Rogers & FR-4 Hybrid PCB Stack-Up Reference

Practical Stack-Up Examples & DFM Checklist for RF, Microwave, SATCOM & Test Boards

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1. Common Reference Stack-Ups (Cost & RF Performance Balance)

Hybrid stack-ups place low-loss Rogers laminates on critical RF signal layers while using High-Tg FR-4 for digital control, power distribution, and mechanical rigidity - reducing material cost by 30-60% compared to full-PTFE builds.

Build Type	Typical Layer Construction	Common Applications
2-Layer Rogers RF Board	1 oz Cu | RO4350B (0.508 mm / 20 mil or 0.762 mm / 30 mil) | 1 oz Cu. Optional aluminum/copper backing for high-power thermal dissipation.	Ku/Ka-band microstrip filters, patch antennas, RF couplers, VNA evaluation boards.
4-Layer RO4350B + FR-4 Hybrid	L1 (RF) | RO4350B 0.254-0.508 mm | L2 (RF GND) | High-Tg FR-4 PP + Core | L3 (Power/Ctrl) | L4 (Digital). Balanced copper distribution.	RF switch modules, LNA/transceiver boards, IIoT wireless gateways, wideband RF ODM modules.
6-Layer SATCOM / SSPA Hybrid	L1 (RF) | RO4350B or RO3003 0.254 mm | L2 (RF GND) | RO4450F Bondply | High-Tg FR-4 Core (L3/L4) | FR-4 PP | L5/L6 (Ctrl/GND) + thermal via array or copper coin.	C/X/Ku/Ka-band BUCs, GaN/GaAs SSPAs, compact outdoor microwave front-ends.
8-12 Layer RF Test / Probe Card	Symmetrical outer low-loss Rogers/PTFE layers + inner High-Tg FR-4 signal/ground planes + controlled-depth backdrilling (stub <=10 mil).	RF & MEMS probe cards, ATE load boards, multi-site wafer test fixtures, high-speed characterization.

2. Key Material Properties Quick Comparison

Laminate	Nominal Dk (10 GHz)	Df (10 GHz)	Engineering Notes
Rogers RO4350B	3.48 (Design 3.66)	0.0037	Hydrocarbon ceramic; FR-4-like processing; ideal for Rogers + FR-4 hybrid builds and 1-30 GHz RF boards.
Rogers RO4003C	3.38 (Design 3.55)	0.0027	Low loss hydrocarbon ceramic; widely stocked for antennas, power amplifiers, and broadband RF modules.
Rogers RO3003	3.00	0.0010	Ceramic-filled PTFE; ultra-low loss for Ku/Ka-band SATCOM, 24-77 GHz radar, and millimeter-wave circuits.
RT/duroid 5880	2.20	0.0009	Glass-microfiber PTFE; lowest loss for millimeter-wave antennas and precision microwave waveguides.

3. Pre-Production DFM & Hybrid Stack-Up Checklist

- Maintain symmetrical copper and dielectric distribution where possible to minimize bow and twist, especially on probe cards and thin RF boards.
- Specify bonding prepreg compatibility (e.g., RO4450F or matched low-flow High-Tg prepreg) to avoid delamination during reflow and thermal cycling.
- Keep solder mask openings cleanly defined over high-frequency microstrip/CPW lines (or omit solder mask on critical >10 GHz RF traces) to reduce insertion loss.
- Include impedance test coupon requirements, target single-ended/differential ohms, and backdrill net lists in your fabrication notes.

- Need a tailored stack-up before finalizing layout? Send your target layer count, frequency band, and total thickness to sales2@xcepcb.com for a Free Engineering Review & No-Obligation Quote.