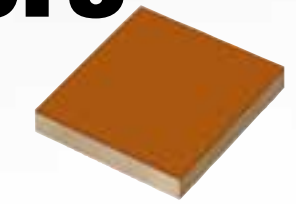
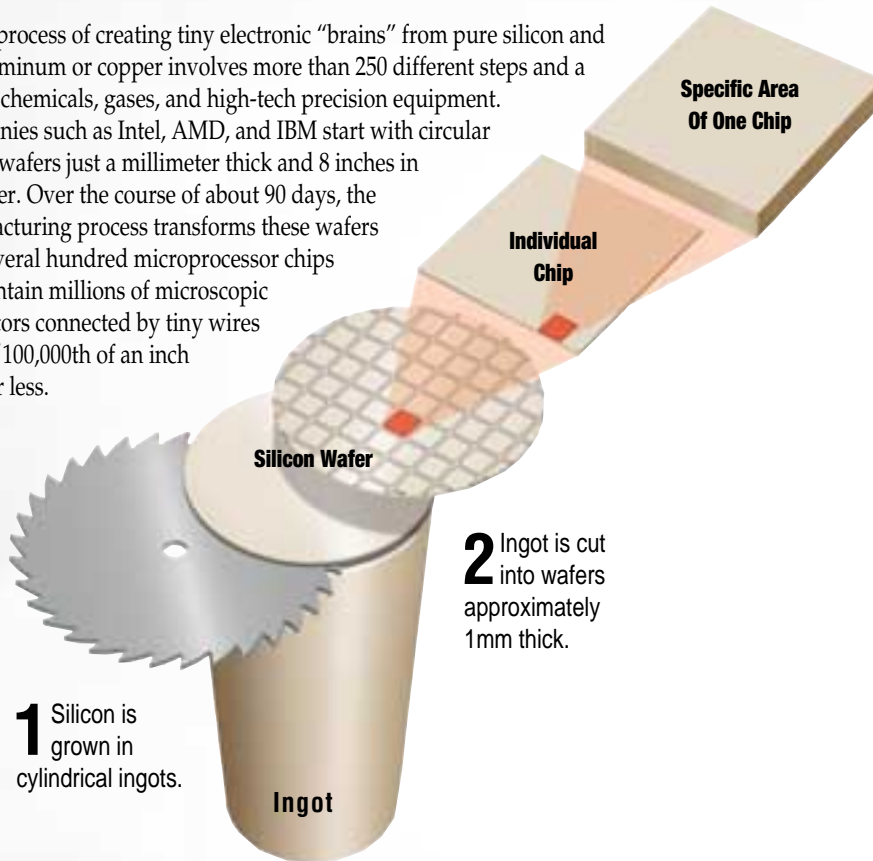
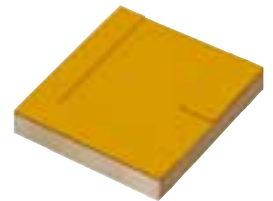


How Microprocessors Are Manufactured

The process of creating tiny electronic “brains” from pure silicon and aluminum or copper involves more than 250 different steps and a host of chemicals, gases, and high-tech precision equipment. Companies such as Intel, AMD, and IBM start with circular silicon wafers just a millimeter thick and 8 inches in diameter. Over the course of about 90 days, the manufacturing process transforms these wafers into several hundred microprocessor chips that contain millions of microscopic transistors connected by tiny wires only 1/100,000th of an inch wide or less.



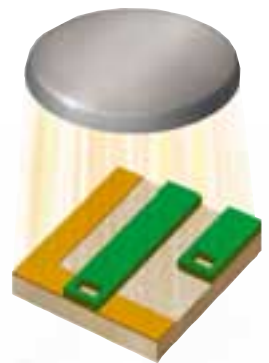
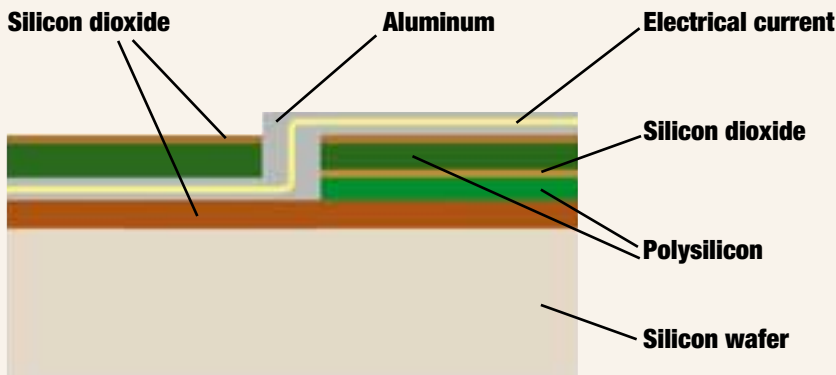
3 Exposure to intense heat and gases causes a thin layer of silicon dioxide to grow on the surface of the wafer like rust.



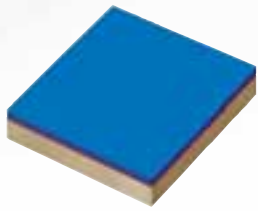
8 A second layer of silicon dioxide is grown on the wafer to act as insulation between layers of circuitry pathways.

Chips On The Side

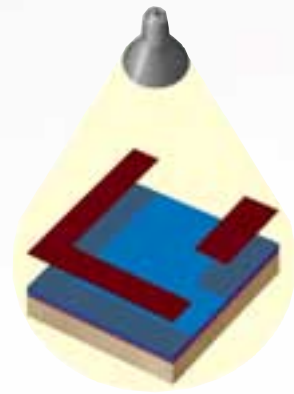
This cross-section represents a simplified view of the layers used to create a processor's intricate circuitry. Actual processors contain about 20 interconnected layers.



13 A process called “doping” bombards the chip with chemical ions, altering the electrical properties of junctions in the circuitry pathways to create transistors.



4 A thin layer of light-sensitive photoresist is applied.



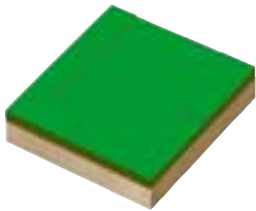
5 A stencil-like mask that contains the desired circuitry pattern is applied, and UV light turns unmasked areas of the photoresist into a jelly-like substance.



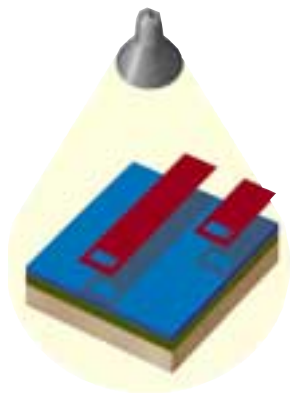
6 The jellied photoresist is washed away leaving the silicon dioxide exposed.



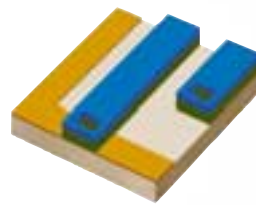
7 The exposed silicon dioxide is etched away using special chemicals, laying bare the silicon wafer. Then the remaining photoresist is washed away.



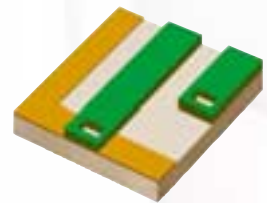
9 A layer of polysilicon, the base for the next level, is applied.



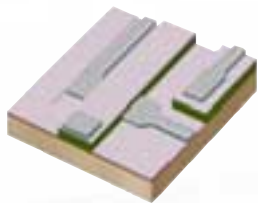
10 Next, another layer of photoresist is applied and masked like before.



11 The process is repeated as before; as the exposed, chemically soluble photoresist is washed away, the appropriate silicon dioxide is cleared away.



12 As more and more layers are added, vertical pathways, or “windows,” are created to connect each layer to the next.



14 Aluminum (or copper) fills the pathways etched into silicon creating wires that connect the transistors.



15 A precision diamond saw cuts the wafer into separate sections.



16 Finally, the manufacturer encases the chips in the familiar processor packages and ships them to customers.