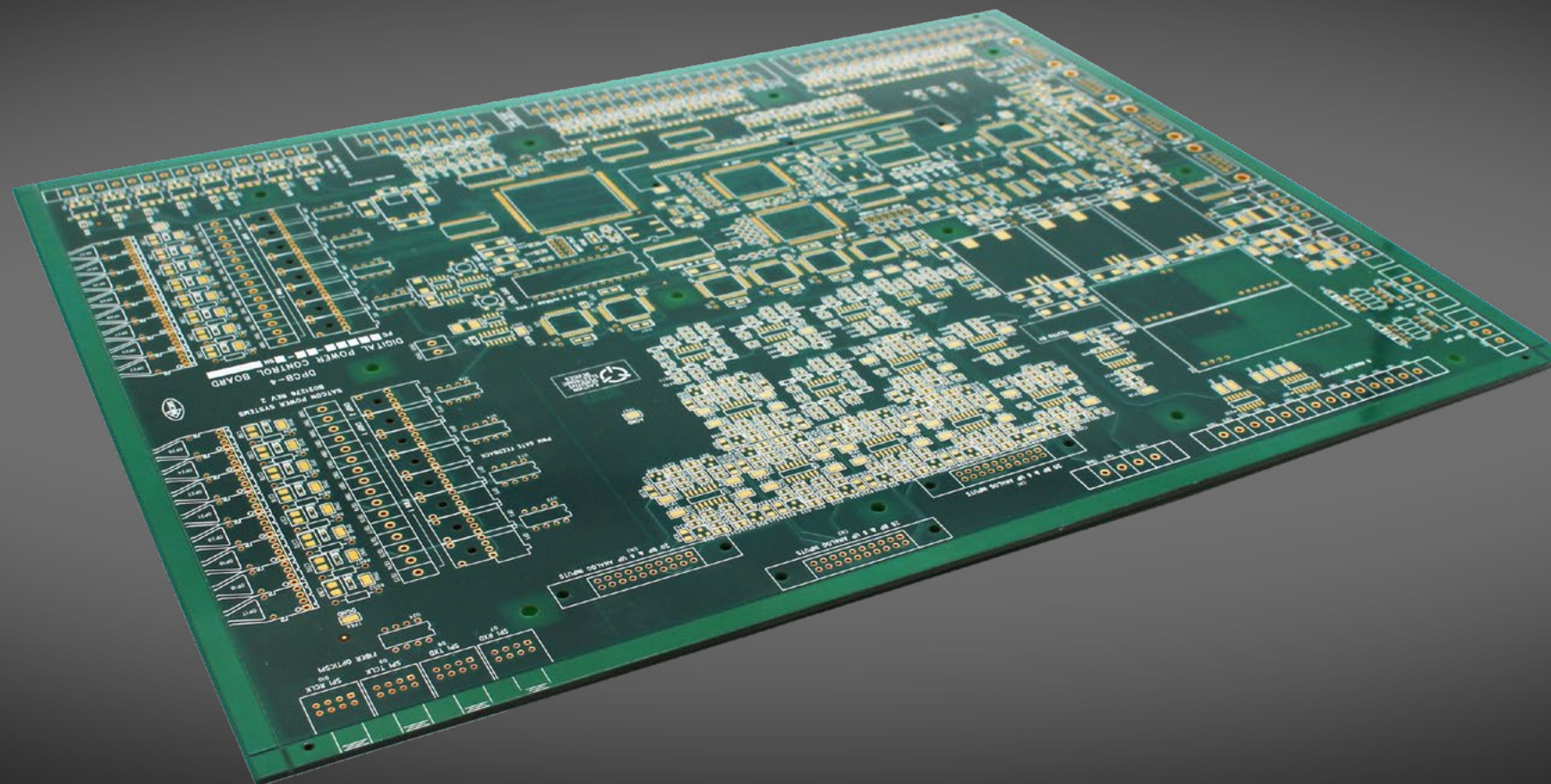


# FR-4 PCBS





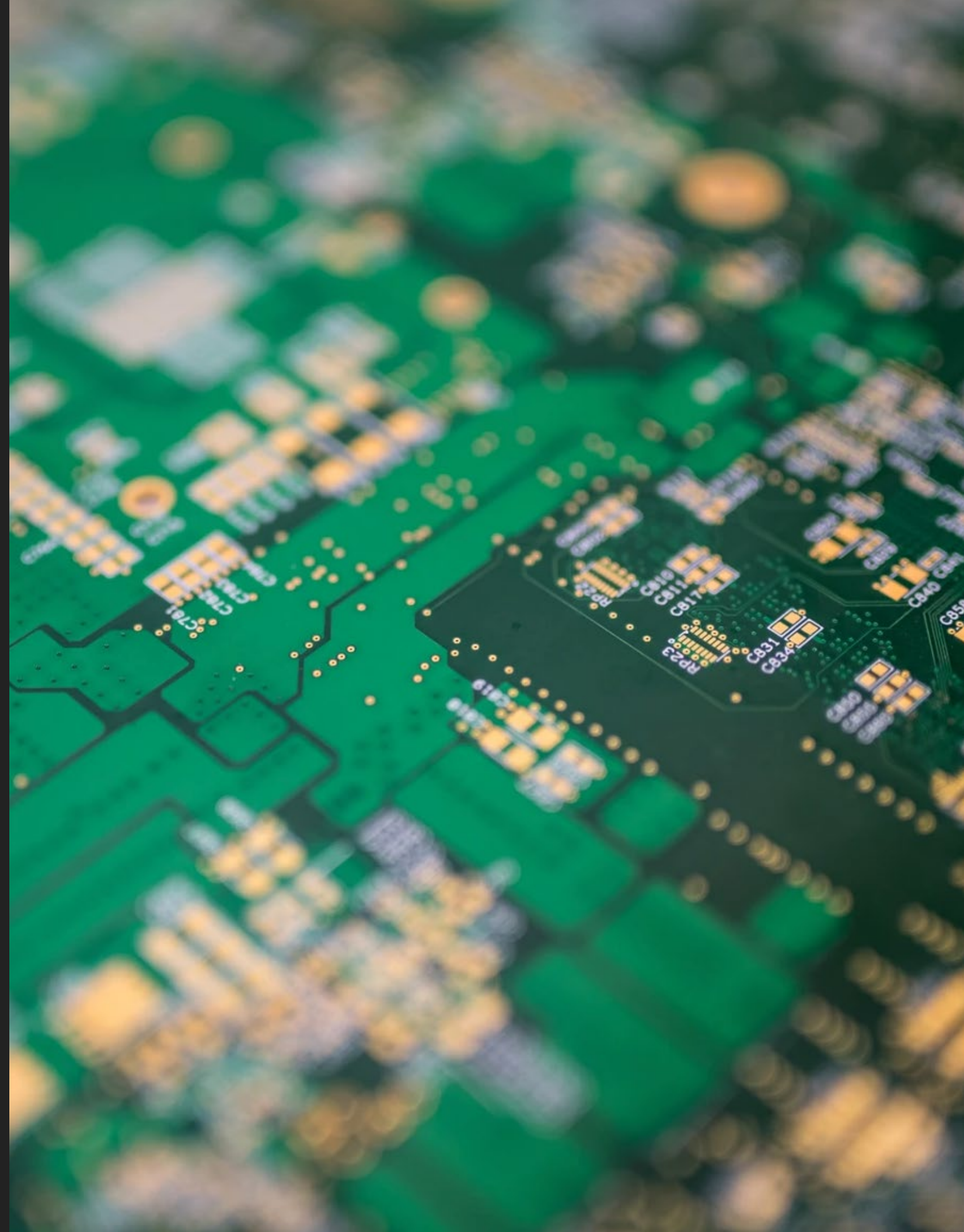
# FR-4 PCBs

## What are FR-4 PCBs?

Most people don't realize that everything is controlled with a PCB. Whether it's your mouse, your keyboard, your phone, your TV, or your router, electronics are dependent on PCBs.

FR-4 is the material upon which the vast majority of PCBs are made. FR-4 PCBs are seen as the standard PCB because of their cost-effectiveness. For applications that don't produce extreme heat, FR-4 PCBs are your tried-and-true solution.

FR-4 copper-clad sheets are fabricated with circuitry etched into copper layers and become more complex as more layers are added. A thin layer of copper foil is laminated to one or both sides of an FR-4 glass epoxy panel, commonly referred to as "copper-clad laminates."





# KEY FEATURES OF FR-4 PCB

## Composition

- Made of woven fiberglass cloth with an epoxy resin binder.
- The epoxy resin makes it flame-resistant (self-extinguishing when exposed to fire).

## Electrical Properties

- High dielectric strength, ensuring good insulation between conductive layers.
- Low moisture absorption, making it stable in humid environments.

## Mechanical Strength

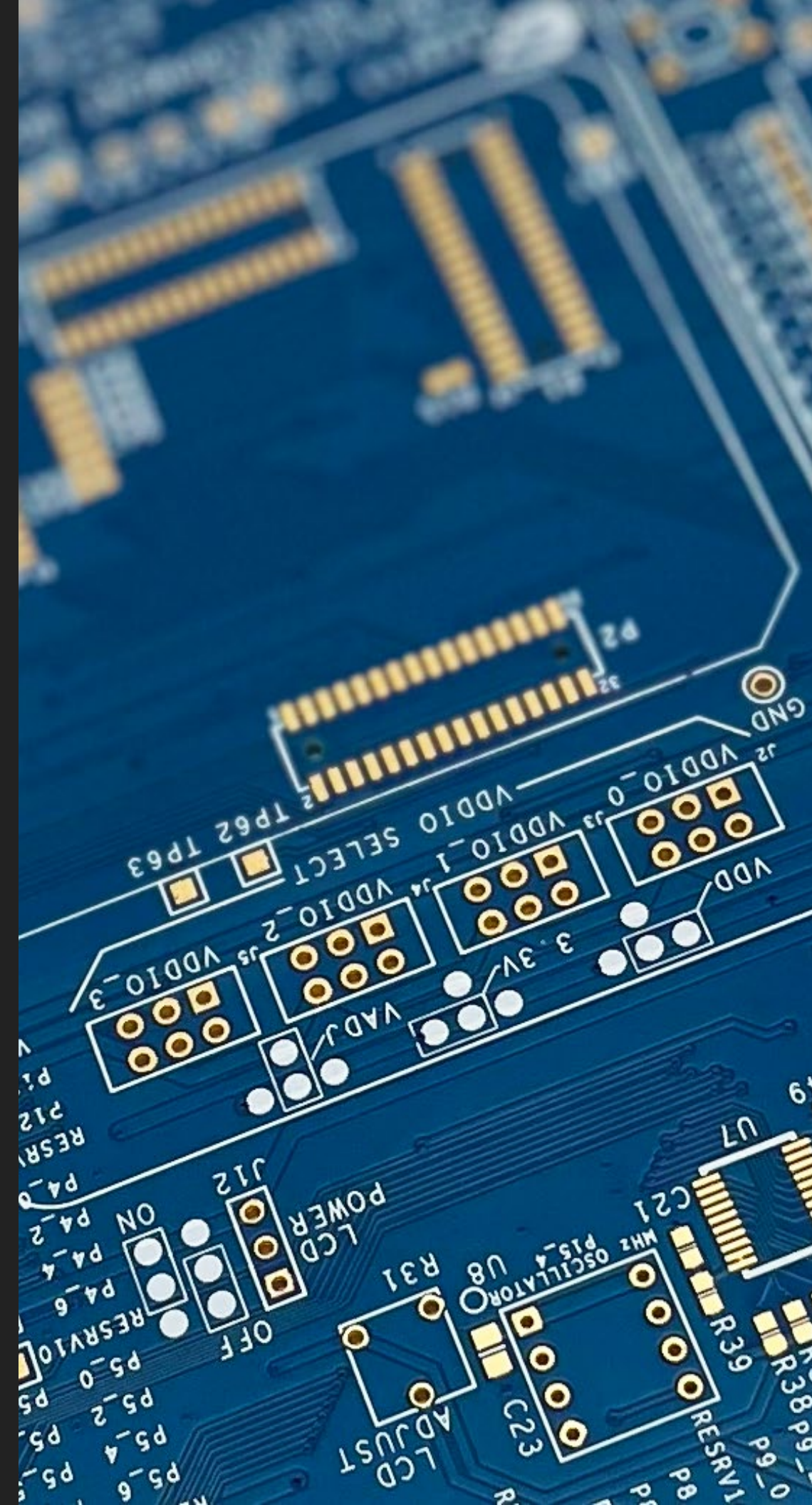
- Strong, durable, and lightweight.
- Can withstand mechanical stress without breaking or bending easily.

## Thermal Resistance

- Glass transition temperature (Tg): Typically ranges from 130°C to 180°C, depending on the grade.
- Can be used in applications that require moderate heat resistance.

## Why is FR-4 Used in PCBs?

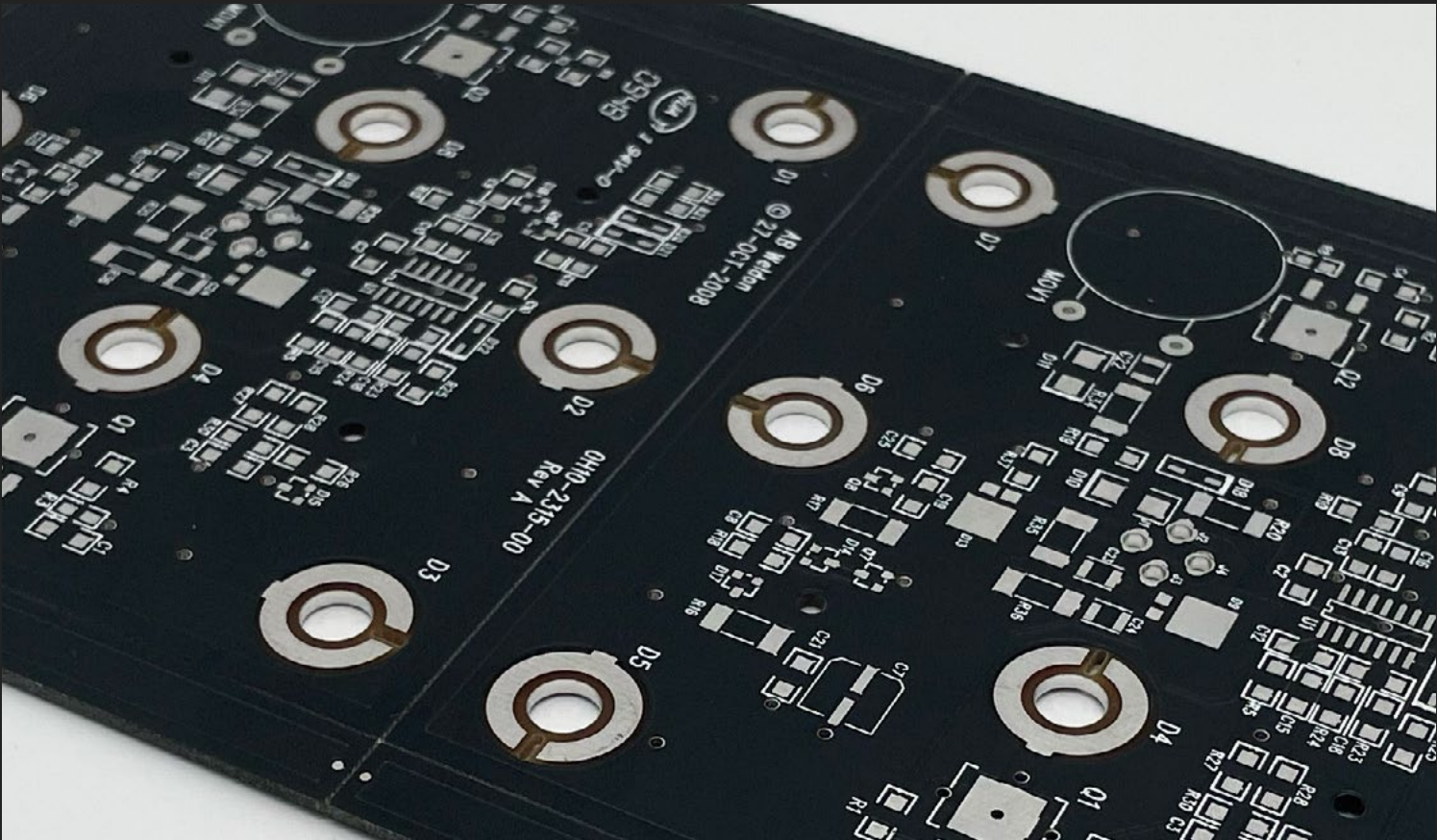
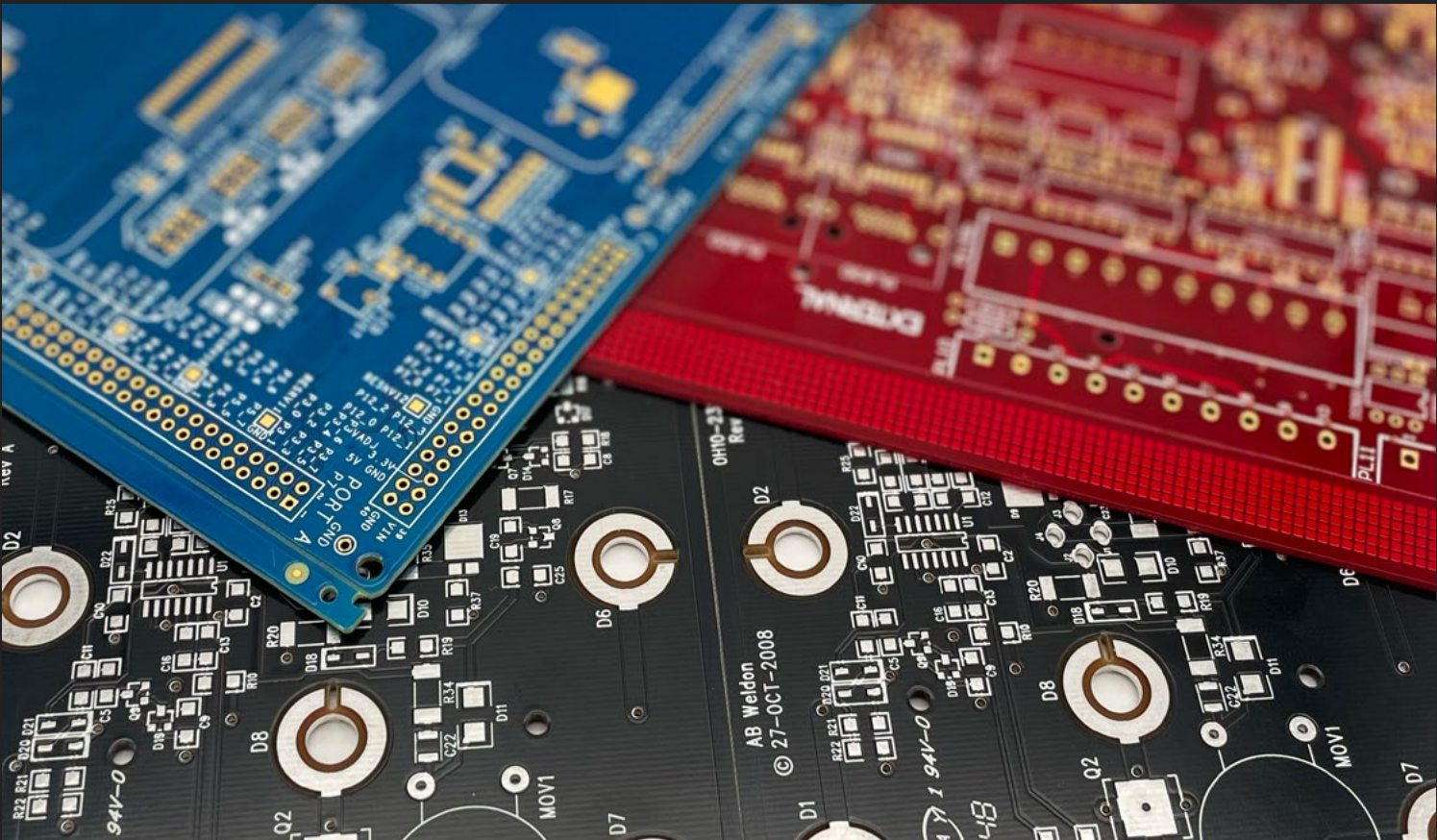
- Cost-Effective: Affordable compared to other high-performance materials.
- Versatile: Used in single-layer, double-layer, and multilayer PCBs.
- Reliable: Offers good electrical insulation and flame resistance (UL94-V0 rated).
- Easy to Fabricate: Can be drilled, etched, and processed easily for mass production.





# FR-4 vs. OTHER PCB MATERIALS

| Feature              | FR-4                | Aluminum PCB           | Ceramic PCB        | Polyimide (Flex PCB) |
|----------------------|---------------------|------------------------|--------------------|----------------------|
| Thermal Conductivity | Low                 | High                   | Very High          | Low                  |
| Mechanical Strength  | High                | Medium                 | High               | Flexible             |
| Cost                 | Low                 | Medium                 | High               | High                 |
| Flame Resistance     | Yes                 | Yes                    | Yes                | Yes                  |
| Applications         | General Electronics | Power Electronics, LED | High-Frequency, RF | Flexible Circuits    |



# FR-4 PCBS

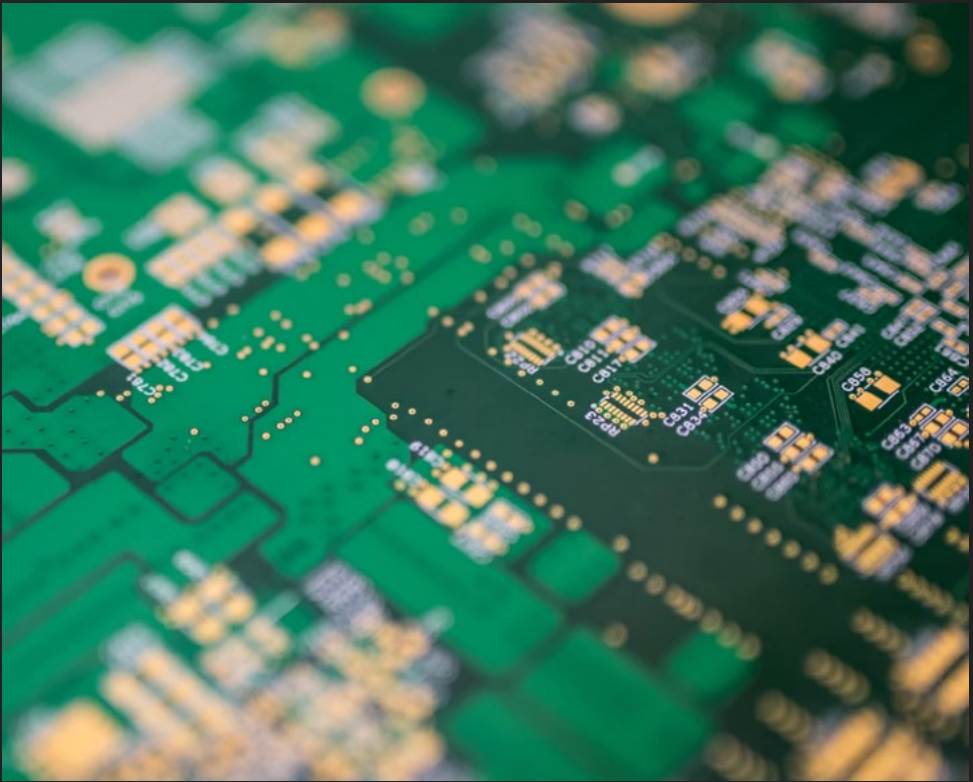
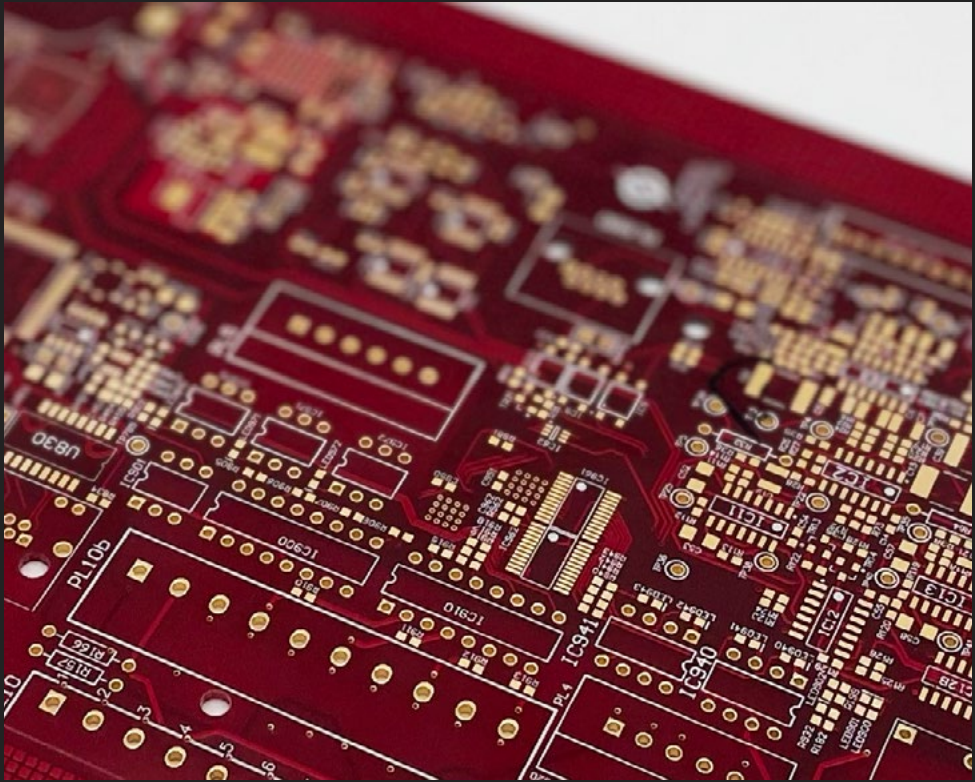
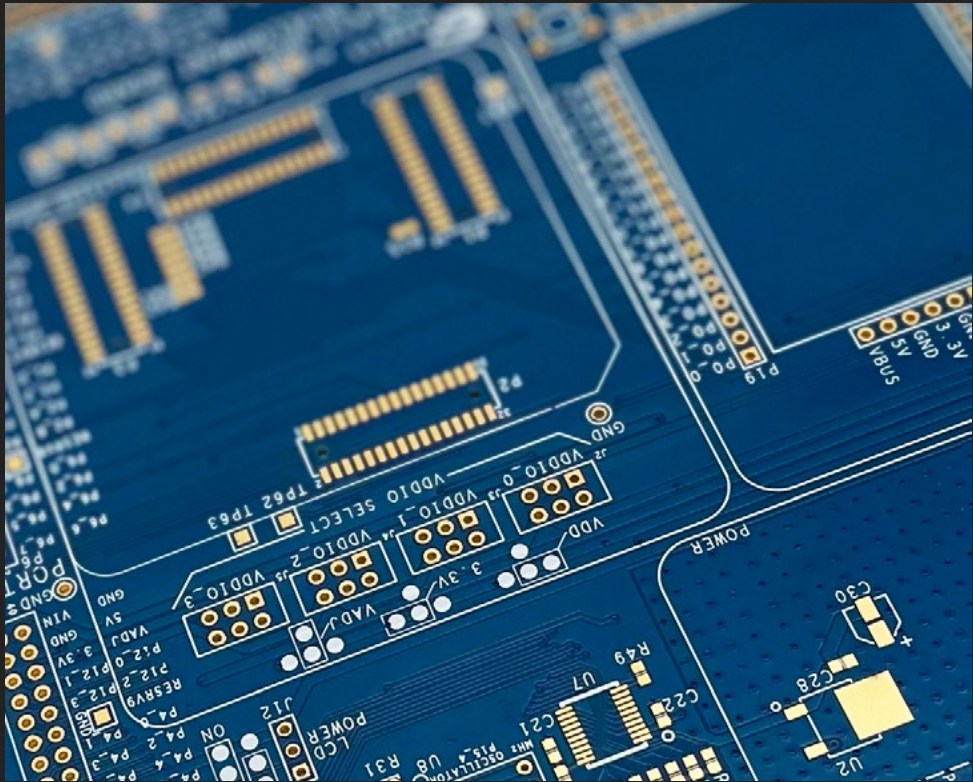
| Process         | Item                                                                                 | Normal SPEC                                                                                                               | Special SPEC     |
|-----------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------|
| 01/ Materials   | 150 °C to 180 °C Layer Count                                                         | 16L                                                                                                                       | 20L              |
| 02/ Mask        | Color                                                                                | Green / blue / Red / Black / White / Golden / Clear                                                                       |                  |
| 03/ Silkscreen  | Color                                                                                | White / Black / Red / Yellow                                                                                              |                  |
| 04/ Testing     | 1. Open/ Short Testing Condition                                                     | Dedicate: 6ml Fly probe, Spacing: 4mil (Smd Pitch: 10 mil)55.10                                                           | Tolerance 5%     |
|                 | 2. Open / Short Board Size                                                           | Dedicate: 600x400mm(max) , Fly probe: 640x450mm(max)                                                                      |                  |
|                 | 3. Open / Short Testing Condition                                                    | Dedicate: 250V / 50Ω / 2MΩ<br>Fly probe: 250V / 50Ω / 10MΩ<br>min / max: 1MΩ ~ 20MΩ                                       |                  |
|                 | 4. Netlist Test                                                                      | 1) Measure Machine: POLAR<br>2) Tolerance: ±10%<br>3) design: Single End / Differential ±10%<br>4) Testing Pitch: 0.254mm |                  |
| 05/ Finish Type | HASL<br>Carbon Ink<br>Imm gold<br>Hard gold<br>Imm Tin<br>Leadfree HAL<br>Imm Silver | Imm Gold+HASL<br>Imm Gold+ENTEK<br>Carbon+ENTEK<br>Imm gold+G / F(3~30μ)<br>Partial Hard Gold<br>Partial Imm Gold         | Imm Gold + SMOBC |

# FR-4 PCBS

| Density                                |          |                        |
|----------------------------------------|----------|------------------------|
| Title                                  | Standard | Advanced & Development |
| Tolerance                              | +/- 8    | +/- 6                  |
| Thickness (Minimum / Maximum)          | 7 / 300  | 5 / 440                |
| QFP                                    | 0.5 mm   | 0.4mm                  |
| Minimum Solder mask Web                | 0.005    | 0.004                  |
| Minimum Prepreg Fill                   | 0.0025   | 0.0020                 |
| Minimum Line/Spacing - Internal 1/2 oz | 0.004    | 0.003 1/3 oz           |
| Minimum Line/Spacing - External 1/2 oz | 0.004    | 0.003 1/3 oz           |
| Minimum Drilled Hole Size              | 0.008    | 0.006                  |
| Minimum Core Thickness                 | 0.004    | 0.003                  |
| Layer to Layer Registration            | +/- .005 | +/- .003               |
| Land Size (Diameter over Drill)        | 0.010    | 0.008                  |
| BGA                                    | 0.5 mm   | 0.4 mm                 |
| Aspect Ratio - Line Card               | 12:01    | 14:01                  |



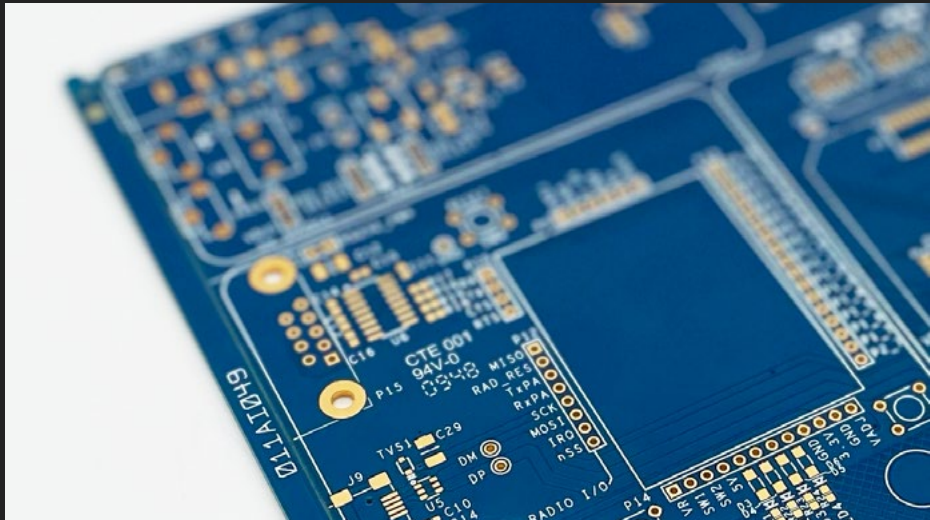
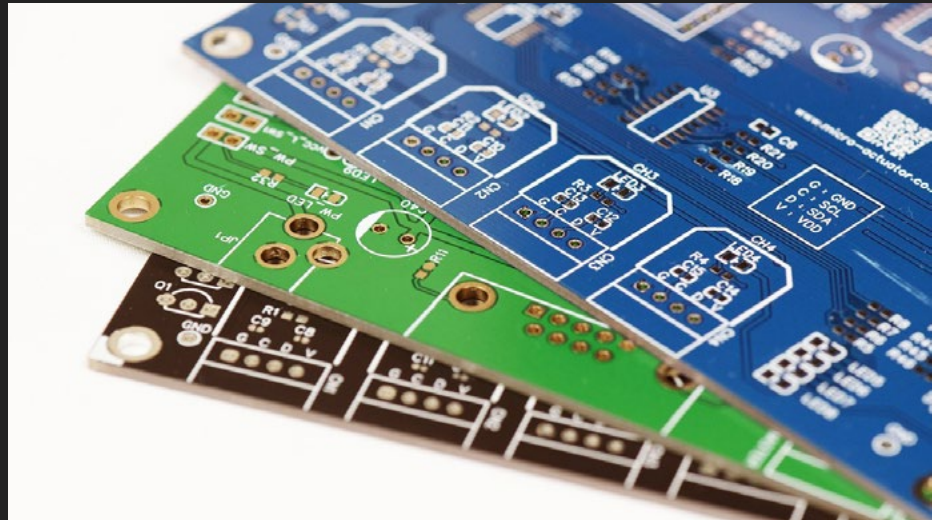
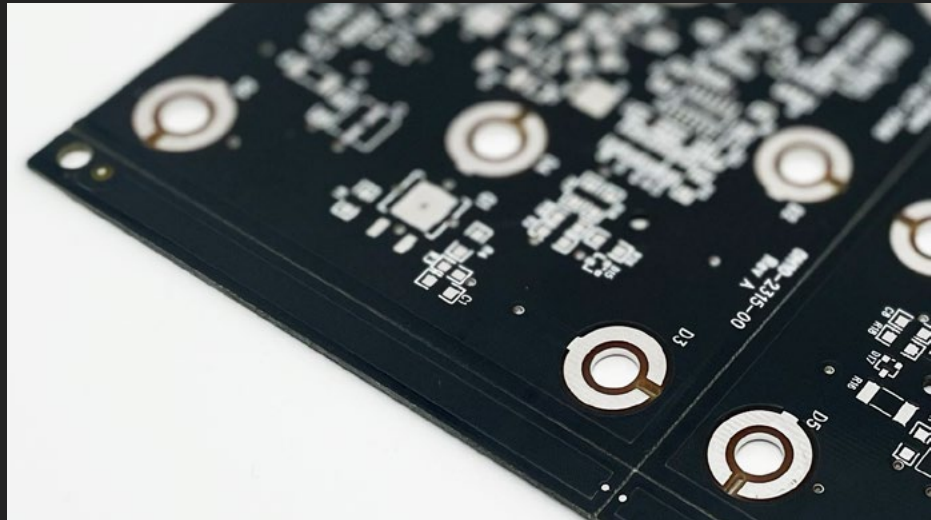
# FR-4 PCBS



| HDI VIAS                                    |              |                        |
|---------------------------------------------|--------------|------------------------|
| Title                                       | Dimension    | Advanced & Development |
| Microvia Aspect Ratio                       | 0.5:1        |                        |
| Variable Depth Laser Via (Depth / Diameter) | 0.004/ 0.006 | 0.004/ 0.005           |
| Minimum Laser Via (Drill / Capture Pad)     | 0.006/ 0.016 | 0.005/ 0.014           |
| BBV Mechanical Drill                        | 0.010        | 0.008                  |



# FR-4 PCBs



| Impedance Control |          |                        |
|-------------------|----------|------------------------|
| Title             | Standard | Advanced & Development |
| 28 - 260Ohms      | +/-10%   | +/-7%                  |
| 50 - 150 Ohms     | +/-10%   | +/-7%                  |

| Copper Weight                             |           |                        |
|-------------------------------------------|-----------|------------------------|
| Title                                     | Dimension | Advanced & Development |
| Min Outer Base Copper - plated layers     | 1/2 oz    | 1/4 oz                 |
| Max Outer Base Copper - plated layers     | 5 oz      | 5 oz                   |
| Max Inner Copper Foil - non plated layers | 4 oz      | 5 oz                   |
| Min Inner Copper Foil - non plated layers | 1/4 oz    | 1/4 oz                 |



# FR-4 APPLICATIONS

## Industrial Equipment

- Used in control panels, sensors, and automation systems where electrical insulation is crucial.
- Manage and distribute electrical power while ensuring circuit insulation and protection.



## Power Electronics

- FR4 PCBs manage power conversion and distribution, ensuring stable and efficient energy flow in renewable energy systems and electronic devices.



## Consumer Electronics

- Found in smartphones, computers, and home appliances, acting as the structural base for circuits.
- Supports compact circuits in smartwatches and fitness trackers, ensuring durability and reliability.



# CERTIFICATIONS

- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2020
- IATF 16949:2016
- Reach-SVCH Statement
- RoHS Compliance Certificate
- ITAR

ISO 9001:2015  
COFAN Dongguan



ISO 9001:2015  
COFAN Taiwan



ISO 14001:2015  
COFAN Dongguan



ISO 14001:2015  
COFAN Taiwan



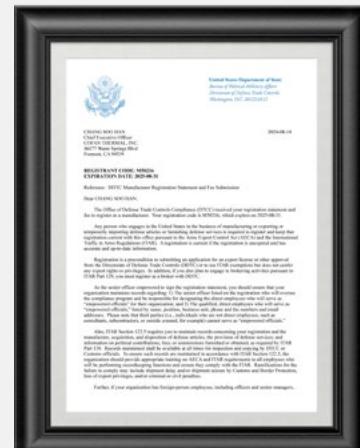
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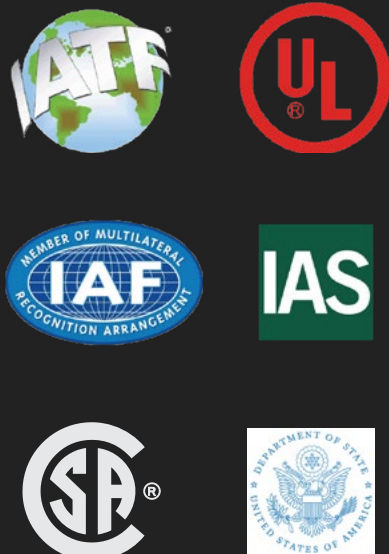
ITAR  
COFAN USA



Reach-SVCH  
Statement



RoHS-Compliance Certificate  
Cofan Taiwan





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