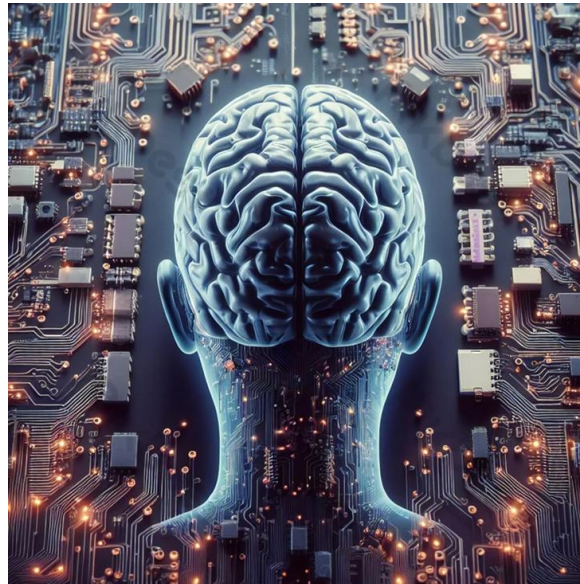


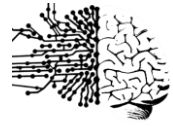
The Art and Science of PCBs



Brain of Electronics

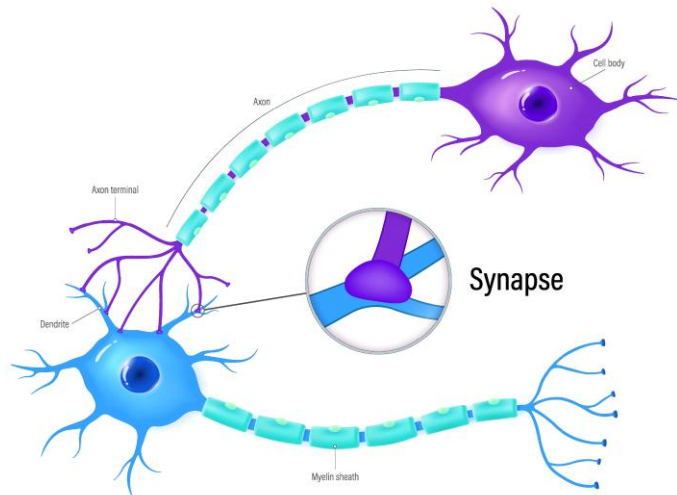
- PCBs are the silicon brains of embedded systems.
- Just as neurons transmit information, PCB traces carry signals and power.
- Without PCBs, modern electronics would be chaotic.





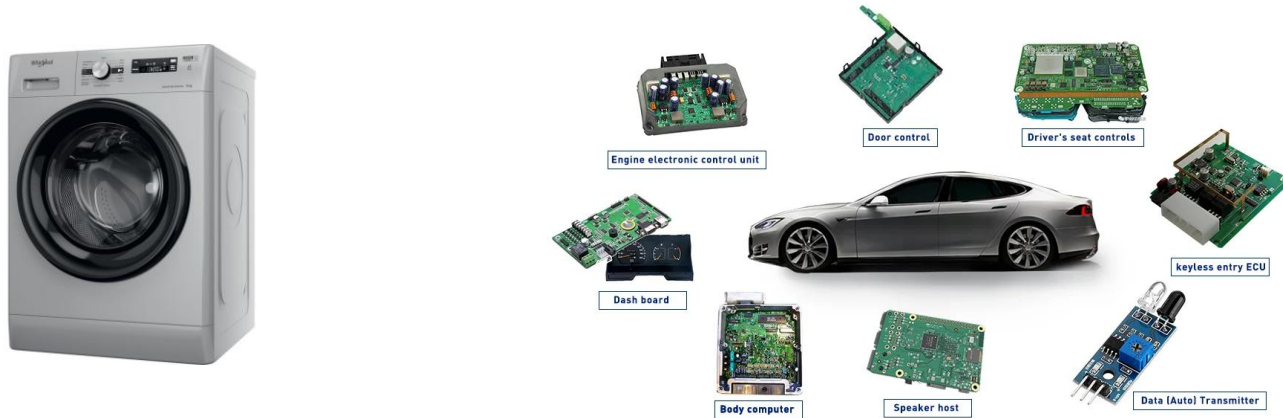
PCB vs Human Brain

Brain Element	PCB Equivalent
Neurons	Electronic Components
Axons/Dendrites	Copper Traces
Synapses	Solder Joints & Vias
Cerebral Cortex	Layers & Substrate



Everyday Importance of PCBs

- Found in smartphones, vehicles, medical devices, etc...
- Invisible heroes of modern life.



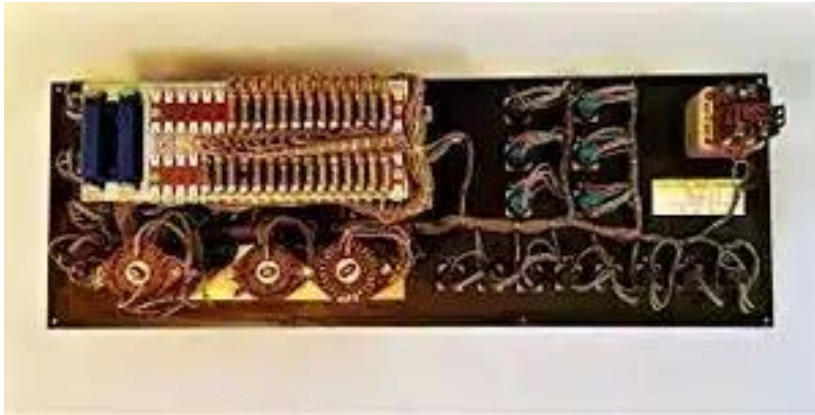


A Timeline of PCB Evolution

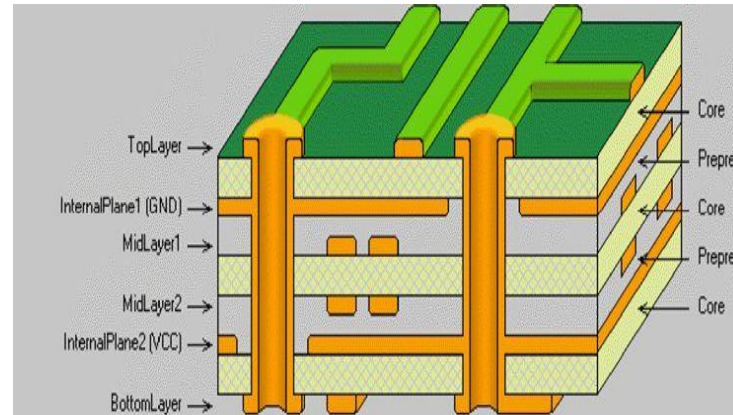
1903 : Invention des circuits imprimés.

1950 : Introduction des cartes multicouches.

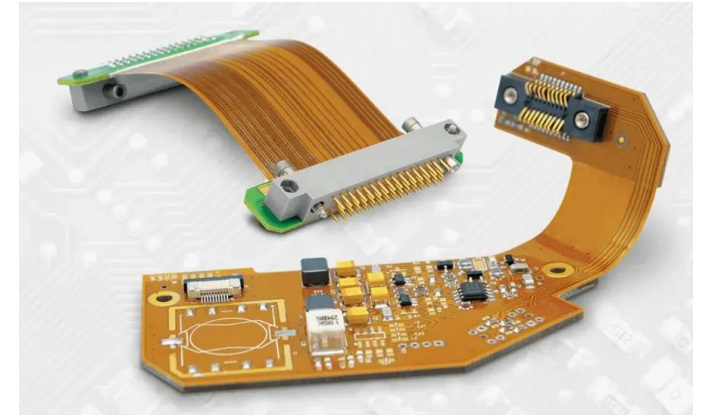
2020 : Apparition des PCBs flexibles et 3D.



Albert Hanson's Vision



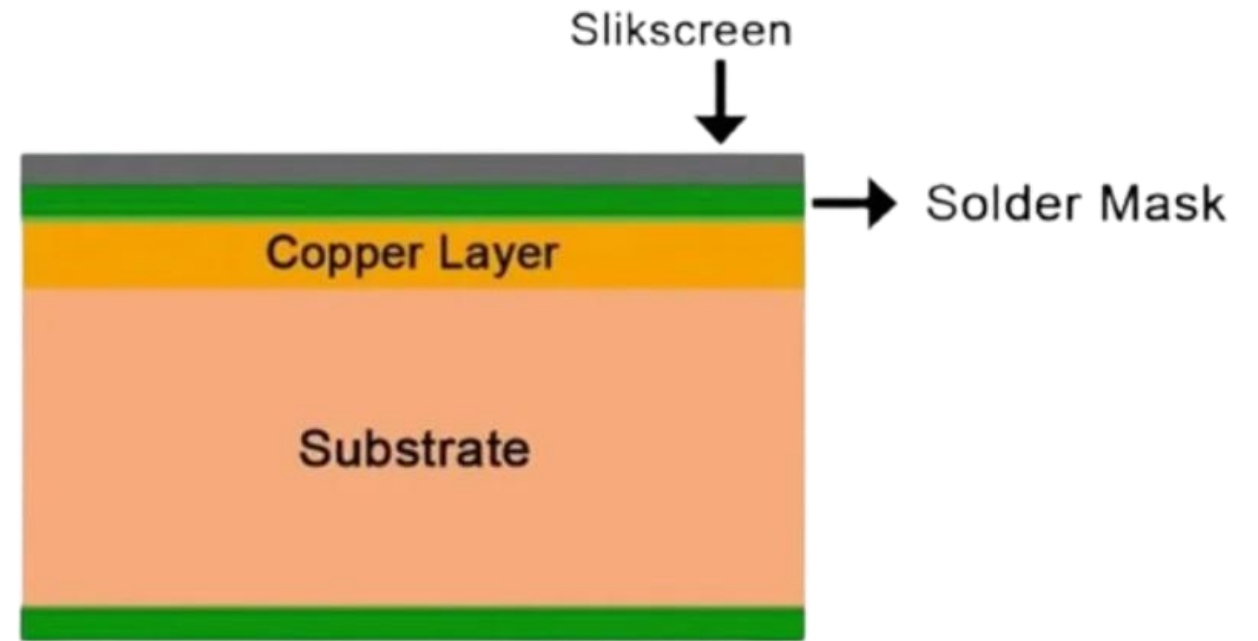
Multi layer PCBs



flexible & 3D PCBs

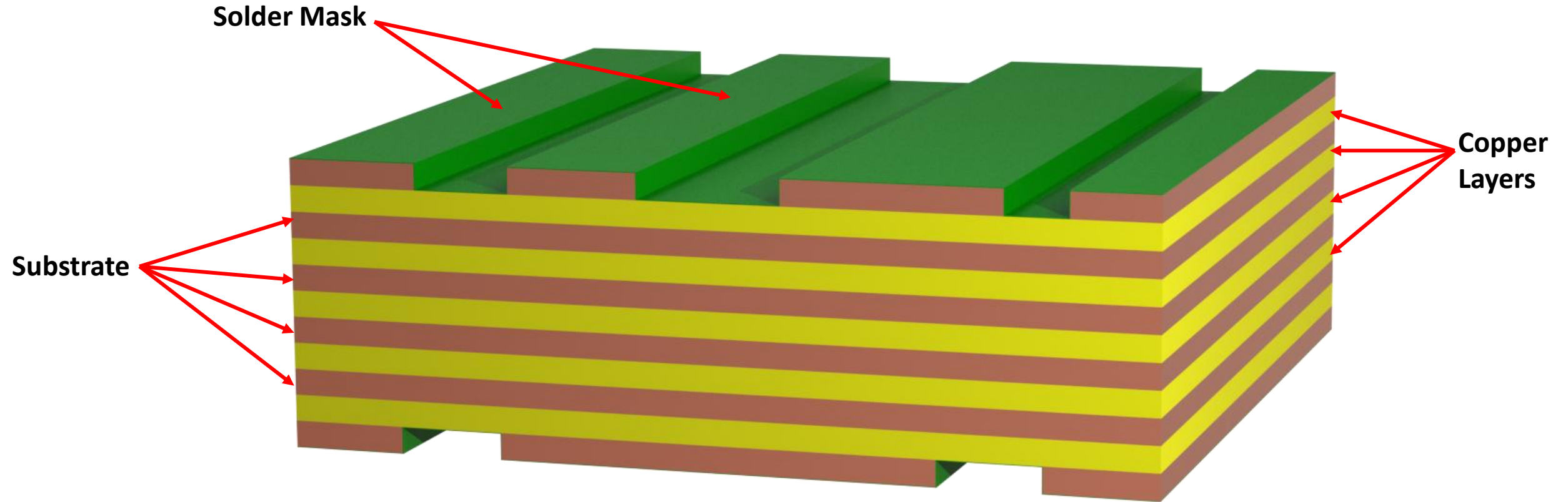
PCB Structure (Anatomy)

- Silkscreen: Component labels
- Solder Mask: Green protective layer
- Copper Layers: Conductive tracks
- Substrate: The base (e.g., FR4)



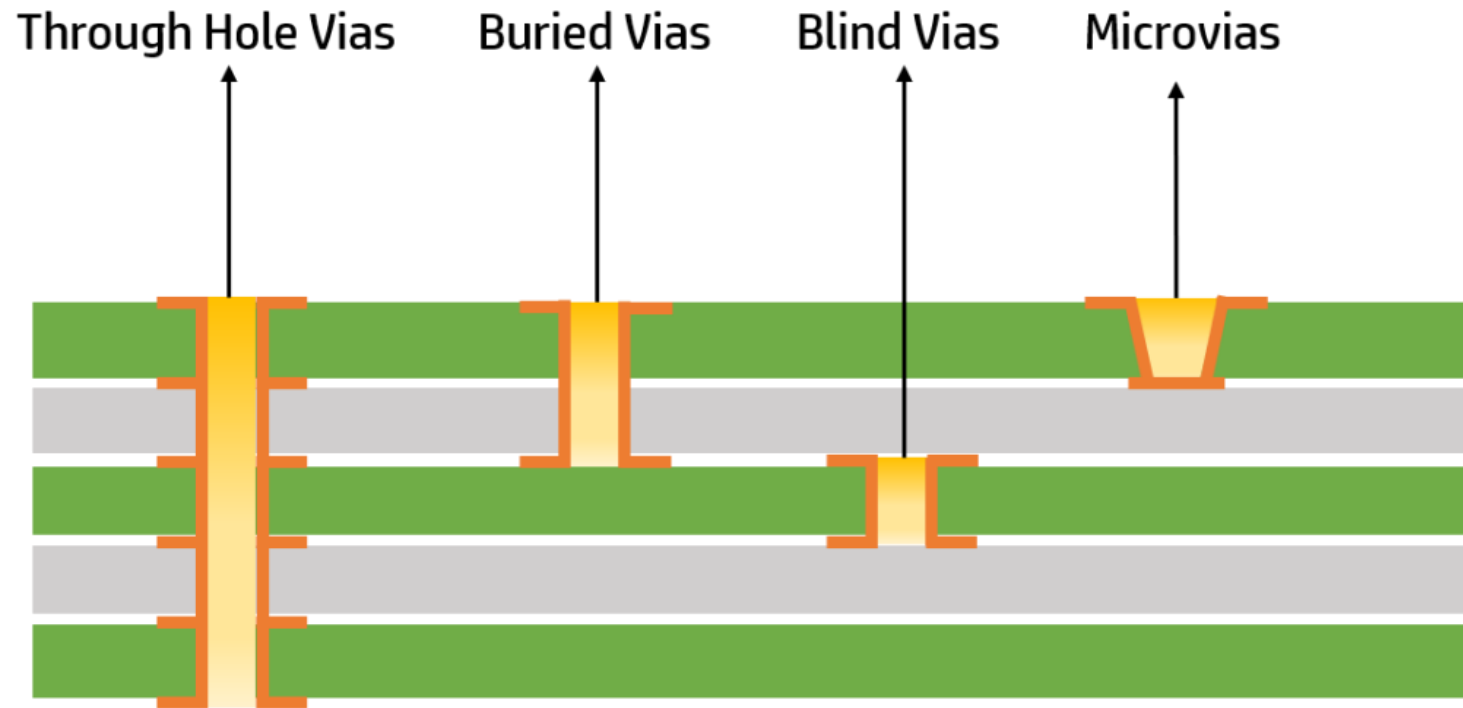
Mono layer PCB

PCB Structure (Anatomy)

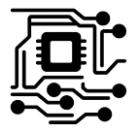


Multicouche PCBs

PCB Structure (Anatomy)

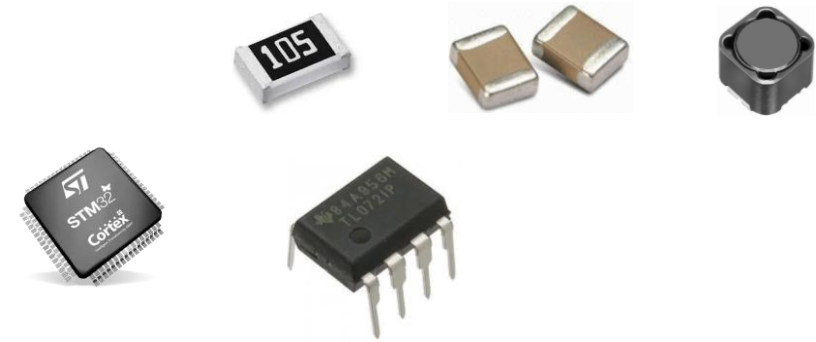


PCB Vias



Electronic Components on PCBs

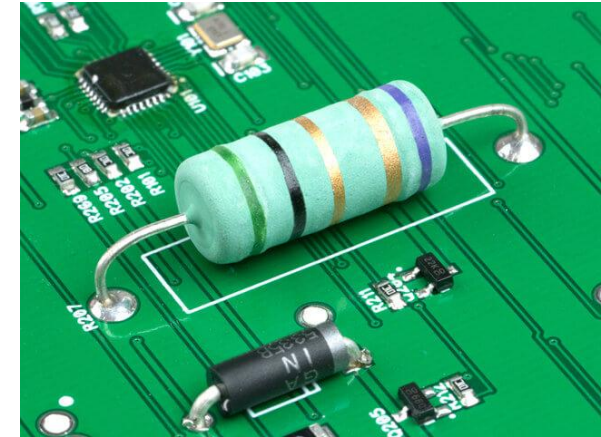
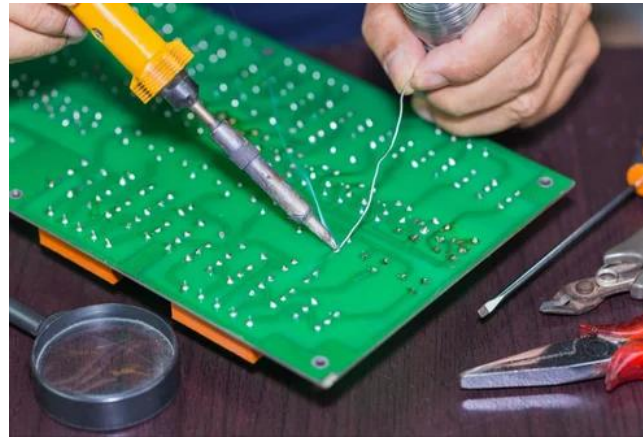
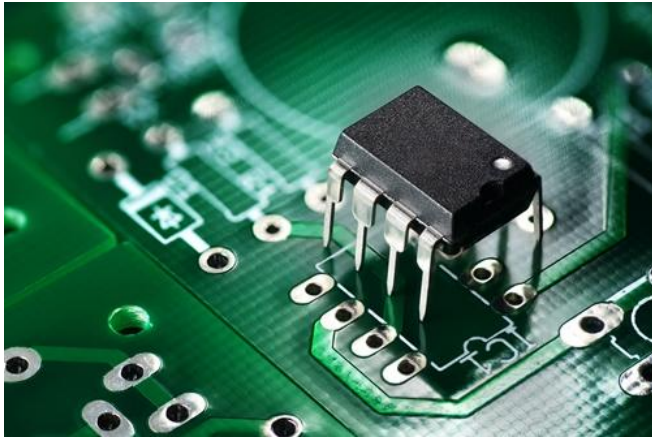
- Passive: Resistors, Capacitors, Inductors
- Active: Microcontrollers, Op-Amps
- Power management: Regulators
- Connectors: USB, Headers





Mounting Technologies

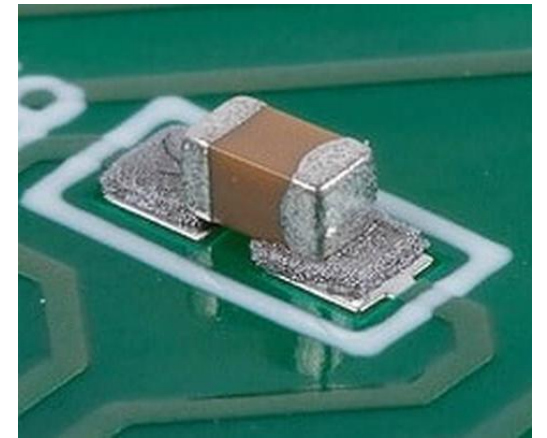
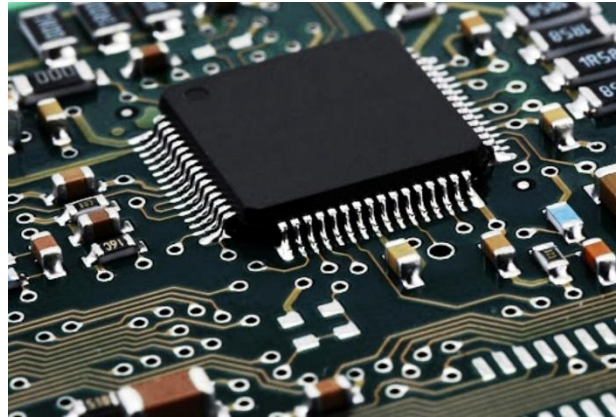
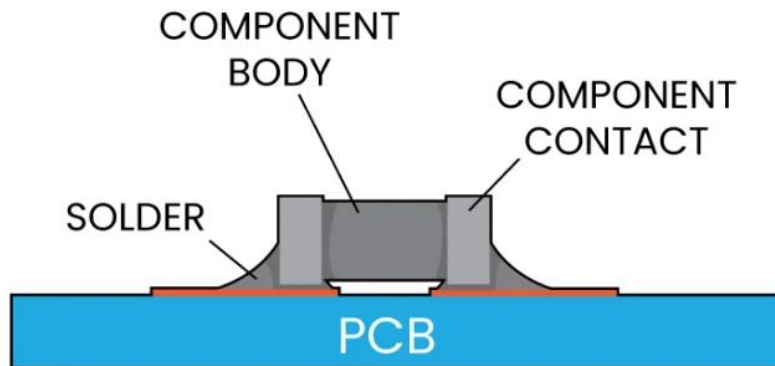
- THT (Through-Hole): Traditional, reliable





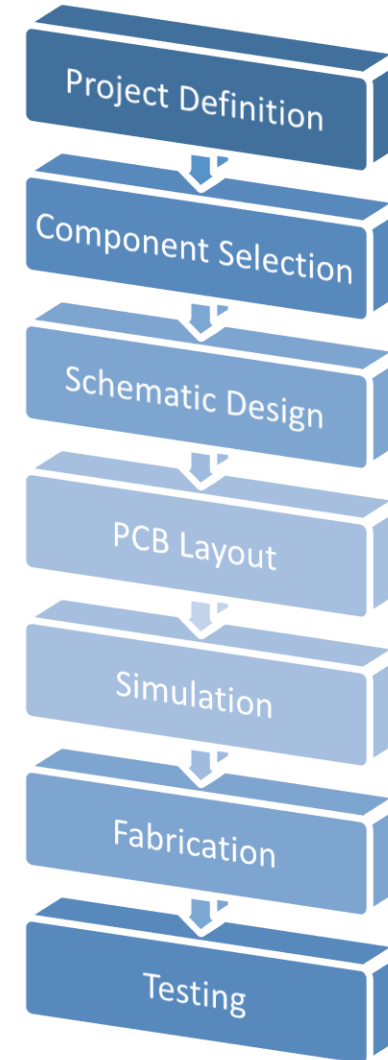
Mounting Technologies

- SMT (Surface-Mount): Compact, modern



From Idea to Reality: PCB Design Flow

1. Project Definition → Define purpose
2. Component Selection → Choose parts
3. Schematic Design → Draw circuit
4. PCB Layout → Place & route
5. Simulation → Test virtually
6. Fabrication → Produce board
7. Testing → Check functionality





Simulation, Validation & Fabrication tools

- Simulation: LTSpice, Multisim



- DRC checks: spacing, width

- Gerber Generation

- Manufacturers: JLCPCB, PCBWay



To Infinity and Beyond

- PCBs are the silicon brains of embedded systems.
- Just as neurons transmit information, PCB traces carry signals and power.
- Without PCBs, modern electronics would be chaotic.