

# Technology Variability and Product Design Implications

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Scaled technologies continue to exhibit variability, driven by both random process effects and systematic structural effects. Process and design rule actions can be taken to reduce, or even eliminate, sources of systematic variability. Random variability is more difficult to combat, but architectural decisions can be made to limit the device sensitivity to specific random effects. A review of several current sources of technology variability is presented, and the impacts to the overall technology offering are assessed.

Any type of variability mitigation from the design perspective requires that the elements of variability are quantified, characterized and analyzed properly. Variation analysis must be delivered as part of a design enablement package. Examples of this type of measurement and enablement are discussed.

Products are increasingly being designed in a manner that reflects the awareness of technology variation. This awareness is an essential element in producing high-performance semiconductor products with acceptable manufacturing yields throughout the window of possible process variation. Innovative techniques and design methodologies, such as latch transparency optimization and statistical timing analysis, have emerged as essential elements in current designs. An overview of these techniques facilitates a product-level understanding of basic technology variability elements.