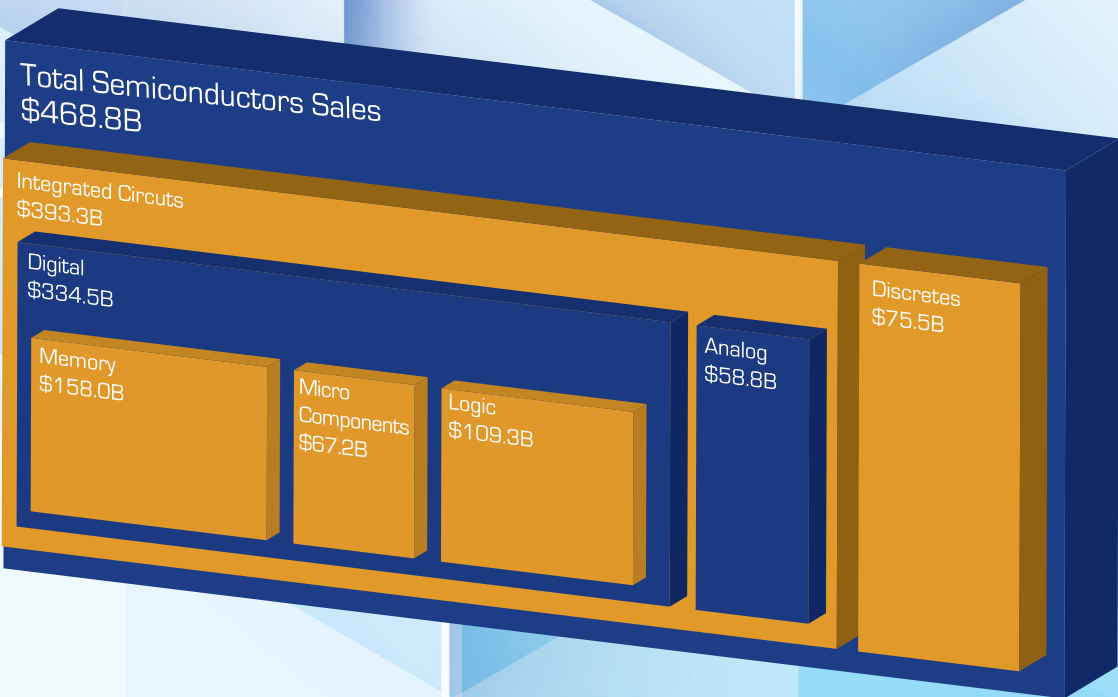


Types of Semiconductors

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 discretes 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

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.



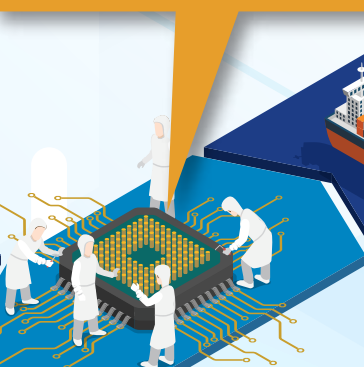
3. Manufacturing

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.



Semiconductor Manufacturing



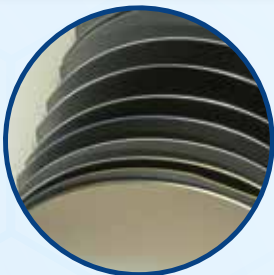
Raw Materials

Many semiconductors start out as sand, which contains a large amount of silicon, but other materials can also be used.



Ingot

Sand is purified and melted into solid cylinders called ingots, weighing 200+ lbs.



Blank Wafer

The ingot is then sliced into very thin (1 mm) silicon wafers and polished to a flawless finish.

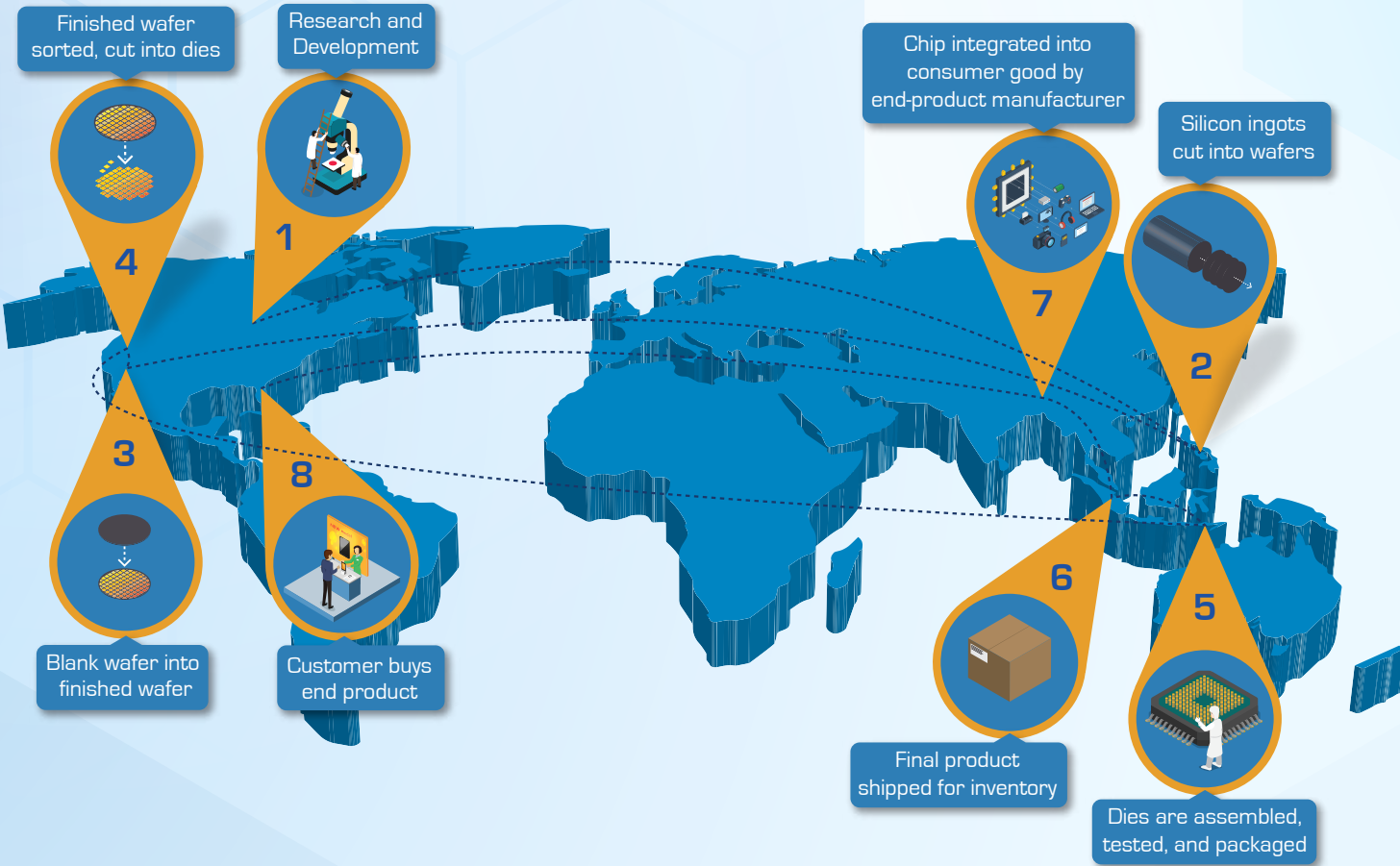


Finished Wafer

Identical semiconductors are then constructed on the blank wafer, a process that involves hundreds of steps.

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, benefitting the semiconductor industry, participating countries, the global economy, and consumers. An example of the path a semiconductor can take during production is shown here.



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S I A

SEMICONDUCTOR
INDUSTRY
ASSOCIATION

Making Semiconductors:

The Highly Complex and Global
Chip Research, Design, and
Manufacturing Process



Semiconductors: A Key Enabling Technology

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.

