



Department of  
Systems Engineering

香港城市大學  
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# Background, Challenges, and Solutions in Integrated Circuit Electrostatic Protection



## Professor Junjie LIU

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### Summary

The development of integrated circuits (ICs) has undergone three stages: the first stage focused on functionality, the second stage emphasized performance, and the third stage prioritized high performance and reliability. China has recently entered the third stage, where the reliability of domestic IC products, especially in terms of high stability and reliability, lags significantly behind international competitors.

The first unit of this workshop introduces the background, requirements, and design principles of IC reliability. The second unit discusses electrostatic protection schemes for designing large signal interfaces with positive and negative voltage oscillations. The third unit explores electrostatic protection schemes for designing high-speed interfaces with low operating voltage and minimal parasitic capacitance. The fourth unit addresses electrostatic protection schemes for designing high-voltage interfaces with latch-up prevention requirements.

### About the Speaker

Professor Junjie Liu is a distinguished professor and the director of the Center for Microelectronics and Solid-State Electronics at North Minzu University. He is a national high-level talent expert, Changjiang Scholar Distinguished Professor appointed by the Ministry of Education, Ministry of Education Overseas Distinguished Teacher, Fellow of the National Academy of Inventors (USA), Fellow of the Institution of Engineers, Singapore, Fellow of the Association for the Advancement of Artificial Intelligence (Singapore), and Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and Institution of Engineering and Technology (IET).

Professor Liu is an internationally recognized authority in IC reliability and a pioneer in the field of electrostatic protection in China. Over the past 30 years, he has dedicated his research and teaching efforts to enhance IC reliability and established one of China's first electrostatic protection laboratories, nurturing numerous professionals in the field.

Controllable silicon (SCR) is an effective IC electrostatic protection device, but it has traditionally faced several technical bottlenecks. Professor Liu's research breakthroughs have overcome these challenges, leading to the development of internationally recognized electrostatic protection solutions using SCR. He has achieved the world's first robust, compatible, low-leakage, low-capacitance, low-resistance, and small-area reliability solution based on standard silicon CMOS and BCD process platforms.

In recognition of his significant contributions to research and teaching in the field of integrated circuits, Professor Liu has received numerous prestigious honors from the Institute of Electrical and Electronics Engineers (IEEE), including IEEE Fellow, IEEE Distinguished Lecturer, IEEE Region 10 Outstanding Engineer Educator Award, and the IEEE Electron Devices Society Education Award. He is the sole recipient of these two awards worldwide.

Professor Liu has authored 13 books, published over 650 academic papers, holds more than 20 patents, and has served as a special editor for many journals and chairperson for over 50 international conferences.