CET246 Electronic Design Automation

Printed Circuit Board Anatomy

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Introduction

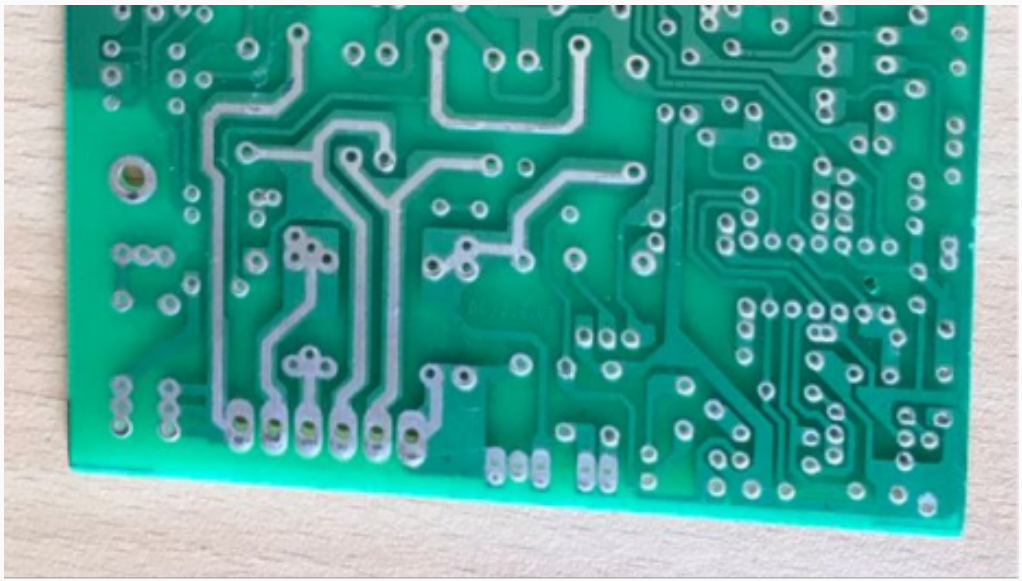
A printed circuit board (PCB):

1. Supports the components physically
2. Connects the components electrically

Electronics have become **smaller** and **more complex** leading to the need for **precise planning** and **thorough testing**

Electrical Connections

- A “trace” is the equivalent of a wire for conduction electricity
- Power/ground traces tend to be larger
- Signal traces are usually narrower

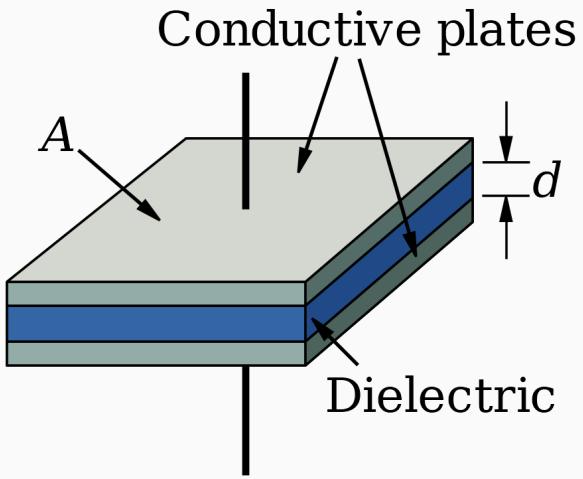


Material Properties

Electrical Properties

Electrical properties include, but are not limited to:

1. Dielectric Constant
2. Dielectric Breakdown Strength
3. Dielectric Strength
4. Arc Resistance



Physical Properties

Physical properties include, but are not limited to:

1. Tensile Strength
2. Compression
3. Shear
4. Flexural Strength
5. Impact Strength
6. Laminating difficulty
7. Copper adhesion
8. Machinability
9. Dimensional Stability

Environmental Properties

Environmental properties include, but are not limited to:

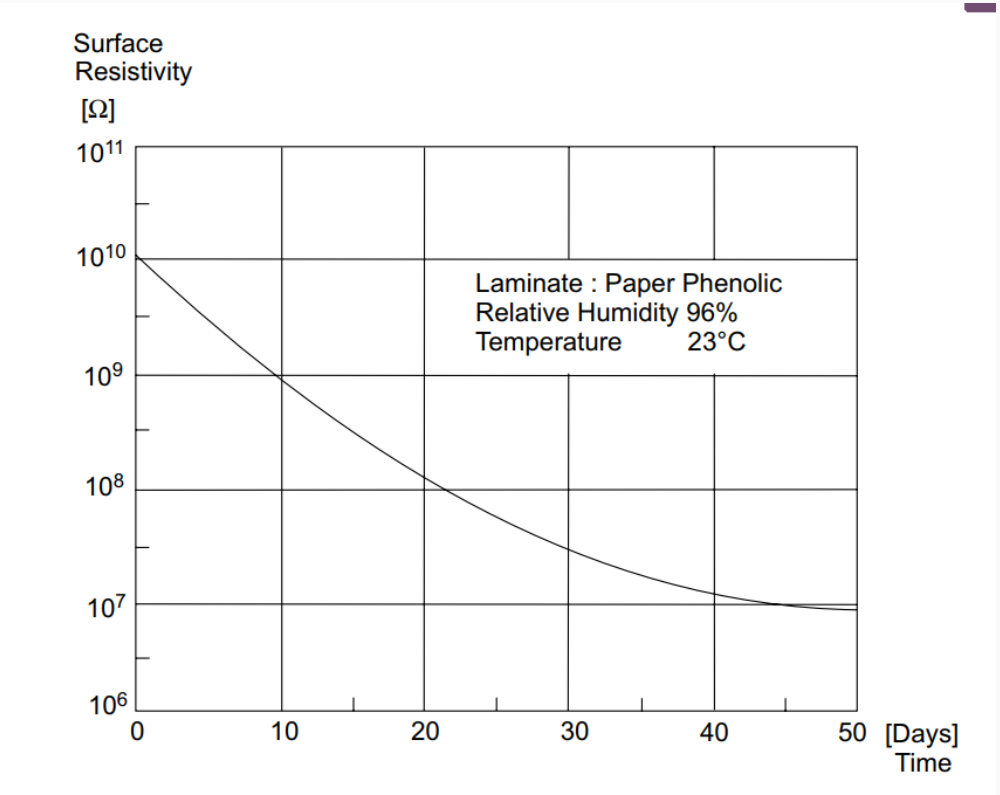
1. Absorption of water
2. Environmental resistance
3. Fungus resistance
4. Flammability
5. Self-extinguishing
6. Heat resistance

Common Materials

Paper Laminate

Resin made of phenol and formaldehyde, reinforced with paper filler

- Easy Fabrication
- Low cost
- Poor arc resistance
- High water absorption



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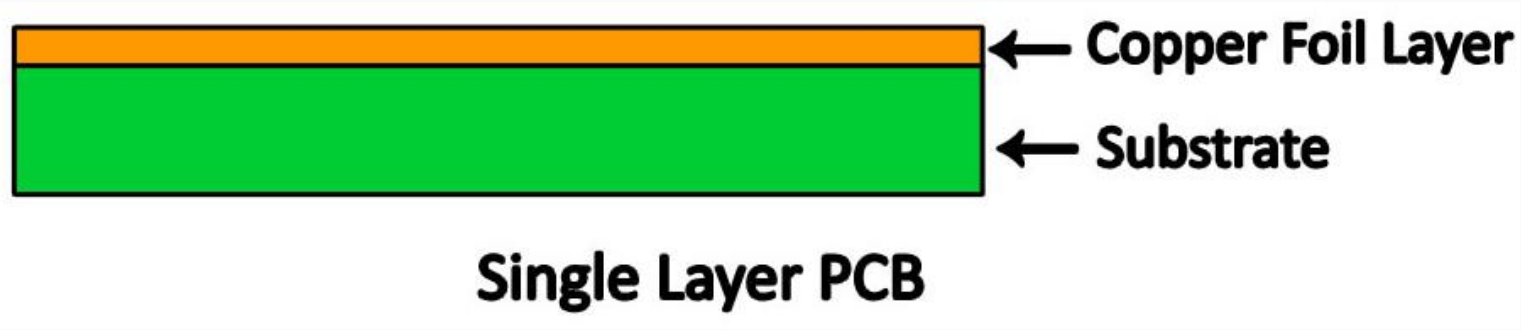
Reinforced with glass fiber or cloth fiber as filler and epoxy resin

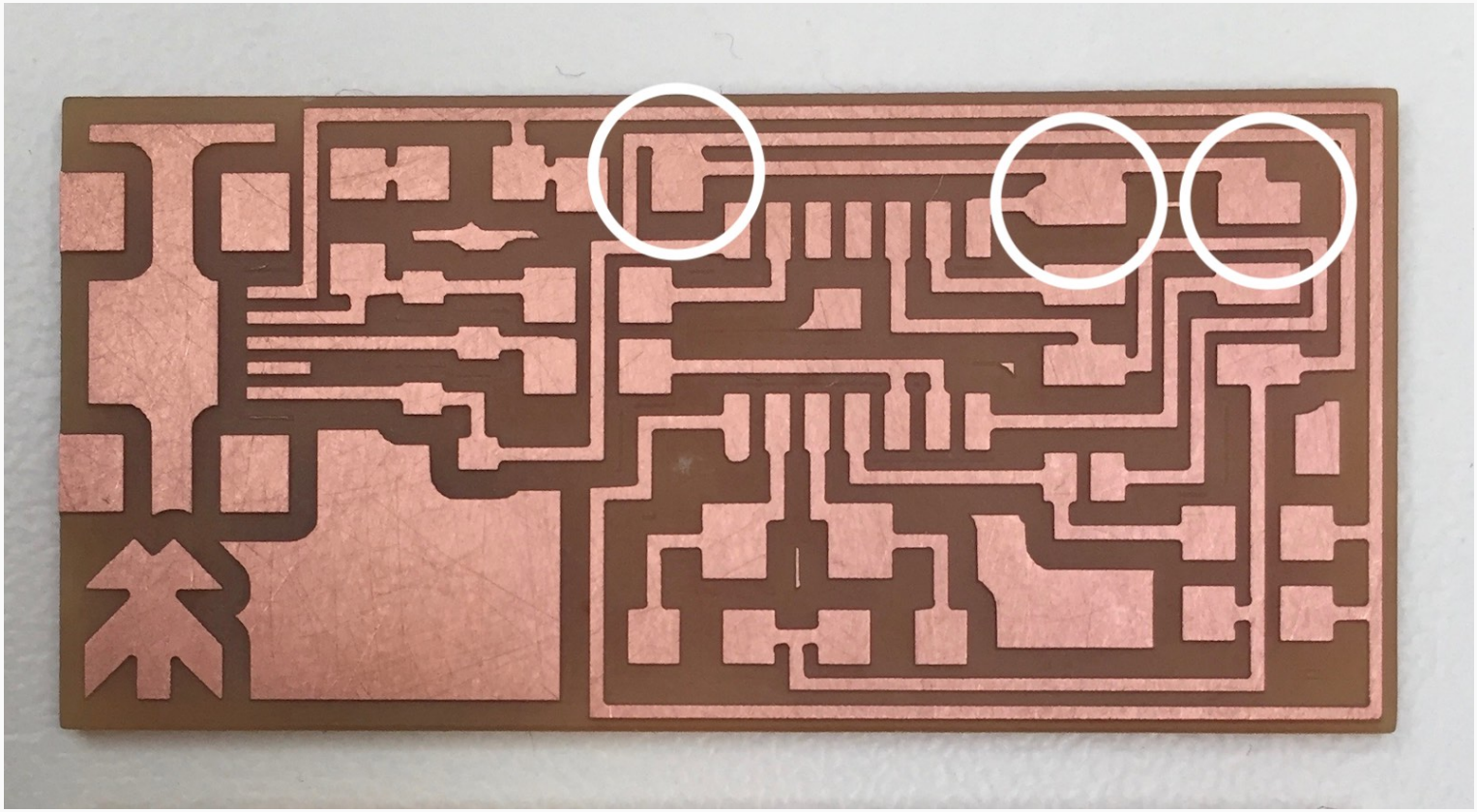
- Good dimensional stability
- Good mechanical strength
- Superior electrical properties
- Low water absorption
- Higher cost

Layers

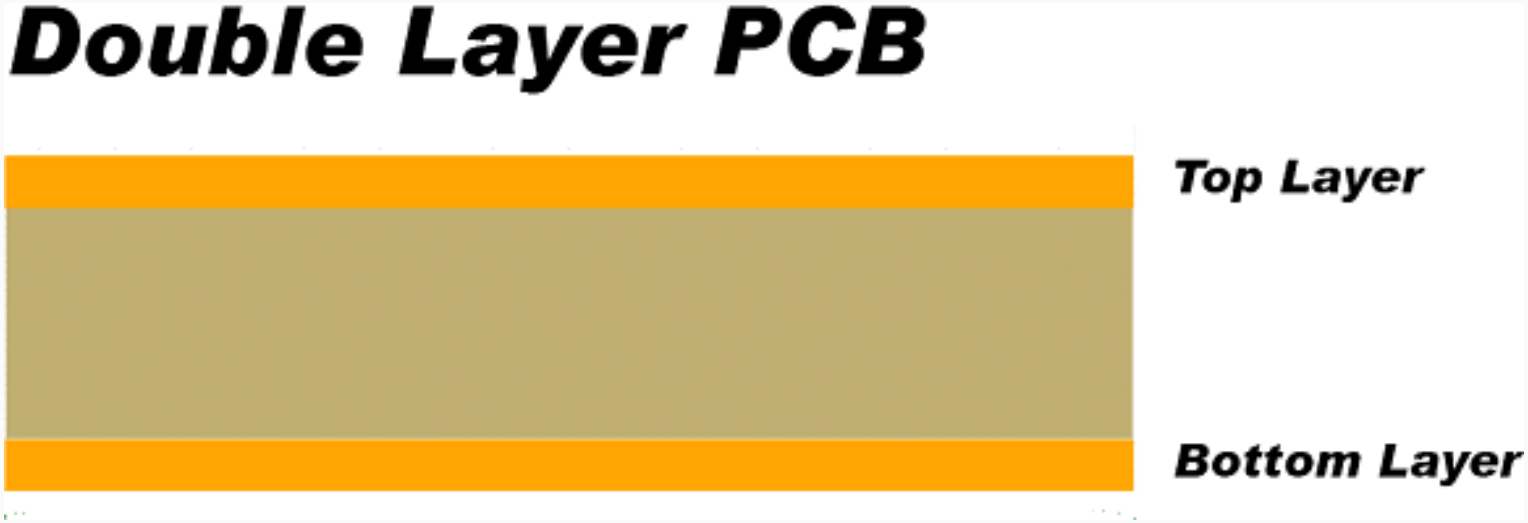
Single Layer Boards



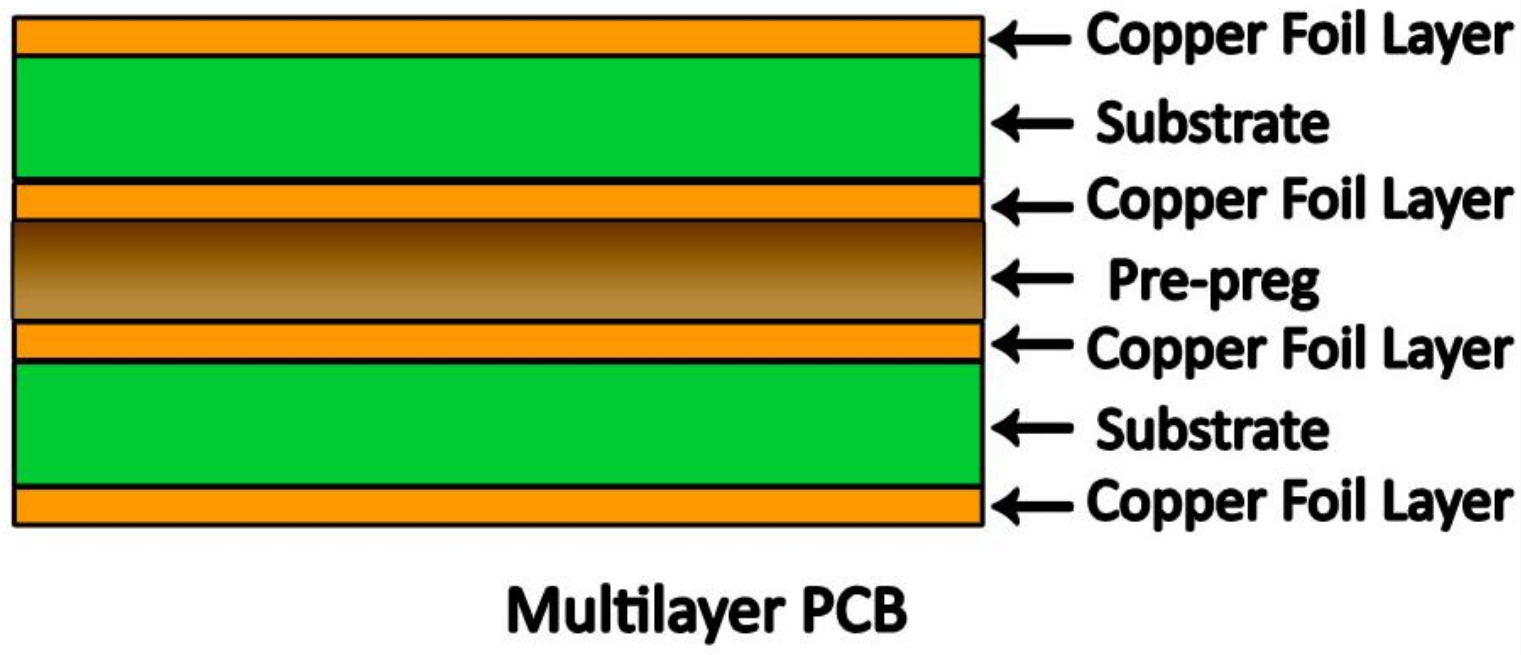
Single Layer Boards



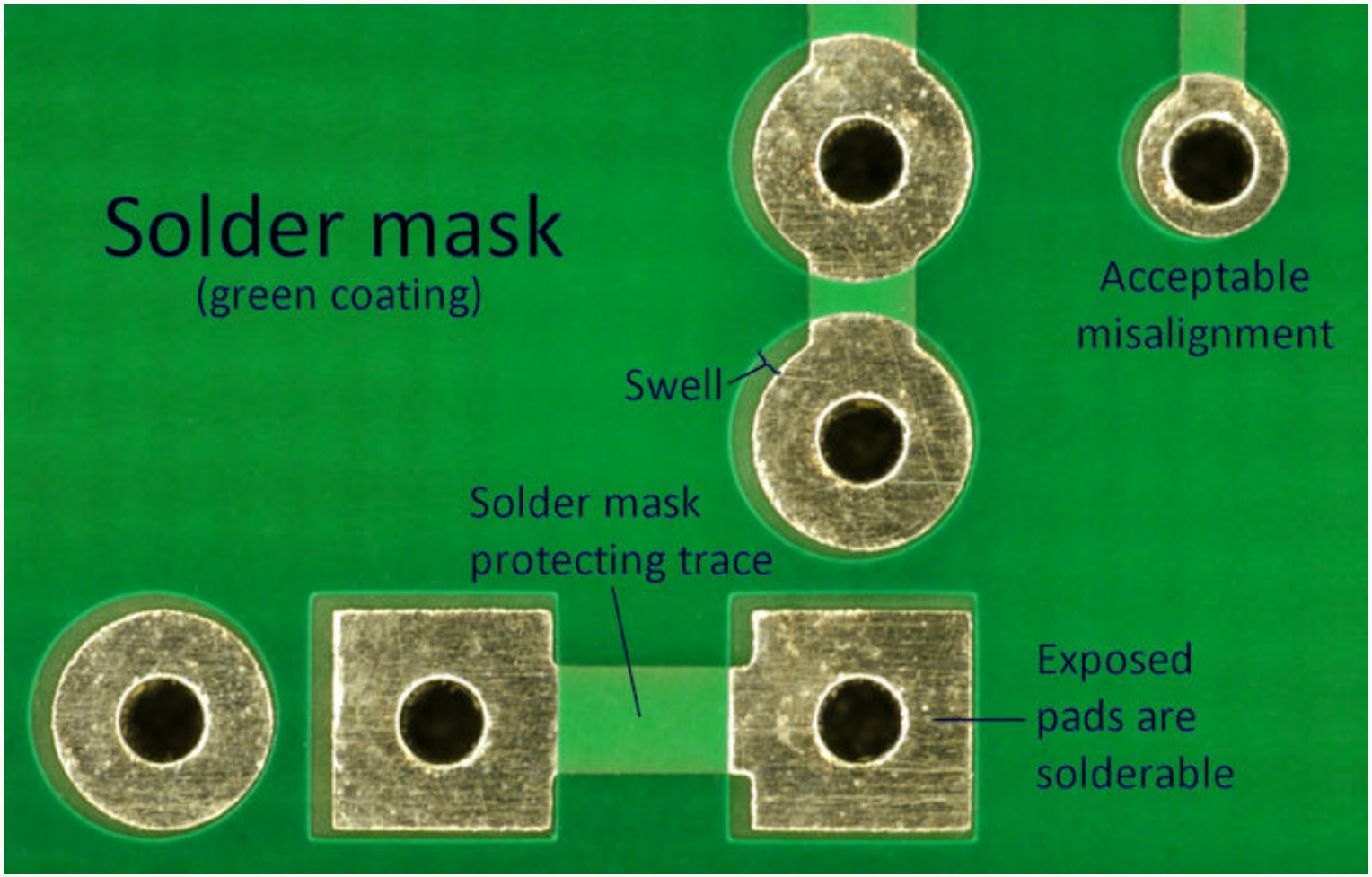
Double Layer Boards



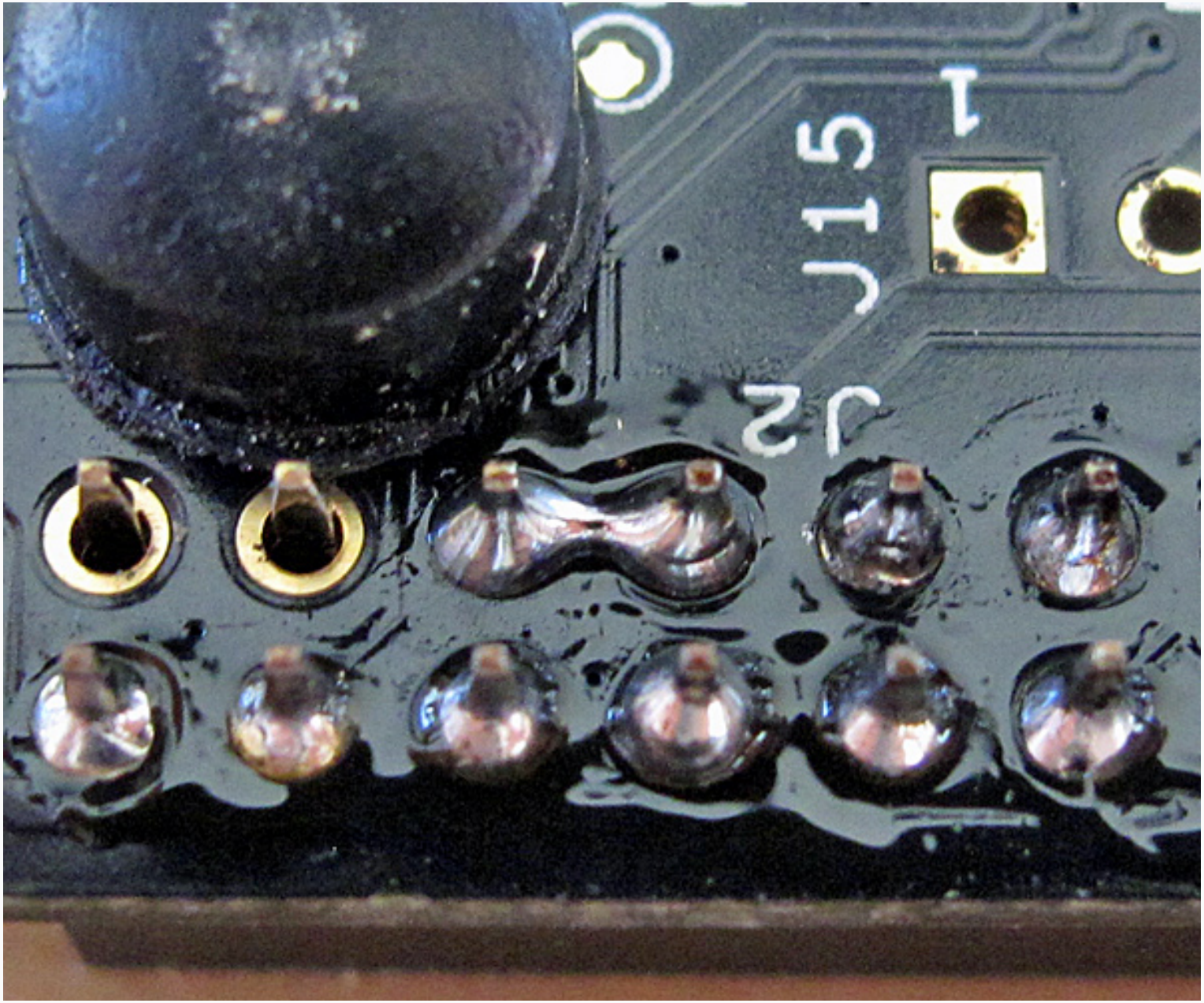
Multi-Layer Boards



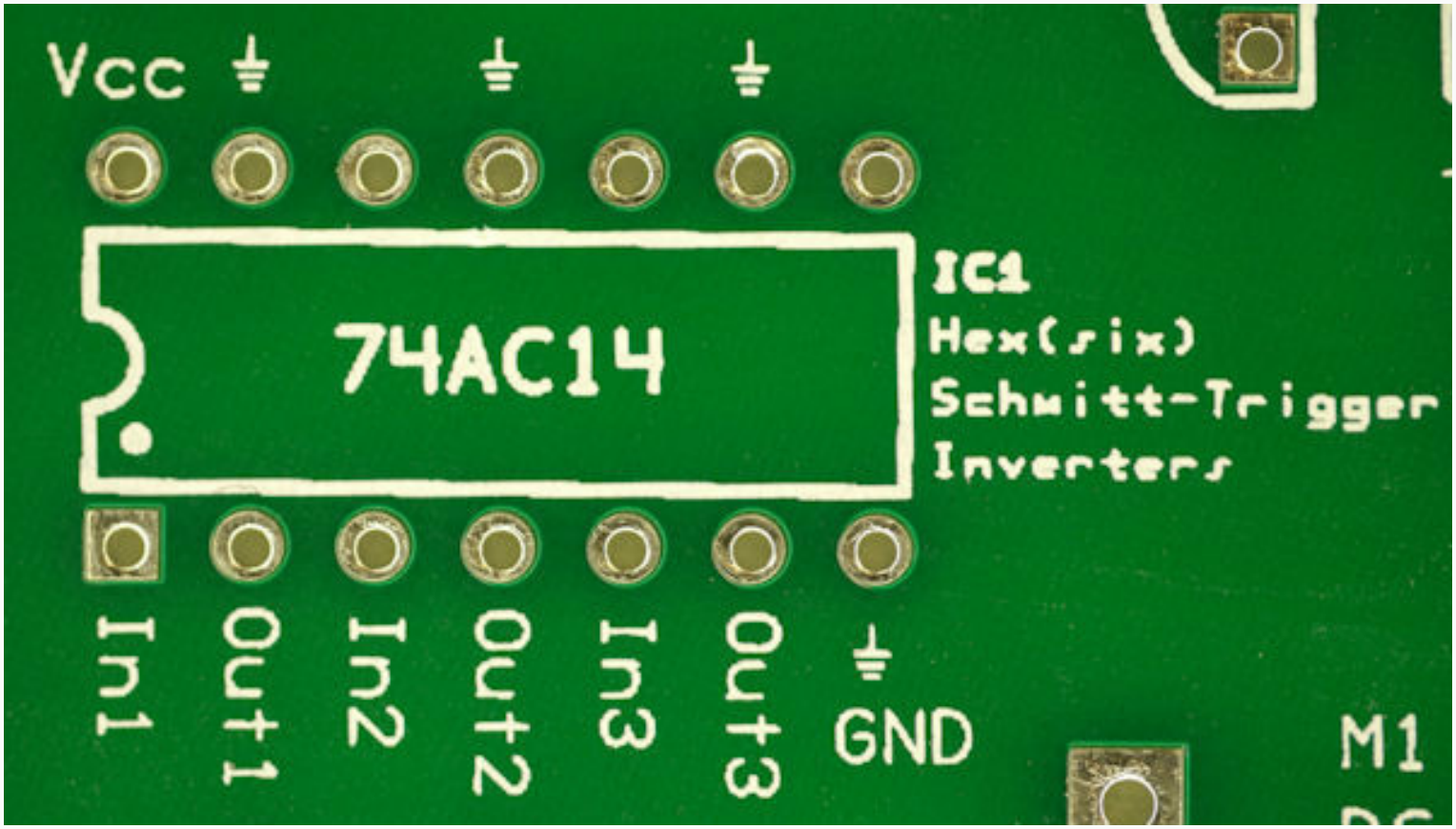
Solder Mask


Solder mask
(green coating)
Acceptable
misalignment
Swell
Solder mask
protecting trace
Exposed
pads are
solderable

Solder Mask

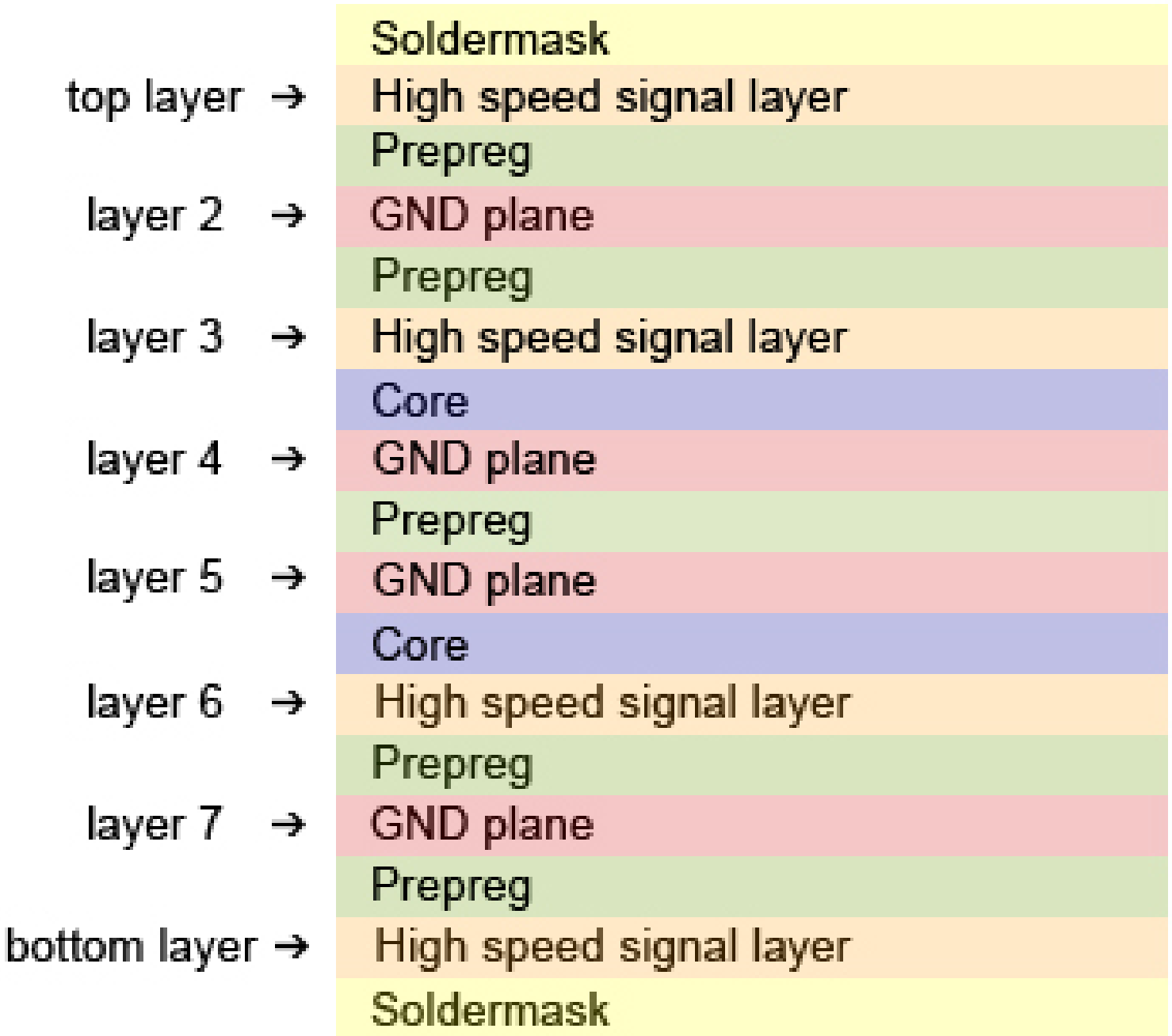


Silk Screen


Vcc
74AC14
IC1
Hex(six)
Schmitt-Trigger
Inverters
In1
Out1
In2
Out2
In3
Out3
GND
M1

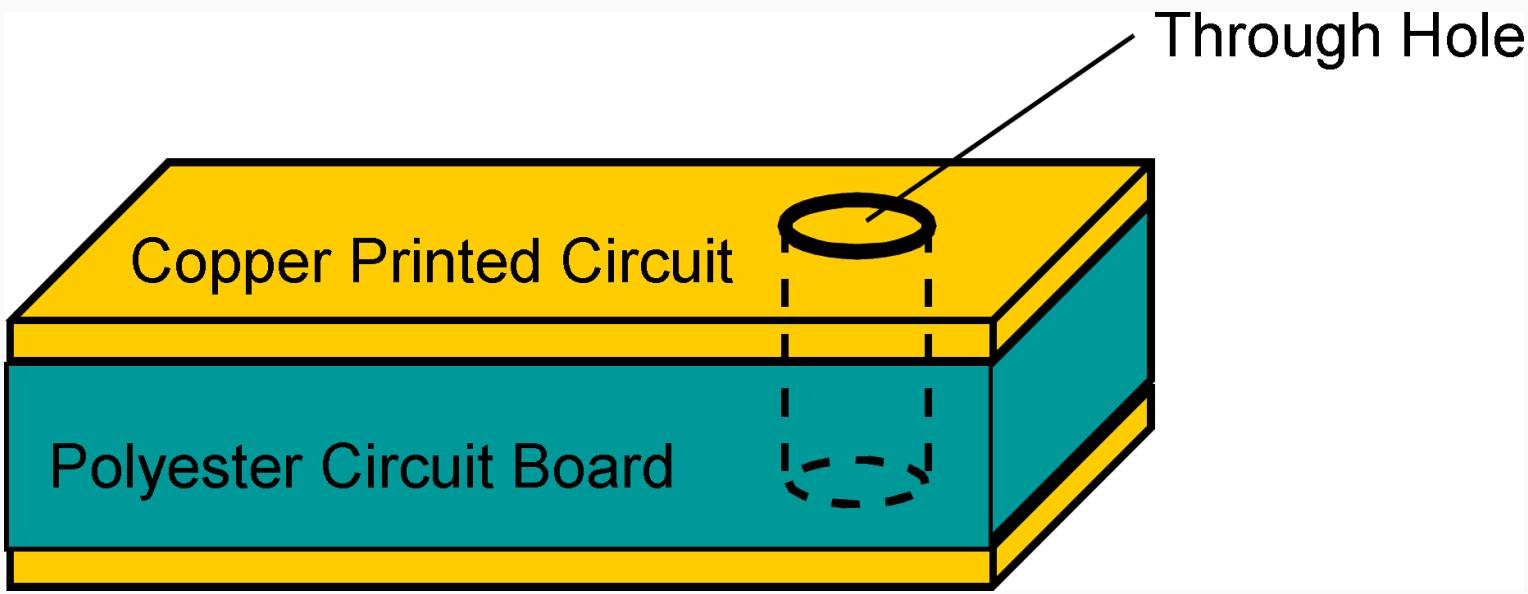
Multi-layer Example

Multi-layer Example

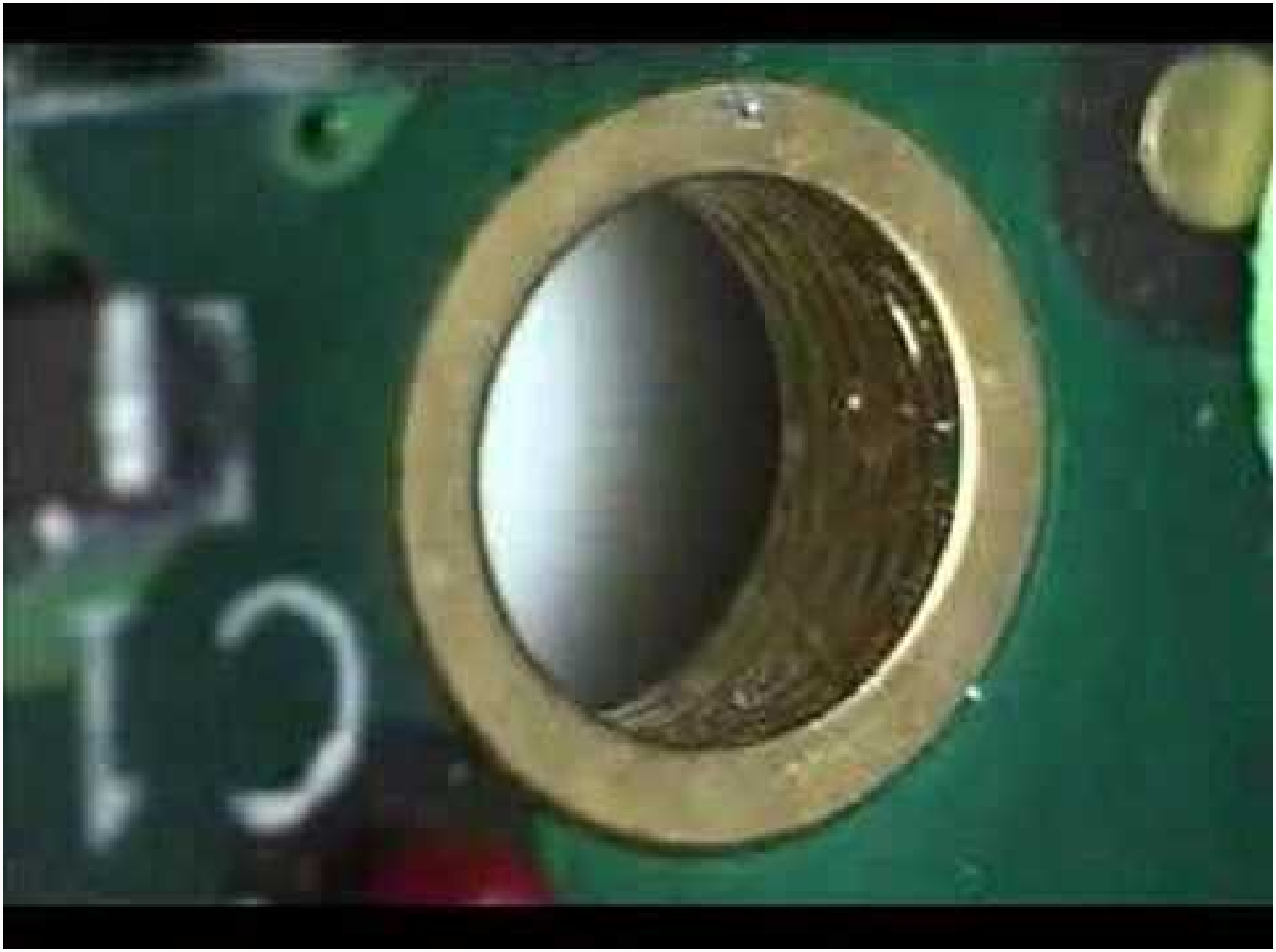


Mounting Methods

Through-hole

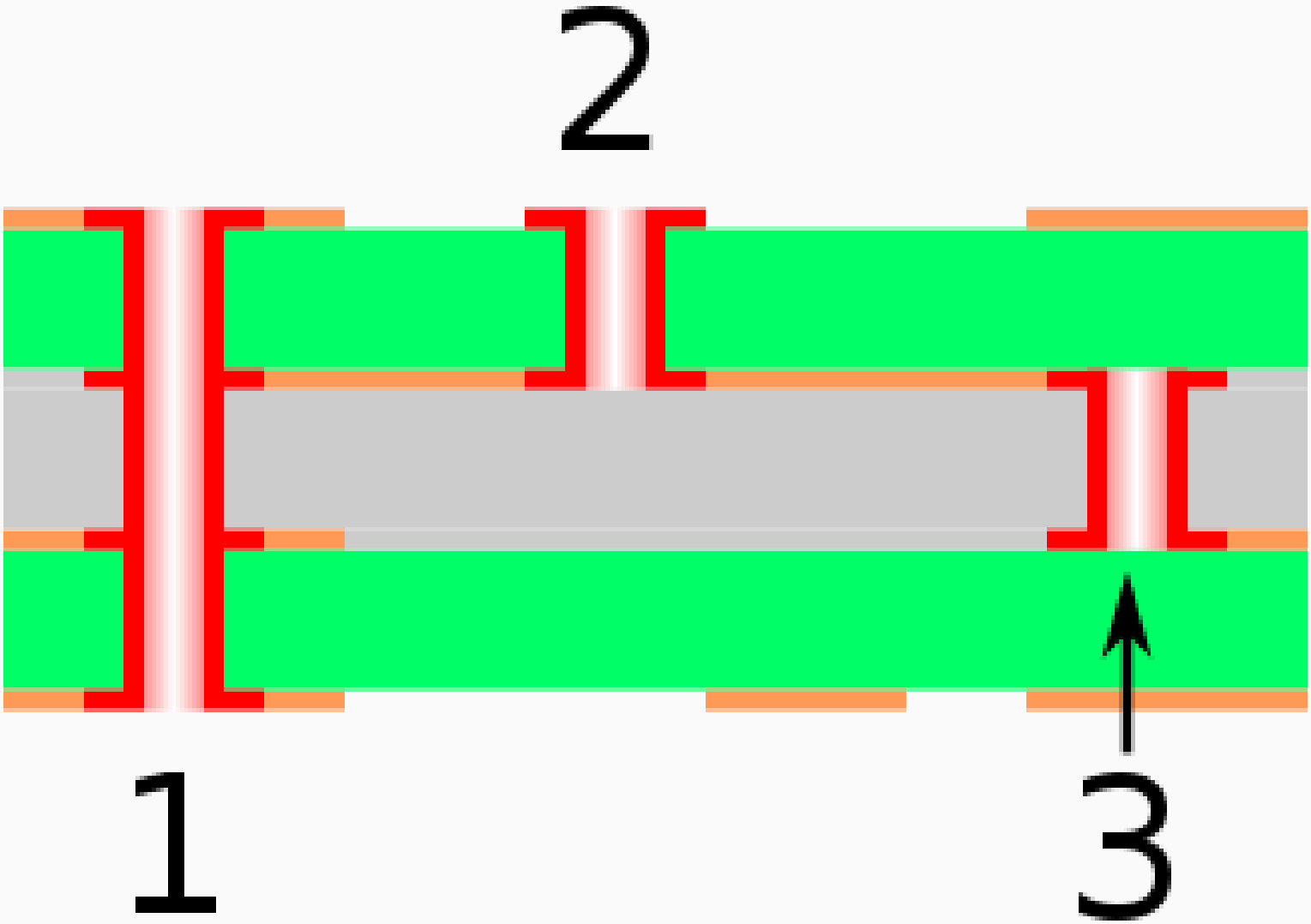


Through-hole Plating

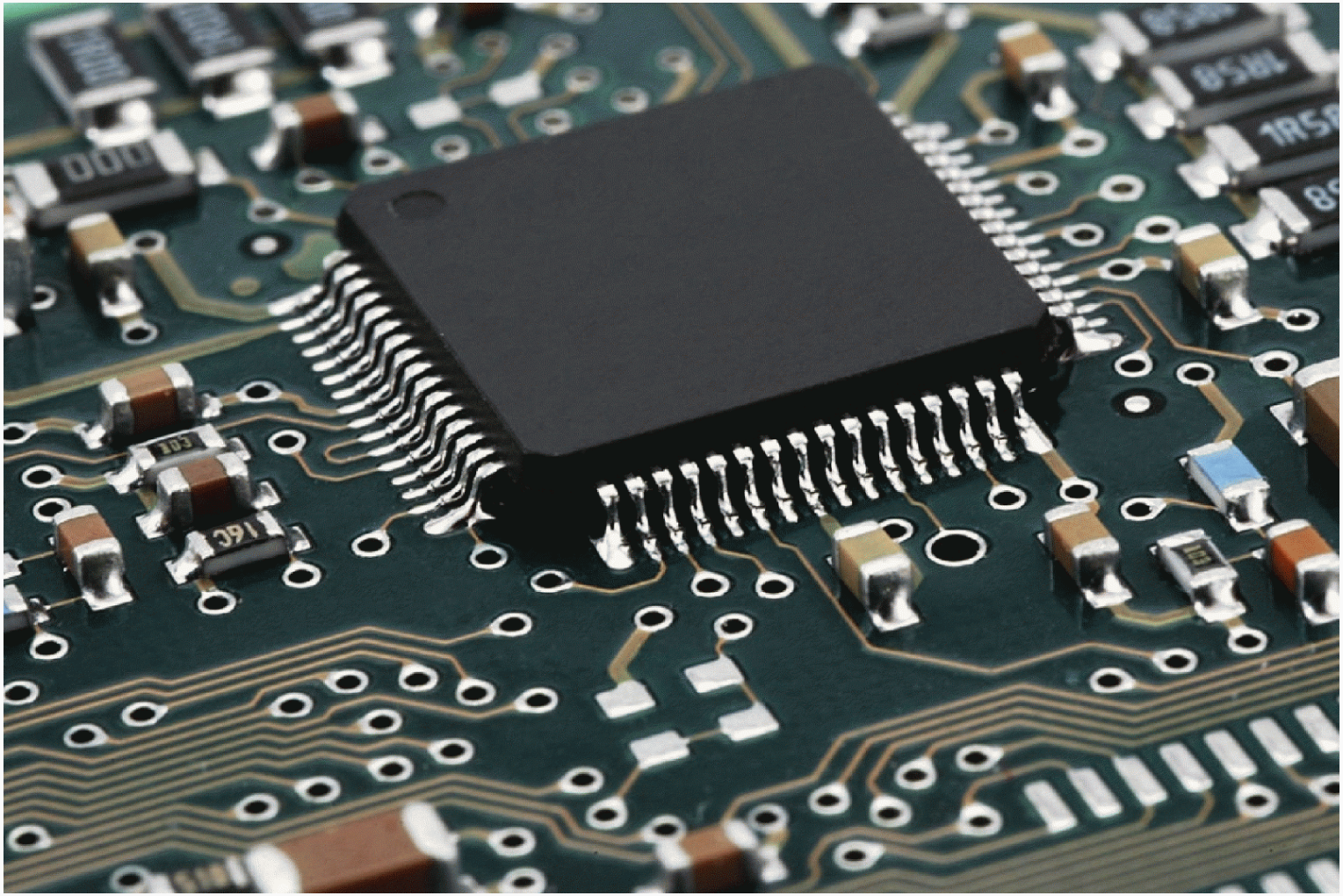


Through-hole Plating

Vias



Surface Mount Technology



SM-Alphabet Soup

1. SMA (surface-mount assembly) a build or module assembled using SMT.
2. SMC (surface-mount components) components for SMT.
3. SMD (surface-mount devices) active, passive, and electromechanical components.
4. SME (surface-mount equipment) machines used for SMT.
5. SMP (surface mount packages) SMD case forms.
6. SMT (surface-technology) the act and method of assembling and mounting electronic technology.

Embedded Components