

# The future of lithography and its impact on the semiconductor industry

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Moore's Law is the defining feature of the information age. First expressed by Gordon Moore in 1965, Moore's Law says that the number of transistors on an integrated circuit doubles every one to two years. The result over the last fifty years has been dramatic improvements in computational capabilities, communications, entertainment, and all aspects of electronic technology, all at ever lower cost. Quite literally, Moore's Law has brought about a radical change in society, with implications for human civilization that are not fully resolved.

But Moore's Law itself has undergone changes over the last 50 years. In addition, Dennard scaling for MOSFET devices has changed radically in the last decade. This talk will describe the history of Moore's Law, and the technical and economic forces that have shaped it. The role of wafer size (and in particular the planned move to 450-mm diameter wafers) will also be discussed. Possible future lithography scenarios will be discussed and their implications explored. Warning: some speculations will be inevitable.

## *About the Speaker*



Chris A. Mack received Bachelor of Science degrees in physics, chemistry, electrical engineering, and chemical engineering from Rose-Hulman Institute of Technology in 1982, a Master of Science degree in electrical engineering from the University of Maryland in 1989, and a Ph.D. in chemical engineering from the University of Texas at Austin in 1998. Mr. Mack founded FINLE Technologies, the developer of the lithography simulation software PROLITH, in 1990, serving as President and Chief Technical Officer until the acquisition of FINLE by KLA-Tencor in 2000. For the next five years he served as Vice President of Lithography Technology for KLA-Tencor. In 2003 he received the SEMI Award for North America for his efforts in lithography simulation and education. He became a fellow of SPIE in 2006, and a fellow of IEEE in 2010. In 2009 he received the SPIE Frits Zernike Award for Microlithography. He is also an adjunct faculty member at the University of Texas at Austin and spent the Fall 2006 semester as a visiting professor at the University of Notre Dame, and summer (winter) 2011 at the University of Canterbury in Christchurch, New Zealand. He has recently completed a comprehensive graduate-level textbook on optical lithography, *Fundamental Principles of Optical Lithography*, published in late 2007. Currently, he writes, teaches, and consults on the field of semiconductor microlithography in Austin, Texas.