PCB, CCL, and Substrate

CPO concerns likely overdone

- **CPO adoption impact on CCL/PCB: Likely limited in the coming year.** We have received many inquiries on the impact of CPO on CCL specifications, which likely accounts for EMC's share pullback today (-8%, vs. TAIEX +1%). In our view, while the adoption of CPO could theoretically reduce the consumption of high-spec CCL, as data travels through optical cables, rather than via PCBs, it is likely too early to be concerned about the impact. At the scale-out level (with CPO taking place at the spine switches), which is the most likely CPO adoption scenario in the coming year, the number of PCBs that could potentially see de-specification is very limited compared with the total PCB content across the entire data center, which should continue to see specification migration in the foreseeable future. Meanwhile, we also expect high-end CCLs (no less than M7) to be used even with CPO adoption for the CPO-enabled data center switches, given that the motherboard also houses many other components.
- **NPO actually a positive driver.** While multi-rack clusters such as the NVL576 design could drive optical connectivity for inter-rack linkages at some point in the future (e.g., Rubin Ultra), there is a high possibility that NPO (near-packaged optics) could be adopted earlier than CPO. NPO could actually accelerate CCL/PCB specification upgrades, given the significant amount of data traveling on NVLink switch boards in these multi-rack clusters. As we have discussed previously, we believe the electrical-performance requirements for this design are extremely demanding, and it has been challenging so far even for M10 CCL grade to meet the requirement. Hence, NPO—which could see adoption among many customers—could turn out to be a driver for CCL/PCB specs. While some may argue that CPO adoption for NVLink (scale-up) could eventually occur, the backplane could emerge by then, which would be a sizable opportunity in terms of scale and PCB/CCL content (given the extremely high connectivity that takes place on these boards), which should more than offset any impact on CCL specs for NVLink switch boards.
- **Time to re-visit EMC (2383 TT).** While EMC shares have been sluggish (-22% in the past month vs. +3% for TAIEX), likely due to concerns around PTFE adoption, we believe the PTFE technology risk is largely in the price. EMC is now trading at ~20x 2027E. Meanwhile, there are still many growth opportunities for high-speed materials (as PTFE is used only in select areas if it is indeed adopted). Furthermore, we still see room for improvement in the electrical performance of high-speed materials beyond M10; hence, investors should not rule out the possibility that high-speed materials could someday deliver similar or even better performance vs. PTFE. We believe concerns around CPO are overdone and that the latest pullback likely creates a decent entry point for EMC, where we continue to see upward earnings revision risk.

Technology

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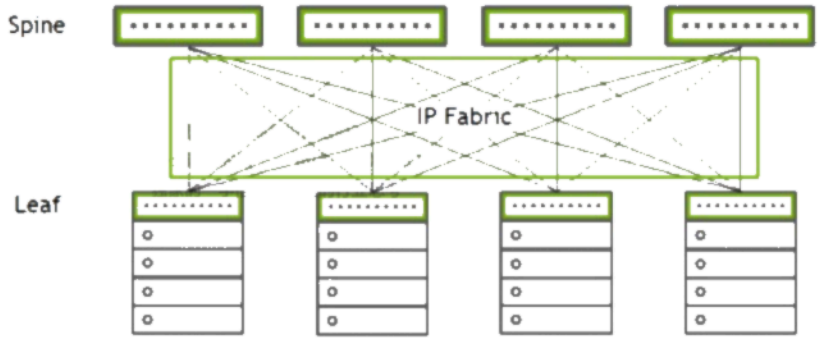
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See page 3 for analyst certification and important disclosures, including non-US analyst disclosures.

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Figure 1: Leaf-Spine switch interconnect structure (two-tier Clos architecture)



Source: Nvidia.

Figure 2: Nvidia NVL576 scale-up system



Source: Nvidia.

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