

Semiconductor Technology from A to Z

How does it work?

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Devices & Digital Technology

How does a MOSFET work?

A gate electrode uses an electric field to control the conductivity of a channel between source and drain. Once the gate voltage is high enough, a conductive channel forms and current can flow; below that threshold, the transistor stays off. The gate is isolated from the channel by a thin oxide layer, so essentially no control current flows.

[Learn more in the chapter Field-Effect Transistors →](#)

How does a FinFET work?

In a FinFET, the conducting channel stands as a thin, vertical "fin" on the substrate, wrapped by the gate on three sides. This multi-sided wrap gives the gate much better control over the channel than in planar transistors. That reduces leakage currents and allows further shrinking of feature sizes.

[Learn more in the chapter Construction of a FinFET →](#)

How does a transistor work in general?

At its core, a transistor is an electronically controllable switch: a small control signal (voltage or current) turns a larger current path on or off, or amplifies it. The two main families are bipolar transistors (current-controlled) and field-effect transistors (voltage-controlled). Modern chips consist of billions of such switches.

[Learn more in the chapter The p-n Junction →](#)

How does flash memory work?

Inside a flash cell transistor, an additional, electrically isolated floating gate sits between the control gate and the channel. Electrons are moved onto or off this floating gate by quantum tunneling and stay trapped there even without power. Their presence measurably shifts the transistor's switching threshold — that's the stored "0" or "1".

[Learn more in the chapter Why New Memory Technologies? →](#)

How does MRAM work?

MRAM stores data through magnetization direction in a magnetic tunnel junction, not through electric charge. A reference layer has fixed magnetization, a free layer has switchable magnetization; whether the two are parallel or antiparallel changes the tunnel resistance measurably. In STT-MRAM, the free layer is switched directly by a spin-polarized write current.

[Learn more in the chapter MRAM - Magnetoresistive RAM →](#)

How does a microprocessor work at the chip level?

A microprocessor combines a control unit, arithmetic logic unit (ALU), registers, and cache memory on a single die, connected via internal buses. The control unit fetches instructions from memory, decodes them, and directs the ALU to execute them — typically using pipelining to process multiple instructions simultaneously. Physically, this is billions of transistors wired together across multiple metal layers.

[Learn more in the chapter Processor Architecture →](#)