

Significant Evolutionary Trends in Electronics Over the Past 20 Years

We are beginning a series of articles that will review 12 technology trends that have had a significant impact on the electronic industry and, in some cases, our daily lives. Our goal is not to just identify the important trends but to show how these trends have changed over the past decades.

We selected 2000 as our starting point and then addressed how the trend changed in 2010 and 2020. At some point, we will try projecting these trends out to 2030. We would appreciate knowing your thoughts on the progression of these trends into this new decade.

Few would argue that the evolution of electronic devices over the past 20 years has been nothing short of incredible. Beginning in the 1940s, the introduction of new electronic equipment has totally altered the way we live, communicate, and get things done. Comparisons between the rate of technological advances in semiconductors to advances in industries such as air transport and automotive leave these relatively lumbering transportation technologies in the dust. The logarithmic improvements in performance, miniaturization, functionality, user volumes, and cost reductions in semiconductors and the innovations they empower have been unmatched in history.

This rapid transformation has created entirely new product categories, such as smartphones, flat-screen digital televisions, and digital imaging, which have often resulted in the complete annihilation of long-established products. Continuous introduction of new devices with improved features has greatly shortened the design and expected life cycle of equipment. The average smartphone is replaced every two to three years. Some products will be recycled before the battery needs replacement.

This accelerating rate of change also impacts the electronic connector industry. Connector manufacturers must constantly upgrade the performance of their interconnects in order to satisfy challenging application demands for higher speed, reduced size, and global availability. High-speed backplane connectors, for instance, have experienced major upgrades of signal integrity over the past 10 years as data center applications drive improvements. Several large suppliers have aggressively acquired manufacturers of synergistic products such as electronic sensors, RF antennas, semiconductors, and silicon photonic devices as fast-growing new business opportunities demand these connector-adjacent technologies.

To illustrate the progression of selected electronic product categories that have evolved over the past 20 years, we have assembled a list of 12 technologies that can be considered to be a representative proxy of the electronic industry. These selections will likely continue to have a significant impact on the connector industry for many years into the future.

2000	2010	2020
USB 1.0 @1.5 Mb/s	USB 3.0 @ 5 Gb/s	USB 4 @ up to 40 Gb/s
Blackberry	iPhone	Smartphones as a universal interface device
3G cellular	4G cellular	5G cellular
3.125 Gb/s NRZ	25 Gb/s NRZ	112 Gb/s PAM4
Rise of data centers	Cloud computing	Edge & Fog computing
Copper circuits	Increasing fiber options	Silicon photonics & expanded beam technology
Many proprietary connectors	Licensed second sourced connectors	Rise of open component/system standards
PCIe 1.0 @ 2.5 GT/s	PCIe 3.0 @ 8 GT/s	PCIe 5.0 @ 32 GT/s
10 GbE	40/100 GbE	200/400 GbE
Multilayer enhanced FR4 backplanes	Multilayer high-performance laminate backplanes	Orthogonal midplane, cable backplanes, twinax cabling
Chip feature size 90nm	Chip feature size 32nm	Chip feature size 5-10nm
Antenna TV	Cable TV	Streaming TV

One could suggest many more important candidates for inclusion on this list. Cars have evolved from cruise control to semi-autonomous steering. Access to broadband Internet has been expanded to enable the Internet of Everything. Incandescent light bulbs were obsoleted first by compact fluorescent and more recently by LED bulbs. Microprocessors are being supplemented with field programmable gate arrays, multicore processors, and complete systems on chips (SoCs). (Please note that the order of these 12 is arbitrary with no intent to indicate the level of relative importance.)

Over the next year we will publish a series of articles that will explore each of these 12 electronic trends in greater depth to provide some background on their origin, rapid progression, as well as how they may impact the design and utilization of electronic connectors in the future. We welcome your comments and suggestions as we investigate these topics.