Tso-Ping Ma (1945–2021)

Scientist and engineer who helped shape semiconductor technologies.

Tso-Ping Ma (often known as T.P.), the Raymond J. Wean Professor of Electrical Engineering and Applied Physics at Yale University, played a key role in the development of various areas of modern semiconductor technologies. He received numerous honours including the Paul Rappaport Award of the IEEE Electronic Device Society, Andrew S. Grove Award of the IEEE, and Connecticut Medal of Technology. Ma was elected a life fellow of the IEEE, a member of the US National Academy of Engineering, an academician of the Academia Sinica in Taiwan, and a foreign member of the Chinese National Academy of Science. He has died aged 75.

In the 1970s, Ma and a colleague at IBM discovered how radiation affected silicon metal–oxide–semiconductor devices, establishing the scientific foundation to understand this phenomenon, and developing processes to repair the defects induced by radiation. Their work gave birth to the field of radiation-resistant electronics, which has increased the lifetime of electronic circuits used in satellites and other spacecraft. Since the 1980s, Ma and his team at Yale University carried out work on the use of high-permittivity (high-*k*) silicon nitride for transistor scaling. The notion inspired and influenced the semiconductor industry and led to the adoption of advanced high-*k* dielectrics in today's highly miniaturized integrated circuits. Since the 1990s, Ma and his team pioneered research on memory devices based on ferroelectric materials.

Ma was born on 13 November 1945 in Lanzhou, a city in the northwest of China on the bank of the Yellow River. As a child, he and his family relocated to Taiwan amid the civil war. Ma received his bachelor's degree in electrical engineering from the National Taiwan University in 1968. He was then admitted to Yale engineering school in 1969, where he serendipitously met his thesis advisor Professor Richard Barker during a planned visit to another professor. This unexpected encounter marked the beginning of Ma's career in semiconductor science and technology.

Credit: Yale University

After receiving his PhD in 1974, Ma worked at IBM for three years, where he developed semiconductor devices and established a lifelong relationship with the company. In 1977, he returned to Yale University as a faculty member of the department of electrical engineering. As a distinguished educator and mentor for almost half-a-century at Yale, Ma trained multiple generations of successful academics, scientists and engineers in semiconductor science and technology. And the alumni of the Ma group have spearheaded the research, development and production of key areas across semiconductor technologies, including transistor scaling, high-*k* dielectrics, advanced interconnects and integration, and emerging materials.

Ma had a distinctive mentoring style, which benefited mentees both within and outside of his research group. He held a high standard for scientific rigour, ensured academic freedom in research, and provided generous support to all of his mentees. He served as the chair of the electrical engineering department at Yale University twice and changed the life trajectories of many junior faculty members. His generosity went well beyond the electrical engineering department, and Ma was always there to help junior university members who were struggling in the early stages of their career. Ma also understood the challenges faced by first-generation immigrant students and scholars, and his unfailing support for those in this group will always be deeply appreciated.

Throughout his life, he has been a personal ambassador for promoting and facilitating research collaborations internationally. Ma was elected a distinguished alumnus of the National Taiwan University (NTU). He was a consultant to the NTU–Taiwan Semiconductor Manufacturing Company (TSMC) Research Centre and advised students and faculty members to develop a global vision and an innovative mindset. Ma established the Yale–Peking Joint Centre for Microelectronics and Nanotechnology, and promoted academic exchanges and collaborations between the two academic institutions.

Besides research and mentoring, Ma enjoyed travelling, music, ice skating and fine wines. He was a man with a great sense of humour, and loved sharing stories with acquaintances and new friends. In gatherings at the International Electron Devices Meeting (IEDM), Ma was always the centre of the conversation. Numerous attendees have heard his humorous stories and benefited from his wisdom and insights. Such lovely moments have become unforgettable memories for many.

Ma was a beloved husband to Dr Pinfang Lin for 49 years; a dedicated father to his son Mahau Ma and daughter Jasmine Ma; and a playful grandfather of his four grandchildren. He will be dearly remembered by his family, alumni of the Ma group, mentees and colleagues, and people across the entire semiconductor community. ❐

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