

# Physical Device to Code

**1** Electronic circuits\* are used to build modern computers.

\* Transistor invented 1947 by **Bardeen, Brattain, and Shockley**. First transistor-based computers early 1950s (earlier digital computers, 1939-1940s, used vacuum tubes).

**MOSFET**, a versatile, simpler and smaller transistor invented 1959 by **Mohamed Atalla and Dawon Kahng**.

perhaps the most abundantly produced device in history

**2** The **transistor** is a physical building block of electronic circuits used as an elementary 2-state switch.

old-school bipolar junction device  
transistor-transistor logic (TTL)  
wiring + totem-pole output circuit  
fun names

**3** Iconic circuit (main figure) implements a simple **digital logic device** (3-input NAND gate) via 5 electronic switches (transistors Q1-4 and diode D0).

Source: Millman & Grabel, *Microelectronics* (2nd ed, pp. 243-47), transistor logic technology circa 1966-85 from my undergrad electronics textbook.

**4** NAND gate, a building block of digital logic, is a logical\* switch based on NOT-AND (turns OFF only if all inputs are ON).

\* Where action controlled by a *Boolean* operation such as AND, OR, or XOR. Physical features of transistor devices determine how to wire them to perform the logic.

**5** Any two symbols may encode the two **states** of a switch; 0/1 are useful (see why in 7).

coined ~1947 by John Tukey  
010101  
▲  
Bit (*binary digit*)

**8** 0s and 1s provide a common form to store **operations and operands** in the same memory.

**7** May interpret the resulting binary code as a number in the binary system to indicate a device's operational state, a stored value, or a numeric coding of an item, such as a text character.

**6** Sequences of 0s and 1s can encode switching states of a digital device to denote a stored info or an operational positions during a computation.

