Producing a semiconductor involves multiple steps that can take years and billions of dollars to complete. The foundation of this process is highly advanced semiconductor research. Here are the five distinct stages of production.

1. Research
   Explore new designs, materials, and architectures to spur semiconductor innovation.

2. Design
   Determine the highly intricate circuit design and logic of a semiconductor. Companies that only participate in this stage of production are called “fabless” firms.

3. Manufacturing
   Construct semiconductors on pure silicon wafers using raw materials and highly sophisticated equipment. This process is explained in more detail below. Companies that only participate in this stage of production are called “foundries.”

4. Assembly, Test, & Packaging
   Cut finished semiconductor wafers into individual chips called “dies,” test to ensure functionality, and package for distribution.

5. Distribution
   Deliver finished semiconductors to customers around the world, where they are embedded into countless electronic devices.

Types of Semiconductors

Most electronic products, from computers and smartphones to complex medical diagnostic equipment and supercomputers, contain a variety of types of semiconductors to enable them to function. Integrated circuits (ICs) are sophisticated semiconductors that often contain billions of transistors and perform high-level functions, while discrete semiconductors often contain fewer transistors and perform simpler functions.

Within ICs are digital semiconductors, which process binary information used by computers, and analog semiconductors, which regulate “real world” conditions such as temperature, speed, sound, and electrical current. Within the digital category are memory products, micro-components (including microprocessors and microcontrollers) and logic products. Memory semiconductors play the critical role of storing data and information in electronic devices, and micro-components and logic devices perform some of the most complex functions in a typical electronic product.

How a Semiconductor is Made

Global Semiconductor Value Chain Map

Few industries, if any, feature a value chain as complex, geographically dispersed, and intensely interconnected as that of the semiconductor industry. It is common for a semiconductor to travel across the globe multiple times, covering many thousands of miles, during the production process. This highly globalized and interdependent structure has been an amazing success story, benefiting the semiconductor industry, participating countries, the global economy, and consumers. An example of the path a semiconductor can take during production is shown here.
Semiconductors, the tiny chips that are the brains of modern electronics, form the basis of America’s innovation infrastructure. They enable technologies critical to U.S. economic growth, national security, and global competitiveness. They are giving rise to new technologies that hold the promise to transform society for the better, including artificial intelligence, quantum computing, advanced wireless networks, the Internet of Things, self-driving cars, and more. Semiconductors are the product of unfathomably advanced research, design, and manufacturing.