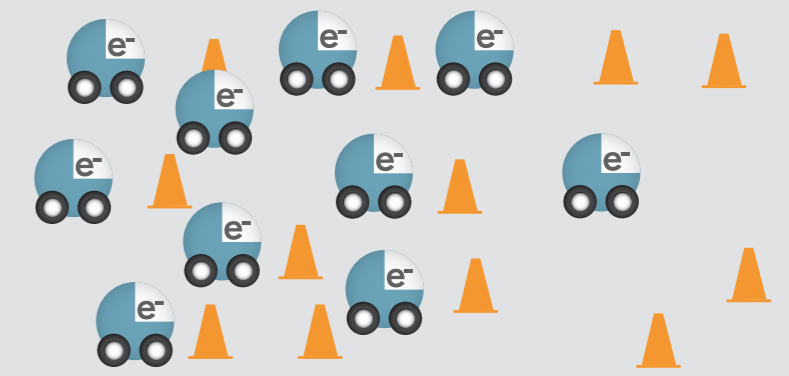
ENDURA CIRRUS HT Co PVD SYSTEM



Robust coverage of low-resistivity Co silicide speeds charge transfer to improve device performance.

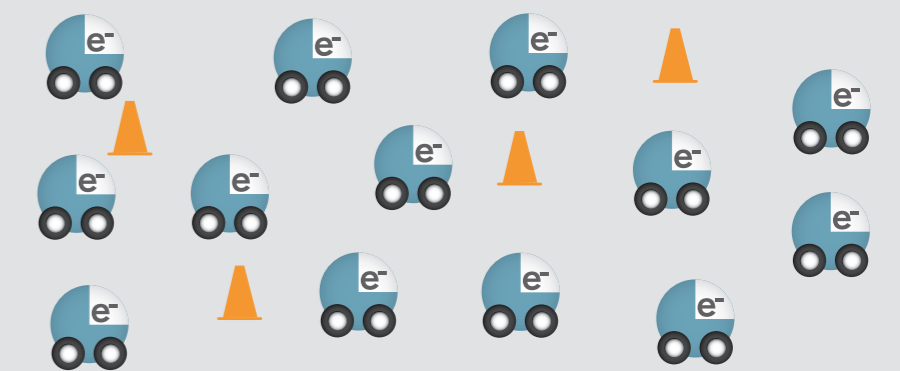
2X-3X
thicker coverage

CURRENT TECHNOLOGY



Impurities and surface roughness impede progress of electrons through circuit wiring.

ENDURA VERSA XLR2 W PVD SYSTEM



Purer, smoother tungsten lowers circuit resistivity.

10-15%
lower resistivity