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).

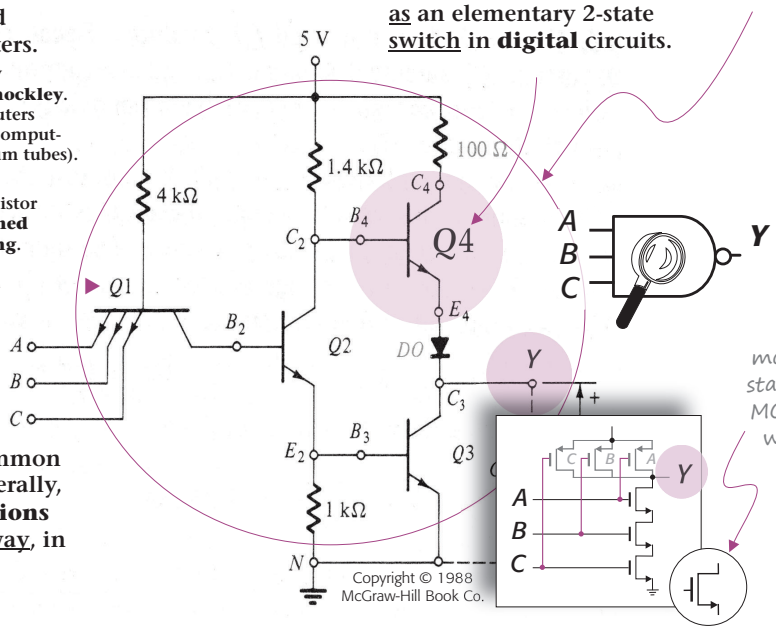
The **MOSFET**, a versatile, simpler and smaller transistor invented 1959 by **Mohamed Atalla** and **Dawon Kahng**.

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 in **digital** circuits.

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

fun names



3 The iconic circuit in the figure implements a simple **digital logic** device (3-input *NAND* gate) via five electronic switches (transistors Q1–4 and a diode).

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

modern standard MOSFET wiring

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

* Action based on 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 next).

Term coined ~ 1947 by John Tukey

010101

Bit (binary digit)

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

7 A resulting **binary code** can be interpreted as a number, expressed 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.

8 0s and 1s provide a common form for numbers (generally, **operands**) and **operations** to be stored the same way, in the same memory.