

Michael Stockinger / NXP Semiconductors

"ESD Protection Devices and their Applications in CMOS Technologies"

As CMOS technology continues its downward scaling trend, and with its supply voltage and device breakdown voltage levels, protecting ICs from failures due to Electrostatic Discharge (ESD) has become increasingly challenging. This tutorial will discuss commonly used ESD protection devices like diodes, bipolar junction transistors (BJTs), silicon-controlled rectifiers (SCRs), and actively triggered MOS transistor clamps. The first half of this course will look at the electrical behavior of these devices in the ESD regime, their triggering mechanisms, and implementation aspects. We will explain what happens if they are pushed outside their normal operating range. The second half of this course will focus on application cases for these devices and introduce design principles for maximizing ESD performance. The tutorial will touch on the subjects of ESD device modeling, ESD stress models, and general ESD design and circuit simulation aspects. Tutorial attendees will leave with a fundamental knowledge about ESD protection devices, which may provide an essential building block for implementing ESD protection on the I/O library, I/O pad ring, and SoC levels.

Michael “Michi” Stockinger received his PhD in electrical engineering with highest honors from Vienna University, Austria, in 2000. His doctoral research focused on the optimization of ultra-low-power CMOS transistors. In 2000, he joined the engineering staff of Motorola’s Semiconductor Products Sector in Austin, Texas, changing to Freescale Semiconductor in 2004 and to NXP Semiconductors in 2016. Michael has been focusing on ESD protection and LU prevention for advanced CMOS products. He is currently a Technical Director of ESD design in NXP’s Microcontroller division. Michael’s on-chip ESD solutions have been implemented in the Qorivva, Kinetis, and ColdFire microcontroller product lines, amongst others. His latest research interests are in the field of on-chip protection solutions for system level (IEC) transient immunity. Michael was awarded the 2001 EOS/ESD Symposium Best Paper award, the 2003 EOS/ESD Symposium Best Paper and Best Presentation awards, and the 2013 EOS/ESD Symposium Best Paper and Outstanding Paper awards. He has authored or co-authored over 35 technical papers and teaches an ESDA tutorial. He has served in the TPC of several EOS/ESD Symposia, International Reliability and Physics Symposia, and International ESD Workshops. Michael holds 24 patents on ESD design, with several others pending.