PCB Stackup DFM Rules

StackupLab Design Reference — Axel Hardware Design — 2026-05-07

1. Foil Construction (Through-Hole MLB)

Standard multilayer PCB fabrication uses foil construction. L1 and LN are copper foil laminated onto prepreg — not on a CCL core. Inner copper pairs sit on CCL cores (copper-clad laminate).

Structure: Foil(L1) / PP / Core(L2-L3) / PP / Core(L4-L5) / … / PP / Foil(LN)

LAYERS	CORES	PREPREGS	STRUCTURE
2L	1	0	Core(L1-L2) — edge case, no foil
4L	1	2	Foil / PP / Core(L2-L3) / PP / Foil
6L	2	3	Foil / PP / Core(L2-L3) / PP / Core(L4-L5) / PP / Foil
8L	3	4	Foil / PP / 3 cores bonded by PP / Foil
NL	(N-2)/2	(N-2)/2 + 1	General formula

Why foil over cap construction: cheaper (fewer CCLs), better registration, industry default. Cap construction is only for specialty substrates (Rogers) or blind-via requirements.

2. Blind-Buried Core Region

For blind-buried (a-b-a split), the core region itself follows foil construction when b > 2:

- First and last core-region layers are inner foil on prepreg, not on CCL.
- Effective visual: a' = a+1, b' = b-2. Via computation uses original a/b.

Example — 2-6-2 on 10 layers: Build-up L01–L03 and L08–L10. Cores: L04–L05 (Core 1), L06–L07 (Core 2). L03 and L08 are inner foil on prepreg. When b = 2: single core, no foil adjustment.

3. Any-Any (HDI Sequential)

- One central core pair with sequential build-up on both sides.
- a = floor(N/2) - 1, b = 2. All non-core dielectrics are prepreg.

4. Standard CCL Thicknesses (mm)

```
0.05    0.10    0.15    0.20    0.25    0.30    0.36    0.40
0.50    0.60    0.71    0.80    1.00    1.20    1.50    1.60
```

Core thickness is snapped to the nearest value from this table.

5. Thickness Distribution

Prepreg gets a guaranteed minimum first; cores get the remainder:

- Minimum prepreg = 100 µm (0.1 mm) per gap — ensures manufacturability between heavy copper.
- Core budget = total dielectric - (prepreg count × 0.1 mm).
- Core thickness = core budget / core count, snapped to nearest standard CCL.
- Actual prepreg = (total dielectric - snapped core total) / prepreg count.

This prevents starving prepreg when there are many more prepreg gaps than core gaps (e.g. 10-layer blind-buried with 7 prepreg gaps and 2 cores).

6. Prepreg Glass Styles

Prepreg bands display standard glass style numbers based on the gap thickness. The selection algorithm prefers fewer sheets — only picks a more complex combination if it is more than 15 µm closer to the target.

GLASS STYLE	PRESSED THICKNESS	TYPICAL USE
106	38 µm	Ultra-thin gaps, fill layers
1080	66 µm	Thin build-up, fine-pitch
2113	95 µm	General purpose, impedance control
2116	114 µm	Most common single-sheet prepreg
1652	144 µm	Medium gaps
7628	175 µm	Thick gaps, structural rigidity

Label format: 1×2116, 2×2113, or 1×1080 + 1×2116.

7. Blind Via Rules

Blind microvias connect adjacent copper layers in the build-up region:

- They drill through prepreg only and land on the next copper layer.
- They never drill into core FR-4 dielectric.
- For a 1-N-1 split there is one microvia per side (L1”L2 top, L(N-1)”LN bottom).
- Microvia count per side = a (the original build-up count).

8. Fab Document Labeling

The stackup preview and PDF must clearly convey foil construction to the fabricator:

- Group brackets show "FOIL" for outer layers in through-hole. Blind-buried keeps "TOP B-UP" / "BOT B-UP".
- Configuration section shows "Build method: Foil Construction" for through-hole with more than 2 layers.
- Layers table REGION column shows "Foil" for L1/LN and "Core N" for inner layers.
- Impedance trace width and space displayed in µm (not mm).

9. Symmetry Rule

Stackups must be balanced around the center plane to prevent warping and bow/twist during lamination and thermal cycling:

- Copper weights mirrored top-to-bottom.
- Dielectric thicknesses mirrored.
- Material types (core/prepreg) mirrored.