

1. Stacking up a four-layer board

To create a good stack up from a mix of materials, the following techniques must be considered:

- 1) Having a thick core layer and thin outer prepreg layers
- 2) The core layer should be copper clad to easily form planes
- 3) The outer layers are never HDI (high-density interconnection layers) build-up layers
- 4) The core and prepreg materials could have any Tg value (Tg or Glass transition temperature, is the base material parameter for the temperature)
- 5) The materials could be low-loss FR4 (fiberglass-reinforced epoxy-laminated sheets used in printed circuit board manufacturing) or PTFE laminates (PTFE or polytetrafluoroethylene is a synthetic thermoplastic fluoropolymer and is the second most commonly used PCB laminate material).

2. Types of four-layer PCBs

2.1 Two internal GND planes

➤ Applications

- 1) computer motherboards as routings are needed on both sides of the PCB and, controlled impedance is needed for high-speed signals
- 2) Double-sided high-speed PCBs
- 3) Mixed-signal PCBs

➤ Advantages

Power does not always require a power plane

➤ Disadvantages

2.2 Two external GND planes

➤ Applications

Low-noise PCBs

Specialty mixed-signal PCBs

➤ Advantages

Due to the ground shielding the exterior of the board, this stack up could be used for some specialized low-noise systems, such as specialized analog systems that require low noise.

➤ Disadvantages

Crosstalk between signals happens in the internal layers so it is not the chosen option for high-speed routing

2.3 Signal-GND-Power-Signal

➤ Applications

Single-sided high-speed PCBs

Power electronic PCBs

➤ Advantages

Having many signals and high power in the same PCB

➤ Disadvantages

The stack up requires a power layer so, the bottom signal layer may not be able to accommodate high-speed signals unless it is kept as a plane layer.

2.4 Signal-GND-GND-Power

➤ Applications

Power electronics with a digital section

➤ Advantages

Suitable for a design that needs large rails for power

➤ Disadvantages

Having lower signal count such that all signals can fit onto a single layer, but also the dedicated layer for power routing is needed. So, routing of multiple voltages on different rails, or using of a single large plane to provide high current is needed.