BofA SECURITIES

Technology - Asia-Pacific (H/A)

CCL for PCB: spec upgrades well on track toward CY27/28 with pricing upside

Price Objective Change

Spec upgrades & demand growth remain on track

Following our discussion on (see report) S/D of high-end CCL for PCB in July, we lay out the benefits from ongoing spec upgrades and ASP uplift, as well as the evolution of recipe for high-end CCL in this report. Overall, we stay constructive given the continuous spec advancements and robust demand growth into 2027-28, and we believe the (see report) overhang from CPO proliferation is already largely reflected in the valuation of CCL names, which we believe also renders an attractive opportunity for Buy-rated EMC with highest AI exposure (reflected in the revenue mix from M7 grade or above) and TUC with highest growth over 2026-28. For Shengyi, we stay relatively conservative on its lower growth with less attractive valuation. We also rate Doosan and Kingboard as Buy, given the former's position in NVIDIA GPU and Amazon switch, as well as the latter's benefits from strong price hike cycle and rising high-end mix. We also increase our PO for Shengyi Tech, though reiterate our Underperform rating. We adjust our estimates for EMC, TUC and Shengyi.

CCL upgrades with production difficulty & diversified path

On the raw material side, we see a rising debate between PTFE-based CCL and HC resin as the CCL grade advances into M9/M10 (vs clearer upgrades in cloth & copper foil), and this will impact the competition dynamics in high-end CCL. The growth headroom for EMC/TUC would be curtailed if PTFE-based solutions are adopted, yet we think both HC and PTFE will coexist and complement each other in M9/M10-grade CCL (from NVIDIA Vera Rubin, TPU v9, Trainium 4, 1.6T switch), given the pros/cons in processibility vs performance, while SiO2 (filler) could be a game changer. In N-T, customers' feedback and specs in Rubin Ultra remains the key watching point toward end-2026/early-2027.

Spec migration across AI GPU/ASIC, networking & optical

Upgrades in CCL across AI GPU/ASIC and networking switches (Exhibit 8) remain clear, thanks to the signal-integrity and data-rate requirements. While NVIDIA leads the way in upgrading glass cloth, ASIC customers seem to focus more on the migration of copper foil, and they will follow suit on the HDI adoption in PCB manufacturing. Optical module is another area with more notable migration in CCL/PCB, and we see robust demand growth for CCL suppliers given the aggressive supply ramp from PCB makers into 2027.

Growth from expansion, better mix & price hike sensitivity

CCL makers' revenue growth will be fueled by capacity expansion and ASP uplift (Exhibit 20), including the benefits of price hike (given the cost push & S/D) and better mix, which will also underpin the GM expansion (Exhibit 14-19) for EMC, TUC and Shengyi. Looking ahead, pricing environment for CCL remains benign, in our view, driven by the cost push from copper foil and glass cloth, and we conduct a sensitivity analysis (Exhibit 24) to each name's 2027 bottom-line, based on different scenarios of price hikes.

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Refer to important disclosures on page 26 to 30. Analyst Certification on page 23. Price Objective Basis/Risk on page 21.

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Please refer to list of acronyms on p.21

Exhibit 1: Summary of PO change
We keep POs on EMC/TUC unchanged in this report

Company	Ticker	PO (local currency) New	PO (local currency) Old
EMC	2383 TT	8200	8200
TUC	6274 TT	2600	2600
Shengyi Tech	600183 CH	99	83

Source: BofA Global Research

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Migration in raw materials of CCL

Spec advancements in resin more debatable

Major raw materials for building CCL (copper clad laminate) include cloth, resin, and copper foil. Glass cloth serves as grounding and offers support to the CCL and PCB (printed circuit board) structure, and it is immersed in resins built on different in-house chemical recipes by CCL makers to obtain PP (prepreg). Afterwards, CCL makers add/laminate the copper foil on this intermediate product (PP), to form the CCL supplied to PCB customers. Across the previous generations (Exhibit 2), we have seen rising penetration of PPE/PPO (polyphenylene ether/oxide) gradually replacing FR-4/ epoxy resins throughout M4-M8 grade CCL, while hydrocarbon resin gradually gains traction from M8-grade CCL. Yet, there is a debate on PTFE-based (polytetrafluoroethylene) CCL vs hydrocarbon resin as the CCL grade advances into M9/M10.

As illustrated in Exhibit 4, we see a more diversified path of resin upgrades from M8-grade CCL, while the advancement in copper foil and glass cloth seems to be more certain. In general, we note that the mix of PPO vs hydrocarbon used is roughly 2:1 in M8-grade CCL, and such proportion reverses to 1:2 in M9-grade CCL. Yet, the broader range of resin options could potentially alter the competitive dynamics within the CCL industry, since different vendors are promoting (or have edge) in different types of CCL solutions. Or in other words, the likely penetration by PTFE-based solutions (pushed mainly by NVIDIA) will favor the suppliers with experiences in handling relevant products (though smaller market size such as base station), while, at the same time, it might curtail the headroom for major Taiwanese suppliers, including EMC and TUC (Taiwan Union), to grow.

PPO/BMI vs hydrocarbon in M8/M9; hydrocarbon vs PTFE in M9/M10

In our view, hydrocarbon resin exhibits an ultra-low dielectric constant (Dk) of 2.2-2.6 and a dissipation factor (Df) reaching 0.001-0.005, as low as 0.0005 at high frequencies (e.g., 10 GHz and above), thanks to its non-polar molecular backbone. However, there are drawbacks to hydrocarbon resin, including rather limited flexibility and high brittleness after curing, which necessitate the mix with ductile polymers such as PPO or BMI (bismaleimide) to improve the toughness (peel strength). Nonetheless, the performance in Dk/Df would be reduced after adding PPO/BMI to hydrocarbon resin, which makes the solution not that favorable in meeting customers' demand/requirement.

Within hydrocarbon resin, we note there are two major advanced versions, including ODV (oxidative vulcanization; lower-end) and BCB (benzocyclobutene; higher-end), and key suppliers for the latter include Dow Chemical and Asahi Kasei. In terms of Df, <0.0008 can be reached by BCB type of hydrocarbon resin based on the standard of M9-grade CCL, and the number would hit <0.0005 based on the standard of M9+/M10-grade. By CCL suppliers, we note EMC (Elite Material) adopts hydrocarbon/BMI resin in M9-grade CCL, while Panasonic blends PPO or BMI (with hydrocarbon) in M9 (vs PPO/hydrocarbon in M7/M8). Shengyi Technology also adopts PPO resin in M9-grade offering.

Given the disadvantages (discussed above) of PPO resin, some CCL providers alternatively also adopt mPPO (modified PPO; Exhibit 5) by blending the PPO with other resins (e.g., epoxy methacrylate, styrene). By doing so, the overall dielectric and thermal properties of the composite are enhanced, and the reduced molecular weight improves solubility in solvents like toluene and MEK (methyl ethyl ketone). This in turn enables the resin to thermoset, and it becomes more suitable for CCL processing. By application, we believe it is adopted in the LPU (language processing unit) and UBB (universal baseboard) under Vera Rubin platform, 1.6T networking switch, and will also be potentially (competing with PTFE-based solutions) adopted in the backplane.

Similar to what we have seen in PPO/PPE vs hydrocarbon in M8/M9, we believe hydrocarbon and PTFE will coexist and complement each other in M9/M10-grade CCL, while the sheer adoption on one side is unlikely, given 1) different consideration on cost/performance by different customers; and 2) the difficulty in sourcing across resin and the adjacent equipment in producing different types of CCL (e.g. vacuum hot press machine). Meanwhile, we note that PPO/PPE cannot be paired with PTFE given the conflicts in characteristics.

In addition to the specialized plasma treatment, and long lead time in pressing machine (operating under high temperature) with high costs, one of the other major drawbacks to PTFE is the lack of stiffness in texture which makes it hard to be processed under PCB drilling/lamination. Thus, SiO2 (silicon dioxide) is used as a filler (or with increasing consumption vs that in M7/M8-grade CCL) to fill the resin matrix, and this helps reduce the thermal expansion coefficient (CTE) and enhance the mechanical strength of the composites. Elsewhere, a lack of adhesion to copper foil is the other key technological challenge when processing PTFE-based solutions, and this requires the help from hydrocarbon resin (to enhance the adhesion).

In short, the pursuit of more advanced materials like PTFE/hydrocarbon will simultaneously incur other technological challenges, which, in our view, makes relevant solutions to become more versatile (to solve the associated challenges). In Exhibit 6, we present the promoted solutions of M9/M10-grade CCL in the market, and we compare different metrics, including signal loss, mechanical strength, processibility, and costs.

Given the low penetration by M9-grade CCL currently (evidenced by single-digit% of industry leader EMC's revenue), we believe none of these solutions has become mainstream. In other words, we deem the ongoing development and qualification/testing results worth monitoring, and these include the feedback from board, ODM (original design manufacturer) and end-customers' levels. In our view, the most imminent (and perhaps critical) one will likely be the solution adopted by Rubin Ultra switch board and backplane (if any), which could be finally confirmed by end-2026/early-2027.

Exhibit 2: Spec migration of CCL and upstream raw materials used
CCL spec advancement is powered by the upgrades in its raw material

Category	Common Resin System	Representative Materials w/Suppliers	Typical PPE Content in Total Resin (when blended)	Typical Glass Fabric Style	Glass Requirement	Copper foil	Notes & References
Mid Loss (below M4)	Modified epoxy FR-4, epoxy/BT, small amount of PPE-modified epoxy	DS-7409D(Doosan); TU862HF(TUC); EM370D(EMC); NPG-170N(Nan Ya); Megtron 2(Panasonic)	0-15% (often pure modified epoxy resin, PPE/PPO optional)	106, 1080, 2113, 2116, 7628	E-Glass	RTF1/2	Mainly FR-4/modified epoxy
Low Loss (M4)	Epoxy/PPE blends, epoxy/cyanate ester (CE), etc	Megtron 4/4S(Panasonic); DS-7409D(X)(Doosan); IT-150DA(ITEQ); S7439(SYTECH); FR408HR(Isola); EM526(EMC)	10-30%	106, 1080, 3313, 2116	E-Glass	RTF1/2	Often use epoxy/PPE or epoxy/CE blends
Very Low Loss (M6)	PPE-based (epoxy/PPE or CE/PPE)	Megtron 6/6N(Panasonic); TU-883C/A, TU-885(TUC); IT968(ITEQ); EM528K(EMC); Synamic 6(SYTECH)	30-50%	106, 1080, 1086, 3313, 2116	E-Glass (Majority) and low Dk1 (Minority)	RTF2/3	Widely referenced in academic/conference literature as 30% vs. 50% PPE systems
Ultra Low Loss (M7)	High-content PPE base, hydrocarbon/ceramic	Megtron 7/7N(Panasonic); TU-883SP/A, TU933(TUC); DS7409DJG(N)(doosan; EM890K/891K(EMC); IT988/968GSE(ITEQ)	50-70% (or higher)	1035, 1078, 2113, 2116, 3313	Low Dk1 (Majority)	RTF2/3, HVLP1/2	To reach Df ≤ 0.003, requires higher PPE content or ceramic fillers
Extreme Low Loss (M8)	Highest-content PPE base	Megtron 8/8S(Panasonic), DS-7409DQN/N2(Doosan); TU-943SN/SR(TUC)	60-80% (also have some hydrocarbon resin system)	1035, 1078	Low Dk2 (Majority)	HVL	To reach Df ≤ 0.002
Super Extreme Low Loss (M9)	Hydrocarbon resin based (Likely ODV)	Megtron 9(Panasonic); EM896K2/3(EMC); DS-7409DYQ(Doosan); TU-953Q(TUC)	Hydrocarbon resin based	N/A	Low Dk2 and Q-Glass	HVL	

Source: BofA Global Research

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CCL spec advancement is powered by the upgrades in its raw material

Category	Common Resin System	Representative Materials w/Suppliers	Typical PPE Content in Total Resin (when blended)	Typical Glass Fabric Style	Glass Requirement	Copper foil	Notes & References

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Exhibit 3: Comparison of resins used in different grades of CCL
Hydrocarbon, PPO and PTFE have a stronger performance in terms of Dk and Df

Type of resin	Dk @ 10GHz	Df @ 10GHz	Tg (Celcius degree)	Major use cases
Hydrocarbon	2.2-2.6	0.001-0.005	<100	5G, AI server
PPO	2.45-2..5	0.001-0.007	160-200	M7/M8-grade CCL
PTFE	2.1	0.0004	200+	mmW, LEO
Epoxy	3.5-3.9	0.025	120-150	Consumer electronics
BMI	3-3.2	0.0015-0.003	250-300	Aerospace, military device

Source: BofA Global Research

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Exhibit 4: The upgrade to M8/M9/M10 CCL is characterized by progressive improvements in glass fiber cloth, copper foil, and resin systems
CCL material evolution takes place across M6-M9 grade products

Grade	Typical Application	Glass Type	Resin System	Copper Foil	Note
FR-4	General PCB, consumer electronics	E-glass	Epoxy/ modified epoxy	Standard Rz copper	Cost-driven, signal loss less critical
M6	Networking / mid-speed server PCB	E-glass/low-Dk1	Epoxy-PPO blend	VLP	Signal integrity starts to matter
M7	AI server / high-speed PCB	Low-Dk1/low-Dk2	PPO/PPE	HVLP3	High-speed signal transmission, supply tightness
M8/M8.5	AI server/ high-end switching	Low-Dk1/low-Dk2	PPO/PPE/BMI/hydrocarbon	HVLP3/HVLP4	Skin effect, supply tightness
M9 / M10	AI server/ substrate-like PCB / packaging	Low-Dk2/Q-glass	Hydrocarbon/PTFE/PPO/PPE	HVLP4/HVLP5	Warpage + chip-package mismatch, supply tightness

Source: BofA Global Research

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Exhibit 5: A comparison between PPO and mPPO
mPPO carries enhanced processability and reactivity when compared with PPO

Characteristics/type of resin	PPO	mPPO
Dk	Inherently low. Values for PPO-based composites are typically in the range of 2.1 - 3.5.	Retains low Dk, with high-performance grades achieving tightly controlled values, e.g., 2.8 - 3.0 for M9 grade.
Df	Inherently very low. Values for PPO-based systems can be as low as 0.0006.	Significantly reduced and optimized. Ranges from 0.004 – 0.008 for M6/M7 grades down to <0.002 (typically 0.0015–0.002) for ultra-low loss M9 grades.
Processability	Limited. High melt viscosity and lack of reactivity make it difficult to process.	Better. Low molecular weight and reactive end-groups enable good solubility, compatibility with CCL manufacturing, and thermosetting cross-linking.
Reactivity	Low. Lacks sufficient reactive groups to cross-link effectively with other resins.	High. Functionalized end-groups (e.g., styrene, methacrylate) allow it to chemically bond with other components in the resin formulation.

Source: BofA Global Research

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Exhibit 6: A comparison among different kinds of M9-grade and PTFE-based CCL
PTFE-based solutions boast stronger performance in signal decay, but also comes with the disadvantages from other perspectives

Formation	Signal decay/loss	Mechanical strength	Processability	Cost
M9 based on low Dk2 cloth & HVLP4 copper foil	Medium	High	High	Low
M9 based on Q cloth & HVLP 4 copper foil	Low	High	Mid/high	Medium
PTFE (with surface treatment) based on Q cloth & HVLP4 copper foil	Low	High	Medium	Medium
PTFE based on low Dk2 cloth & HVLP4 copper foil	Low	Medium	Low/medium	Medium
PTFE based on SiO2 filler & HVLP4 copper foil	Very low	Low	Low	High

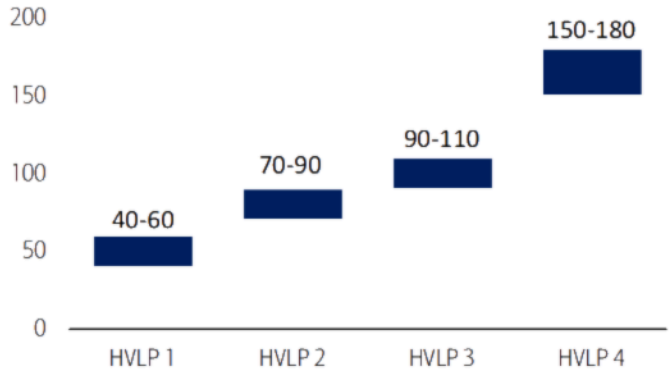
Source: BofA Global Research

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Clearer upgrades in glass cloth and copper foil

While the upgrades in resin system appear to be more debatable with a versatility in solutions, we witness a firmer roadmap advancement in glass cloth and copper foil. For glass cloth, (see reports) Nittobo shared the view of 100% demand growth in NER this year (FY3/27), followed by another c60% growth next year. As for copper foil, Mitsui Kinzoku also revised up the mix of HVLP4 and above products in 1H26 (within very smooth profile copper foil) to 45% (was 40%), and the figure is expected to reach 60% in 2H26. On pricing, we note that Mitsui Kinzoku also mentioned it would try pursuing a higher ASP in product segments where demand remains strong, while there is a higher processing fee (Exhibit 7) charged by copper foil suppliers in the high-end copper foil market. All-in-all, we see positive indications to the high-end CCL pricing, given that the CCL makers will try to pass through the inflated costs (due to stronger demand and the premium in processing fee) to the product ASP.

Exhibit 7: HVLP processing fee (RMB '000/t)
Pricing gaps are significant across HVLP generations.



Source: BofA Global Research

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Ongoing spec migration on multiple fronts into CY27-28

We see a clear upgrade cycle for CCL materials and PCB production technique across networking switches and AI (artificial intelligence) accelerators, including GPUs (graphic processing unit) and ASICs (application specific integrated circuits). In our view, the spec advancement (Exhibit 8) is primarily driven by faster data rates and increasingly stringent signal-integrity requirements. For NVIDIA, GB200/GB300 largely adopt M8-grade CCL, with low-Dk1/2 glass cloth and HVLP2/3 copper foil. The transition to VR200 drives further CCL specification upgrades toward M8+/M9-grade, along with the adoption of HVLP4 copper foil in VR200 compute board and midplane, while LPU adopts Q cloth with less signal loss (vs low Dk2).

While NVIDIA tends to place greater emphasis on glass cloth upgrades, ASICs and networking switches are more focused on copper foil migration. Among ASICs, we expect the CCL spec for Google TPU (tensor processing unit) v8 to migrate to M8+

based on low Dk2 cloth and HVLP3 copper foil (vs M7-grade CCL with low Dk1 and HVLP2 for TPU v7), followed by M9-grade adoption in TPU v9 based on HVLP4 copper foil (with either low Dk2 or Q-cloth). As for the Trainium chips by Amazon, there is a more visible upgrade in copper foil (vs glass cloth) taking place in Trainium 3 (2026), while its OAM (open accelerator module) in Trainium 4 (2027) will likely be upgraded to M8-grade CCL based on low Dk2 cloth. Simultaneously, we also expect a migration toward HDI (high-density interconnect) from HLC (high-layer count), with regard to the PCB production for the UBB (universal baseboard) in TPU v9 and Trainium 4.

Exhibit 8: Major GPU/ASIC/networking switch PCB/CCL spec migration trend
NVIDIA tends to place greater emphasis on glass cloth upgrades, while ASICs and networking switches are more focused on copper foil migration; upgrades toward M8+ and above are labeled in red texts

Customer/application	Generation/platform	Products	PCB type	CCL grade	Glass cloth (and copper foil) used
NVIDIA	GB200	Compute board	HDI	M8	Low Dk1 / HVLP3
		Switch board	HLC (MLB)	M8	Low Dk2 / HVLP2
	GB300	Compute board	HDI	M8	Low Dk1/Dk2; HVLP3
		Switch board	HLC (MLB)	M8	Low Dk1/Dk2; HVLP2
	VR200	Compute board	HDI	M8	Low Dk1/Dk2; HVLP4
		Switch board	HLC (MLB)	M8+	Low Dk2; HVLP3
		Midplane	HLC (MLB)	M8+/M9	Low Dk2; HVLP4
		LPU	HDI	M9	Q cloth; HVLP4
Networking switch	400G		HLC (MLB)	M7	Low Dk1 / HVLP2
	800G		HLC (MLB)	M8	Low Dk1/Dk2; HVLP3/4
	1.6T		HLC (MLB)	M8+/M9	Low Dk2/Q cloth; HVLP4/5
	3.2T		HLC (MLB)	M9+/M10	Q cloth; HVLP5
Google	TPU v7	UBB	HLC (MLB)	M7	Low Dk1 / HVLP2
	TPU v8	UBB	HLC (MLB)	M8+	Low Dk2 / HVLP3
	TPU v9	UBB	HDI	M9	Low Dk2/Q cloth; HVLP4
Amazon	Trainium 2	OAM	HDI	M6	Low Dk1 / HVLP2
		UBB	HLC (MLB)	M8	Low Dk1 / HVLP2
	Trainium 2.5	OAM	HDI	M7	Low Dk1 / HVLP2
		UBB	HLC (MLB)	M8	Low Dk1; HVLP2/4
	Trainium 3	OAM	HDI	M7	Low Dk1 / HVLP4
		UBB	HLC (MLB)	M8+	Low Dk2 / HVLP4
	Trainium 4	OAM	HDI	M8	Low Dk2 / HVLP4
		UBB	HDI	M9	Low Dk2 / HVLP4

Source: BofA Global Research, company data

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Along with the data-rate migration toward 800G and beyond (from 100/200G) for optical module, PCB structure evolves from conventional tenting design toward more complicated mSAP/SAP (semi-additive process) with higher layer count, enabling finer L/S (line/space) and smaller pitch (Exhibit 9). To elaborate, L/S of 3.2T optical module should shrink materially to 15/15μm from 60/60μm at 800G, and it was 125/125um for 100G generation. Simultaneously, the layer count would also increase to up to layers for 3.2T products, vs 10-layer in 400G generation.

Amid the backdrop of rapid spec migration, major PCB suppliers are accelerating capacity expansion to capture the burgeoning demand in high-end optical module (Exhibit 10), and these include Avary under ZDT (Zhen Ding Technology), Founder, SCC (Shennan Circuits), Unimicron and Compeq. While Unimicron remains the biggest supplier of optical module PCB (printed circuit board) in 2H26, we flag Avary and SCC could potentially become the other major suppliers in 2027, given their more aggressive capacity increase.

Exhibit 9: Optical module PCB/CCL spec migration trend
PCB structure is evolving toward mSAP/SAP at 800G/1.6T/3.2T

Technical Requirement	100G	200G	400G	800G	1.6T	3.2T
PCB Structure	1+N+1	2+N+2	Anylayer	Anylayer, mSAP	mSAP	SAP
Layer Count	-	-	10L	10-12L/12-16L	12-16L	12-18L
Copper Thickness (μm)	≥35	25-35	20-25	Min. 15	Min. 10	Min. 10
BGA Pitch (mm)	0.5-0.55	0.4-0.5	0.4-0.5	0.4-0.5	0.13-0.15	0.09-0.11
W/B pad pitch (μm)	300	250	250	100	100	85
L/S (μm)	125/125	100/100	75/75	60/60	25/25	15/15
PCB Design	Tenting	Tenting	Tenting	Tenting/mSAP	mSAP	SAP
Solder Mask	Liquid	Liquid	Liquid	Liquid/Dry	Liquid/Dry	Liquid/Dry
Special Design		Cavity	Cavity/Embedded copper coin	Cavity/Embedded copper coin	Cavity/Embedded copper coin	SOP

Source: BofA Global Research

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Exhibit 10: Optical module PCB capacity expansion plan by suppliers
Major PCB suppliers in Taiwan/China are planning to expand capacity throughout 2026/27 for optical module

Supplier	Headquarter	Current Capacity	Capacity by end-2026	Capacity by end-2027	Footnotes
ZDT (Avary)	Taiwan	Equivalent to NT$10bn revenue in 2026	Equivalent to NT$10bn revenue in 2026	Equivalent to NT$20-25bn or above revenue in 2027	Accounts for ~30% of total market
Founder	China	300-400K units/month (1 production line)	n.a.	2M units/month (expanding to 5 lines)	Capacity fully allocated to NVIDIA supply chain
Shennan Circuit	China	N/A	1.8M units/month	Expand by 1-2x	Supplier of Innolight
Unimicron	Taiwan	N/A	3M units/month	Add one more line in 2027, capacity to increase 40%	Supplier of 800G mSAP PCB to Innolight

Source: BofA Global Research, company data

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Expect further ASP uplift driven by mix & cost inflation

We expect CCL (for PCB) names' revenue growth to be fueled by continuous capacity expansion and ASP uplifts, and these include EMC, TUC, Shengyi Tech and Kingboard Laminates among our coverage. The ASP increase, in our view, will be driven by both price hike on a like-for-like basis (given the cost push) and mix improvements to higher CCL grades, and we note the former/latter represent bigger boost to the near-term/long-term ASP. To elaborate, the difference in near-term vs long-term boost can be explained by 1) a shorter production cycle time of less than 1-2 weeks by CCL makers which normally carry less than a quarter of inventory; and 2) a continuous spec advancement in CCL material grade given the requirement in data-transmission.

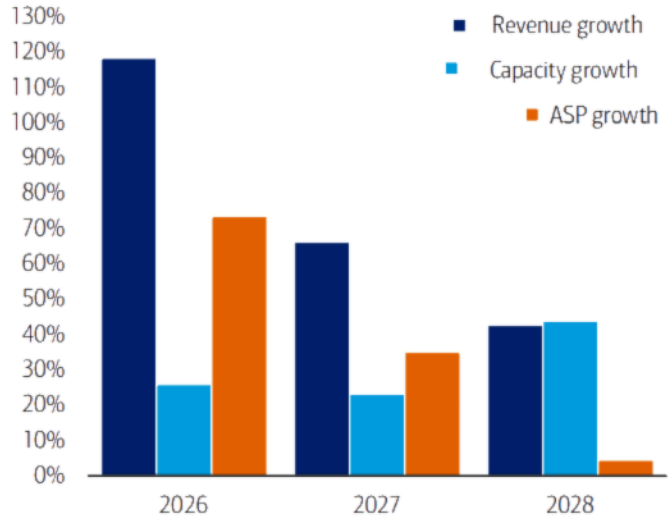
In Exhibit 11-13, we decipher the revenue growth by different CCL names based on the planned capacity expansion and ASP uplift, as well as the assumption of 95%/90%/90% capacity utilization rate by EMC/TUC/Shengyi Tech in 2028. In our view, the implied ASP growth of 4%/11%/18% by respective names look conservative, and we see room for further upside in the case of continuous cost inflation from the raw materials (e.g. glass cloth, copper foil). Further, we believe a smaller magnitude of ASP increase by EMC (vs TUC/Shengyi Tech) in 2028 can be explained by its already significant exposure to high-end CCL market in 2027. For reference, we present the CCL ASP by each grade with the figure for M4-grade indexed to 100 in Exhibit 20, and the gap of ASP by each grade remains quite meaningful, in our view.

Regarding the CCL mix by grade, we break down the revenue contribution by different grades to each company throughout 2025-28, and we compare the numbers to their gross margins in Exhibit 14-19. When comparing the gross margin, we carve out the revenue mix from M7-grade and above CCL, given that M6-grade is already in supply-demand balance (or slightly oversupply) situation from late-2025.

Among the three names, we expect EMC to remain the industry leader with 73%/85%/92% revenue mix from M7-grade and above CCL in 2026/27/28, which helps strengthen its gross margin to 35.8%/36.7% in 2027/28 (vs 34% in 2026). TUC will follow suit with 43%/47%/53% revenue mix from M7-grade and above CCL in 2026/27/28, with gross margin edging toward 32.6%/33.7% in 2027/28 (vs 30.4% in 2026). As for Shengyi Tech, we expect 28%/35%/57% revenue mix from M7-grade and above CCL in 2026/27/28, and its gross margin (in CCL business) is expected to inch up to 31%/31.8 in 2027/28 (vs 30.7% in 2026).

Exhibit 11: Revenue growth breakdown by ASP and shipment YoY - EMC

We expect EMC's revenue growth across 2025-28 to be powered by 30%+ capacity CAGR and ~35% ASP CAGR

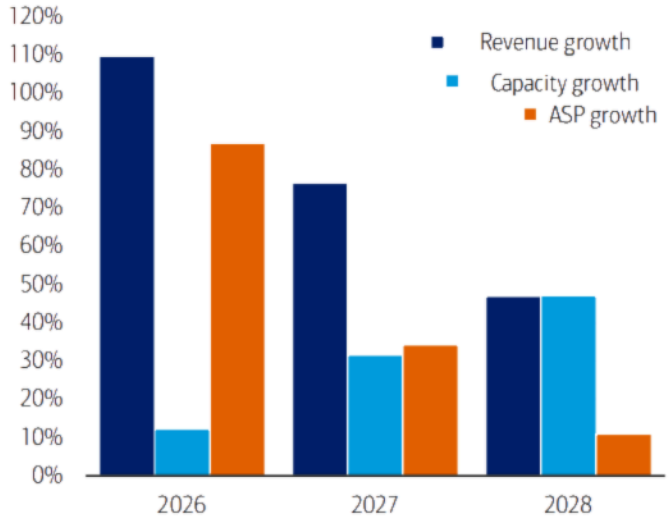


Source: BofA Global Research estimates

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Exhibit 12: Revenue growth breakdown by ASP and shipment YoY - TUC

We expect TUC's revenue growth across 2025-28 to be powered by ~30% capacity CAGR and 40%+ ASP CAGR

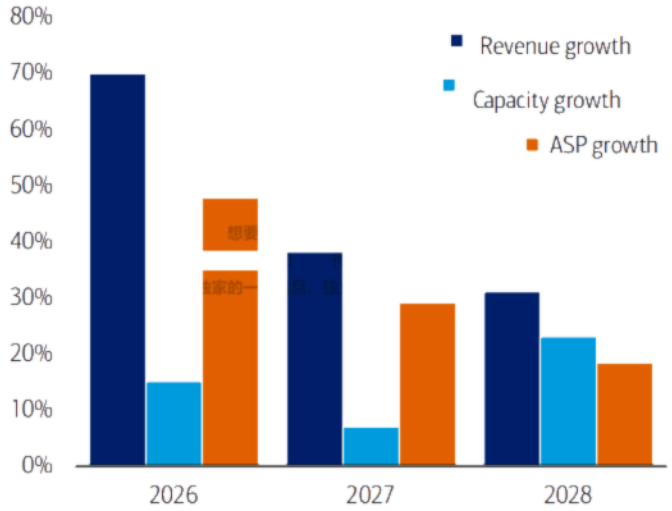


Source: BofA Global Research estimates

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Exhibit 13: Revenue growth breakdown by ASP and shipment YoY - Shengyi

We expect Shengyi's revenue growth in CCL business across 2025-28 to be powered by ~15% capacity CAGR and ~30% ASP CAGR

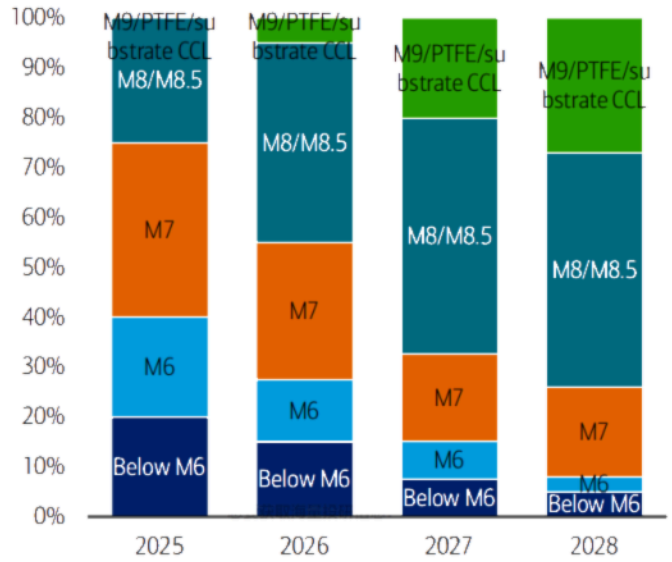


Source: BofA Global Research estimates

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Exhibit 14: Revenue mix by CCL grade - EMC

We expect 73%/85%/92% revenue contribution from M7-grade and above CCL in 2026/27/28

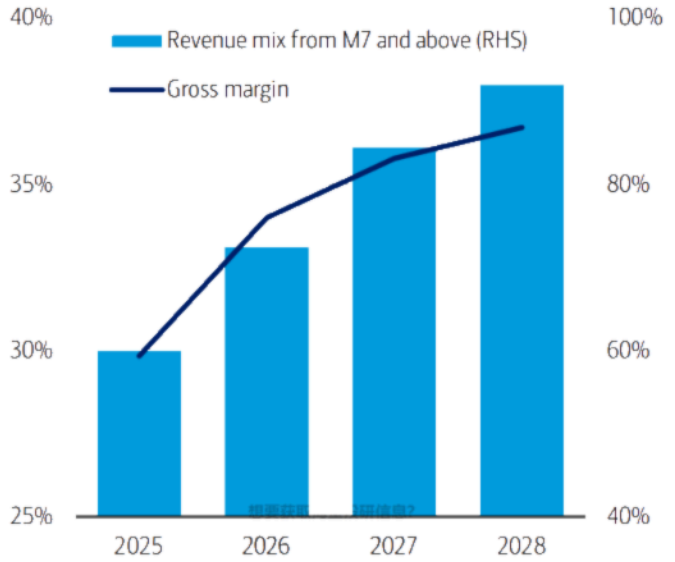


Source: BofA Global Research estimates

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Exhibit 15: Revenue mix from M7 and above vs gross margin - EMC

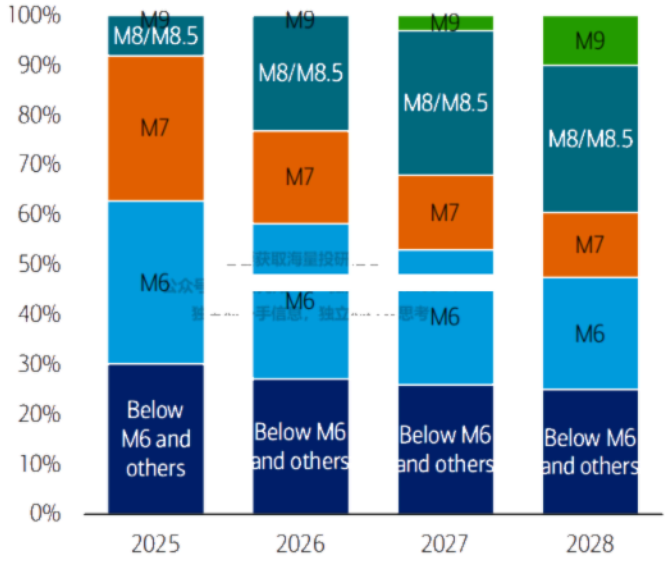
We expect 35.8%/36.7% gross margin in 2027/28 along with rising mix from high-end CCL



Source: BofA Global Research estimates

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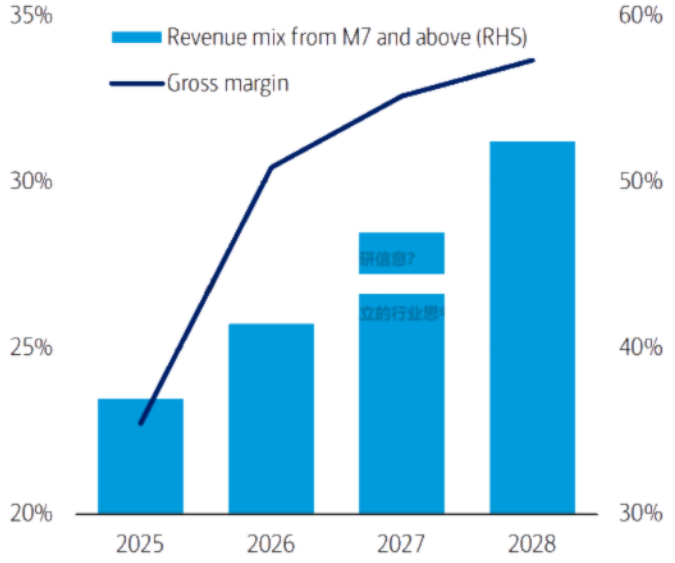
Exhibit 16: Revenue mix by CCL grade - TUC
We expect 43%/47%/53% revenue contribution from M7-grade and above CCL in 2026/27/28



Source: BofA Global Research estimates

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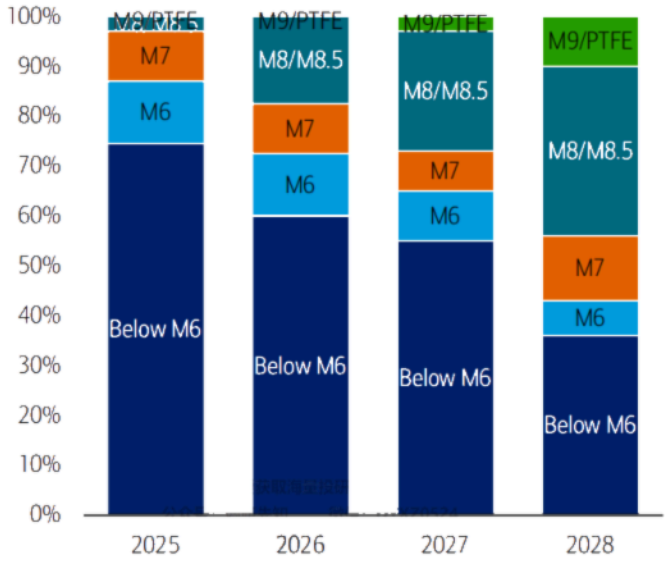
Exhibit 17: Revenue mix from M7 and above vs gross margin - TUC
We expect 32.6%/33.7% gross margin in 2027/28 along with rising mix from high-end CCL



Source: BofA Global Research estimates

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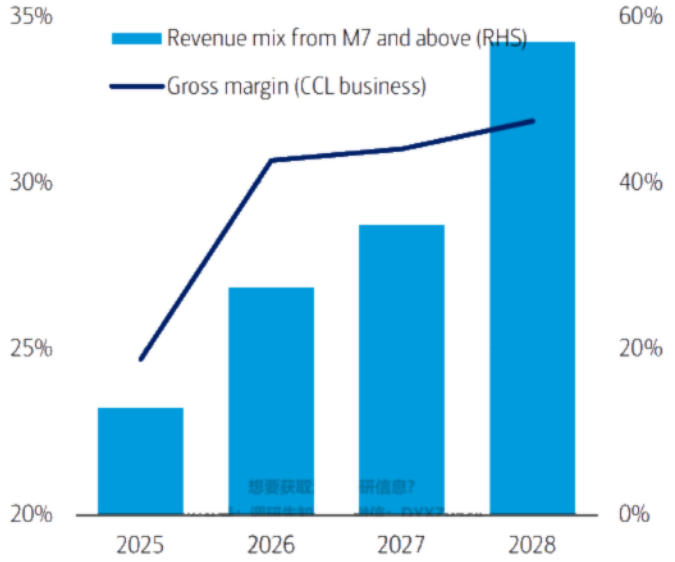
Exhibit 18: Revenue mix by CCL grade - Shengyi
We expect 28%/35%/57% revenue contribution from M7-grade and above CCL in 2026/27/28



Source: BofA Global Research estimates

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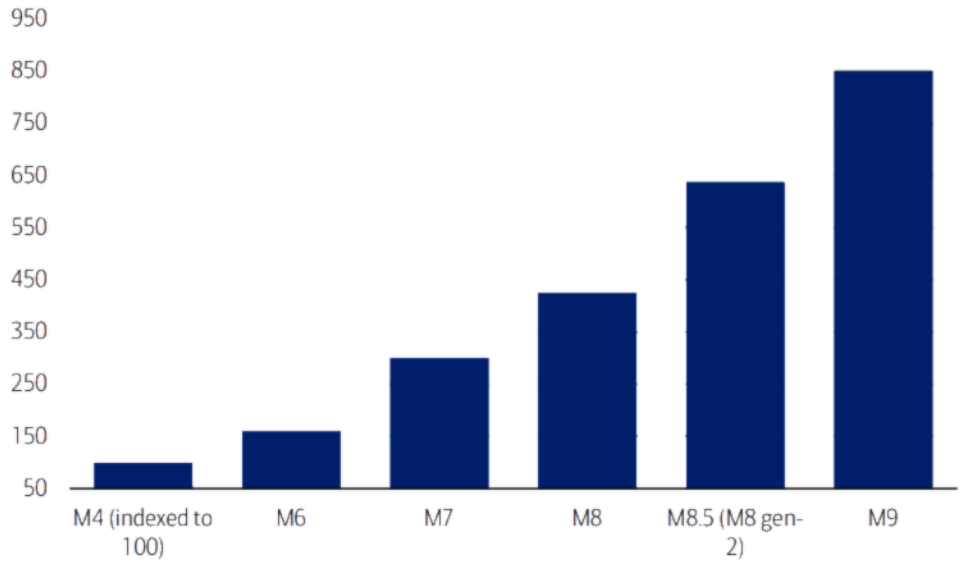
Exhibit 19: Revenue mix from M7 and above vs gross margin - Shengyi
We expect 31%/31.8% gross margin in 2027/28 along with rising mix from high-end CCL



Source: BofA Global Research estimates

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Exhibit 20: CCL ASP comparison by grade
There is ~50%/100% price premium by M8.5/M9 vs M8



Source: BofA Global Research

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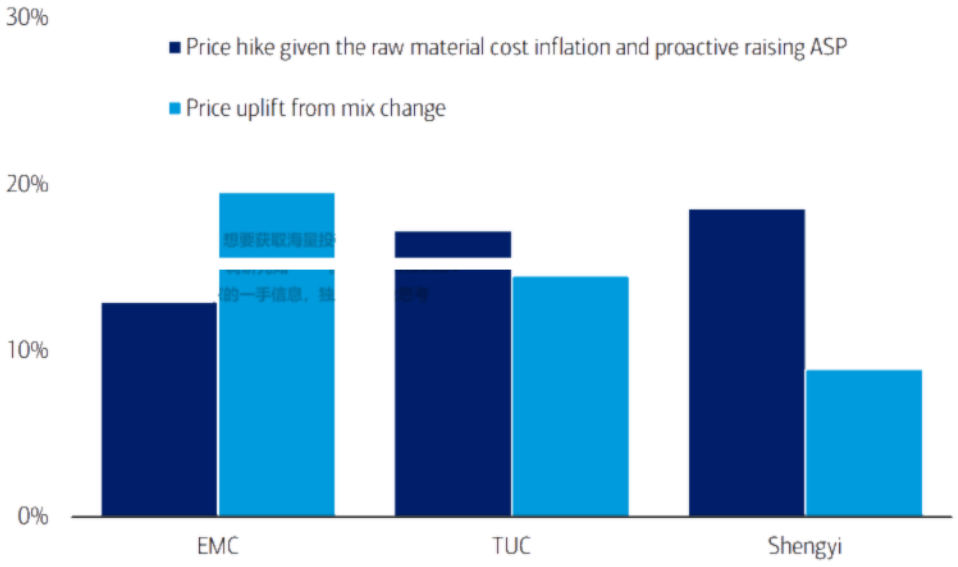
Regarding the ASP uplifts by firm in 2027, we further decode into the factors of cost inflation and mix enhancement as shown in Exhibit 21. To simply put, we expect a smaller boost to EMC (vs TUC/Shengyi Tech) from cost inflation of raw materials and the corresponding pass-through, given its relatively lower revenue exposure to low-/mid-end CCL market, where CCL makers pass through the cost more frequently upon squeezed margin profile. Yet, on the other hand, EMC (in terms of ASP) is expected to benefit more from the enhanced mix in 2027, thanks to the further ramp of M8/M8.5-grade CCL as well as the penetration increase of M9 and PTFE-based solutions.

Year-to-date, we believe there is already 40%+/20%+ price hike across low-/high-end CCL, and we do not rule out the likelihood of further price increase given the (see report) expectations of continuously rising copper price into late-2026 and 2027 (Exhibit 22). There was a price hike of VSP (very smooth profile) foil, effective from July 2026 by Mitsui Kinzoku given the demand strength and likely to be followed suit by a Taiwanese supplier (Co-Tech), based on our checks with supply chain. On the glass cloth side, we note the potential pricing upside from low Dk2 cloth given the supply shortage, while the price of low-end E-glass cloth (such as 7628 type) remains on the uptrend (Exhibit 23) and may reach CNY15-16 (per msq) by end-2026. In our view, all of these point to a benign pricing outlook for CCL makers.

To pinpoint the benefits from price increase by CCL makers, we conduct a scenario analysis to each name's 2027 bottom-line as shown in Exhibit 24. In short, we expect 1.2-1.6% upside to the net income estimates coming from every 1ppt price hike, if such price increase purely reflects cost inflation. On the other hand, we expect 3.3-5.1% upside to the net income estimates, if the price hike is purely driven a supply shortage (which enables CCL makers to raise the ASP proactively). Further on Shengyi Tech, we assume that its PCB business (Shengyi Electronics) can also pass on the cost increase (from CCL side), with same magnitude to its ASP.

For Kingboard Laminates, its vertical integration significantly enhances its earnings sensitivity to price hikes, as most of its key raw materials are produced in-house. Notably, price hikes in glass fiber cloth can translate almost entirely into profit, given in-house production of yarn. Our analysis suggests that 100% increase in CCL prices could drive c.28ppt gross margin expansion for KBL, and more than 200% growth at the EPS level in 2026. This assumes that future price hikes are primarily driven by cloth tightness, while input costs for copper foil and resin remain relatively stable.

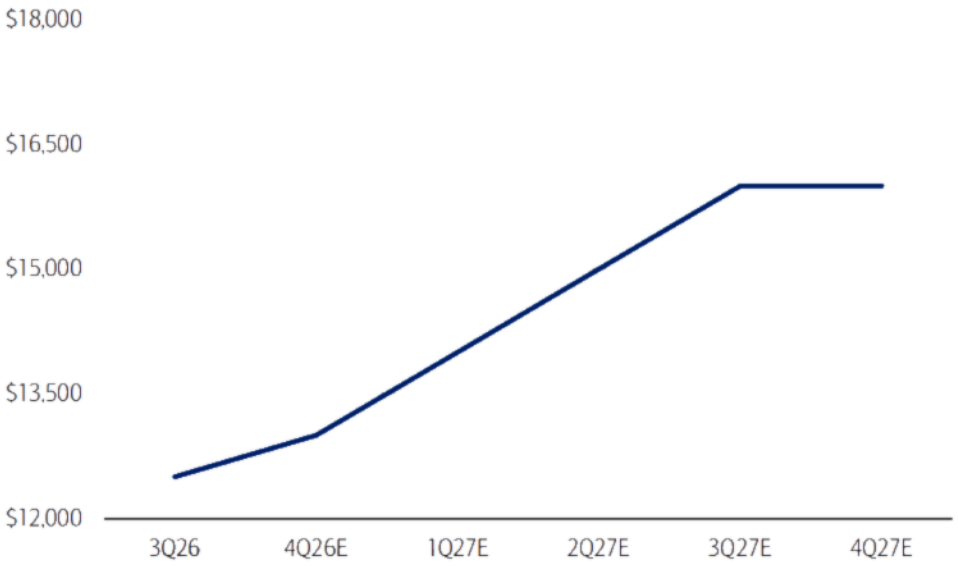
Exhibit 21: Breakdown of the factors to drive ASP uplift in 2027
EMC is expected benefit more (on the ASP) from the mix enhancement



Source: BofA Global Research estimates

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Exhibit 22: Copper price trend (US$/ton)
We expect continuous rise in copper price toward end-2026 and 2027



Source: BofA Global Research estimates

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Exhibit 23: Summary of price hike (after tax) by different types of glass cloth
Low-end glass cloth registered stronger price hike year-to-date (YTD)

Type of glass cloth	YTD price uplift	Price as of Aug 2026 (msq)
E-glass 7628	Over 1.2x	~CNY10
E-glass 2116	Over 1.5x	~CNY13
E-glass 1080	Over 1.5x	~CNY13.5
Low Dk1	20-30%	CNY26
Low Dk2	10-20%	CNY95-100

Exhibit 23: Summary of price hike (after tax) by different types of glass cloth
Low-end glass cloth registered stronger price hike year-to-date (YTD)

Type of glass cloth	YTD price uplift	Price as of Aug 2026 (msq)
Q-glass	n.a.	CNY200+

Source: BofA Global Research, company data

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Exhibit 24: Sensitivity on 2027 net income per 1% of price hike
We expect 1-2% and 3-5% bottom-line benefits based on different scenarios, per every 1ppt of CCL price hike

	Scenario 1	Scenario 2
Company	CCL price hike w.o. any cost inflation	CCL price hike purely driven by cost inflation
EMC	3.3%	1.2%
TUC	3.8%	1.2%
Shengyi	5.1%	1.6%

Source: BofA Global Research estimates

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Exhibit 25: 100% price hike could drive over 200% EPS upside for Kingboard laminates, assuming (1) 20% usual GM before price hike, and (2) price hike can be all translated into profit
Scenario analysis of CCL price hike's impact on EPS, 2026E

Impact on EPS (2026E)		CCL price hike				
		20%	40%	60%	80%	100%
Usual GM without price hike	20%	67%	105%	142%	180%	217%
	25%	88%	125%	163%	200%	238%
	30%	108%	146%	183%	221%	258%
	35%	128%	166%	203%	241%	278%

Source: BofA Global Research estimates

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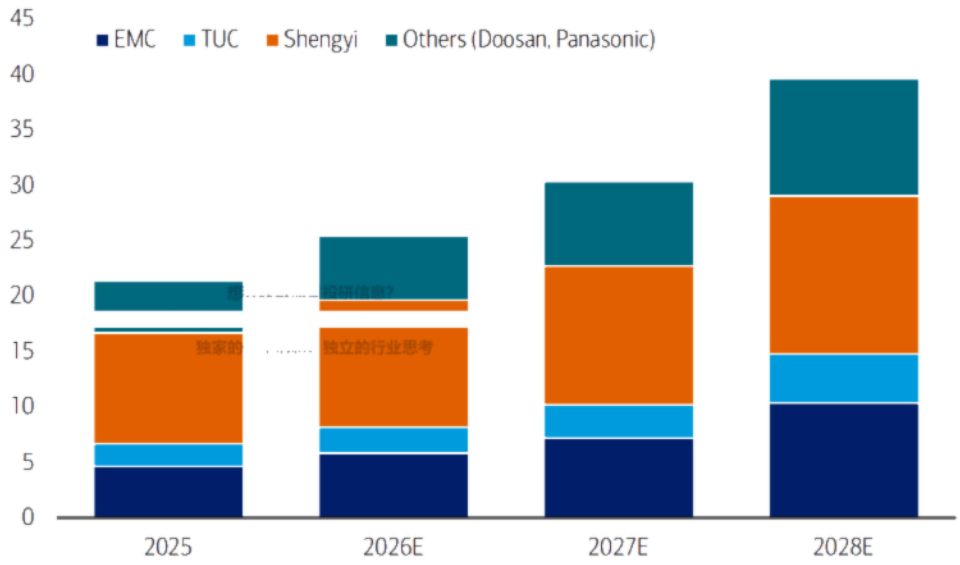
Sector view: stay positive on industry leaders

We stay constructive on the CCL for PCB area, given the ongoing spec upgrades and robust demand growth into 2027-28, and we believe the worries from CPO (co-packaged optics) proliferation are either overstated or distant, as the mass adoption of CPO to replace NPO (near-packaged optics) or pluggable optical modules will not take place until 2029/30, at earliest.

Currently, we see extended lead-time (of production) toward 2-3 months by high-end CCL makers in 2H26 (vs 1-2 months seen in 1H26), while low/mid-end suppliers' lead time is also extended to 1-2 months (7-10 days before). We also believe the current valuation by EMC (21-22x 2027E P/E) and TUC (17-18x 2027E P/E) looks compelling, given that the numbers do not seem lofty when compared with the historical trading range of 1) 15-20x before mid-2023; and 2) normally above 20x after mid-2023 when the strong demand from AI server starts to emerge. As for Kingboard Laminates, it is traded at 8x 2027E P/E, below historical average of 10x.

Among our coverage, we highlight Buy-rated EMC, given its technology leadership in high-end CCL area along with diversified customer profile across GPU and ASIC accounts, as well as TUC, given its (see report) aggressive capacity expansion into 2027 and beyond. We also highlight Buy rating on Doosan Corp and Kingboard Laminates, given the former's solid position in NVIDIA GPU and Amazon switch, as well as the latter's robust earnings expansion amid CCL price hike and rising high-end contribution starting 2027. As for Shengyi Tech, we remain relatively conservative, given its relatively slower expansion in CCL capacity along with a milder growth in the PCB business.

Exhibit 26: Forecast of high-end CCL capacity (mn sheets per month) by vendors
EMC, TUC and Doosan are expected to expand the capacity by 40-50% CAGR during 2026-28



Source: BofA Global Research estimates, company data

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EMC (2383 TT; Buy; PO NT$8,200)

We reckon EMC's potential share loss in Rubin Ultra switch board (tray), given the competition in PTFE-based (hybrid) solutions (vs M9-Q), as well as the ongoing debate between PTFE and quartz-glass/hydrocarbon resin solutions into M10-grade CCL. We also note that M9-Q (where EMC has more notable technology leadership) is likely to be adopted in backplane by NVIDIA, no matter if it will initially be seen in Rubin Ultra or Feynman generation. Net-net, we believe the impact on bottom-line (if any) from aforementioned headwinds should be confined to LSD (low-single-digit)%, considering 1) 80-90k (per month) of relevant demand by NVIDIA's switch board vs EMC's capacity of ~6/9mn in 2026/27; and 2) the demand backfill from other high-end projects across AMD and other ASIC customers.

Looking ahead, we see further expansion plan beyond 1H28 as a catalyst, if it is announced. In addition to the CCL for PCB business, we note that substrate CCL business boasts at least 50-60% GM (gross margin), and EMC could expand relevant capacity to 1.2mn sheet /month which could help expedite its market-share gain toward ~5% (vs 1-2% in 2025). We raise 2026/27/28E EPS by 5%/11%/14% after penciling in stronger revenue growth and gross margin profile, while our PO stays at NT$8,200 as we apply a lower P/E multiple of 30x (was 34x), with the same valuation period of 2H27-1H28E, mainly reflecting the overhang from competition in PTFE-based solutions.

Exhibit 27: Earnings estimate change - EMC
We raise EPS by 5-14% after baking in the assumptions of stronger revenue growth and gross margin

(NT$mn)	BofA 26 (E)			BofA 27 (E)			BofA 28 (E)		
	New	Old	Diff (%)	New	Old	Diff (%)	New	Old	Diff (%)
Total sales	205,611	196,632	4.6	341,554	317,082	7.7	486,890	450,919	8.0
Gross profit	69,889	66,621	4.9	122,190	111,146	9.9	178,713	158,381	12.8
Gross margin	34.0%	33.9%	0.1 ppt	35.8%	35.1%	0.7 ppt	36.7%	35.1%	1.6 ppt
Operating profit	56,322	53,707	4.9	102,563	92,758	10.6	152,140	133,726	13.8
Operating margin	27.4%	27.3%	0.1 ppt	30.0%	29.3%	0.8 ppt	31.2%	29.7%	1.6 ppt
Pretax income	56,402	53,787	4.9	102,538	92,732	10.6	152,108	133,695	13.8
Pretax margin	27.4%	27.4%	0.1 ppt	30.0%	29.2%	0.8 ppt	31.2%	29.6%	1.6 ppt
Net income	44,033	41,965	4.9	79,931	72,278	10.6	116,983	102,813	13.8
Net margin	21.4%	21.3%	0.1 ppt	23.4%	22.8%	0.6 ppt	24.0%	22.8%	1.2 ppt
EPS (NT$)	122.89	117.12	4.9	223.07	201.71	10.6	326.47	286.93	13.8

Exhibit 27: Earnings estimate change - EMC
We raise EPS by 5-14% after baking in the assumptions of stronger revenue growth and gross margin

(NT$mn)	BofA 26 (E)	BofA 27 (E)	BofA 28 (E)

Source: BofA Global Research estimates

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Exhibit 28: BofAe vs consensus - EMC
We are 1%/10% behind consensus for 2027/28E EPS given more conservative assumptions on gross margin

(NT$mn)	2026E			2027E			2028E		
	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)
Total sales	205,611	195,995	4.9	341,554	330,916	3.2	486,890	499,850	-2.6
Gross profit	69,889	67,034	4.3	122,190	125,291	-2.5	178,713	195,546	-8.6
Gross margin	34.0%	34.2%	-0.2 ppt	35.8%	37.9%	-2.1 ppt	36.7%	39.1%	-2.4 ppt
Operating profit	56,322	53,503	5.3	102,563	105,038	-2.4	152,140	164,057	-7.3
Operating margin	27.4%	27.3%	0.1 ppt	30.0%	31.7%	-1.7 ppt	31.2%	32.8%	-1.6 ppt
Pretax income	56,402	53,695	5.0	102,538	104,749	-2.1	152,108	167,442	-9.2
Pretax margin	27.4%	27.4%	0.0 ppt	30.0%	31.7%	-1.6 ppt	31.2%	33.5%	-2.3 ppt
Net income	44,033	41,293	6.6	79,931	80,762	-1.0	116,983	129,814	-9.9
Net margin	21.4%	21.1%	0.3 ppt	23.4%	24.4%	-1.0 ppt	24.0%	26.0%	-1.9 ppt
EPS (NT$)	122.89	115.24	6.6	223.07	225.39	-1.0	326.47	362.28	-9.9

Source: BofA Global Research estimates, Bloomberg

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Exhibit 29: Income statement - EMC
We expect the company to record 50+% revenue CAGR during 2026-28

(NT$mn)	1Q26	2Q26	3Q26E	4Q26E	1Q27E	2Q27E	3Q27E	4Q27E	2025	2026E	2027E	2028E
Revenue	33,067	47,275	59,607	65,662	74,131	80,827	88,616	97,979	94,261	205,611	341,554	486,890
COGS	-23,338	-31,233	-38,817	-42,335	-48,177	-52,181	-56,878	-62,128	-66,141	-135,723	-219,364	-308,177
Gross Profit	9,729	16,042	20,790	23,328	25,954	28,646	31,739	35,851	28,120	69,889	122,190	178,713
Operating expenses	-2,601	-3,308	-3,752	-3,906	-4,173	-4,478	-5,244	-5,732	-9,012	-13,567	-19,627	-26,574
SG&A	-1,836	-2,448	-2,775	-2,895	-3,102	-3,402	-3,680	-3,912	-6,870	-9,954	-14,097	-18,615
R&D	-764	-861	-978	-1,011	-1,070	-1,076	-1,564	-1,819	-2,142	-3,613	-5,529	-7,959
Operating income	7,128	12,734	17,038	19,422	21,782	24,168	26,495	30,119	19,108	56,322	102,563	152,140
Non-operating income	66	51	82	-118	32	32	-19	-70	-232	80	-26	-31
Interest income	-65	-65	-66	-67	-67	-67	-67	-68	-216	-263	-269	-274
Investment income	0	0	0	0	0	0	0	0	0	0	0	0
Others	131	116	148	-52	98	98	48	-2	-16	344	243	243
Pre-tax profit	7,194	12,785	17,120	19,303	21,813	24,199	26,475	30,050	18,876	56,402	102,538	152,108
Tax	-1,855	-2,912	-3,938	-3,668	-5,671	-4,840	-6,089	-6,010	-4,231	-12,373	-22,611	-35,130
Net income	5,340	9,876	13,183	15,637	16,143	19,360	20,390	24,041	14,649	44,033	79,931	116,983
EPS (NT$)	14.90	27.55	36.79	43.64	45.05	54.03	56.90	67.09	41.86	122.89	223.07	326.47
Margin												
Gross margin	29.4%	33.9%	34.9%	35.5%	35.0%	35.4%	35.8%	36.6%	29.8%	34.0%	35.8%	36.7%
Operating margin	21.6%	26.9%	28.6%	29.6%	29.4%	29.9%	29.9%	30.7%	20.3%	27.4%	30.0%	31.2%
Pre-tax margin	21.8%	27.0%	28.7%	29.4%	29.4%	29.9%	29.9%	30.7%	20.0%	27.4%	30.0%	31.2%
Net margin	16.1%	20.9%	22.1%	23.8%	21.8%	24.0%	23.0%	24.5%	15.5%	21.4%	23.4%	24.0%
QoQ growth												
Revenue	32.7%	43.0%	26.1%	10.2%	12.9%	9.0%	9.6%	10.6%				
Gross profit	36.6%	64.9%	29.6%	12.2%	11.3%	10.4%	10.8%	13.0%				
Operating profit	44.4%	78.6%	33.8%	14.0%	12.2%	11.0%	9.6%	13.7%				
Pre-tax profit	55.7%	77.7%	33.9%	12.8%	13.0%	10.9%	9.4%	13.5%				
Net profit	42.9%	85.0%	33.5%	18.6%	3.2%	19.9%	5.3%	17.9%				
YoY growth												
Revenue	46.9%	88.0%	139.1%	98.6%	56.8%	35.6%	35.0%	32.2%	46.4%	118.1%	66.1%	42.6%
Gross profit	42.5%	111.8%	191.8%	139.8%	61.8%	37.8%	36.1%	38.1%	56.5%	148.5%	74.8%	46.3%
Operating profit	53.5%	155.2%	245.2%	172.5%	71.1%	41.8%	36.4%	38.3%	57.2%	194.8%	82.1%	48.3%
Pre-tax profit	61.1%	149.6%	270.5%	168.3%	70.6%	41.4%	37.2%	37.8%	55.6%	198.8%	81.8%	48.3%
Net profit	53.5%	149.1%	252.8%	192.8%	63.4%	46.9%	30.4%	48.9%	52.9%	200.6%	81.5%	46.4%

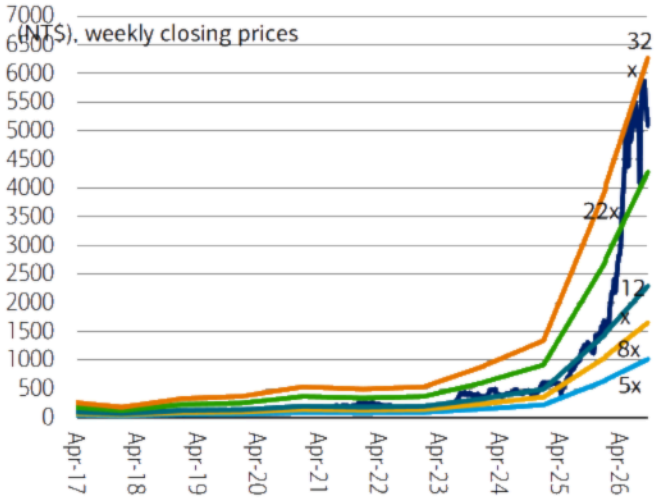
Source: BofA Global Research estimates, company data

Exhibit 29: Income statement - EMC
We expect the company to record 50+% revenue CAGR during 2026-28

(NT$mn)	1Q26	2Q26	3Q26E	4Q26E	1Q27E	2Q27E	3Q27E	4Q27E	2025	2026E	2027E	2028E

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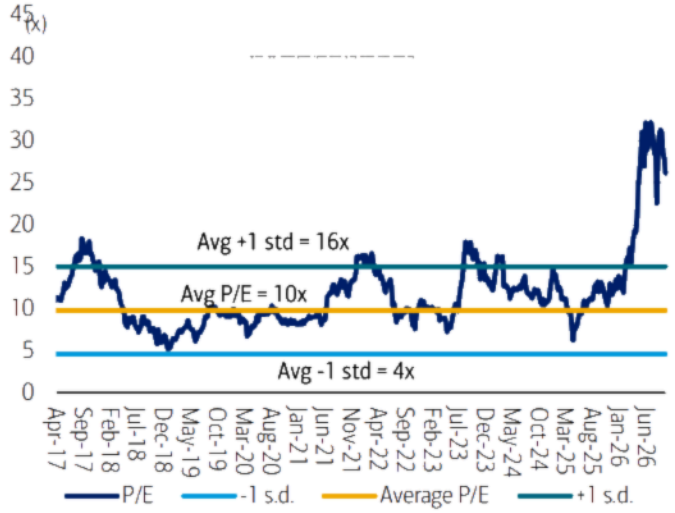
Exhibit 30: 12-month forward P/E - EMC
The stock is traded at ~26x forward P/E



Source: BofA Global Research estimates, company data

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Exhibit 31: 12-month forward P/E with standard deviation - EMC
The multiple (26x) is higher than 2 standard deviation above the historical average



Source: BofA Global Research estimates, company data

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TUC (6274 TT; Buy; PO NT$2,600)

Looking into 2027, we flag multiple positives from spec advancements for TUC, including 1) the potentially partial adoption of M9-grade CCL by 1.6T networking switch, where TUC's solution is based on low Dk3 glass cloth; 2) the upgrade to M8-grade CCL for LEO (low earth orbit); and 3) the migration toward M8-grade material by Vera CPU (central processing unit). Meanwhile, we share the view that hybrid solution from PTFE-based CCL may last toward M10-grade. Demand from high-end optical module (800G and above) could have remained underestimated at current stage, as we believe relevant TAM (total addressable market) for CCL could reach NT$30bn+, which represents close to 50% of TUC's total revenue in 2026. In terms of Thailand operations, we believe it could turn breakeven or profitable from 3Q26, thanks to the smooth ramp of capacity/output to pair with the robust demand growth outlook from customers.

We raise 2026/27/28E EPS by 7%/11%/7% after baking in the assumptions of stronger revenue growth and slightly enhanced GM profile as well as operating leverage. Our PO stays at NT$2,600, based on a lower P/E multiple of 27x (was 30.5x) and an unchanged valuation period of 2H27-1H28E. We attribute the cut in valuation multiple to the likely growing traction by PTFE-based solutions that serve as other alternatives in the high-end CCL market.

Exhibit 32: Earnings estimate change - TUC
We raise 2026-28E EPS by 7-11% after baking in the assumptions of stronger revenue growth and operating leverage

(NT$mn)	BofA 26 (E)			BofA 27 (E)			BofA 28 (E)		
	New	Old	Diff (%)	New	Old	Diff (%)	New	Old	Diff (%)
Total sales	63,603	60,362	5.4	112,263	104,405	7.5	164,882	163,619	0.8
Gross profit	19,354	18,216	6.2	36,570	33,757	8.3	55,494	53,219	4.3
Gross margin	30.4%	30.2%	0.2 ppt	32.6%	32.3%	0.2 ppt	33.7%	32.5%	1.1 ppt
Operating profit	15,367	14,427	6.5	29,897	27,553	8.5	46,019	43,816	5.0
Operating margin	24.2%	23.9%	0.3 ppt	26.6%	26.4%	0.2 ppt	27.9%	26.8%	1.1 ppt
Pretax income	15,492	14,552	6.5	29,907	27,562	8.5	45,989	43,785	5.0
Pretax margin	24.4%	24.1%	0.2 ppt	26.6%	26.4%	0.2 ppt	27.9%	26.8%	1.1 ppt
Net income	11,653	10,910	6.8	22,240	20,012	11.1	34,181	32,034	6.7
Net margin	18.3%	18.1%	0.2 ppt	19.8%	19.2%	0.6 ppt	20.7%	19.6%	1.2 ppt
EPS (NT$)	40.35	37.78	6.8	77.01	69.30	11.1	118.37	110.93	6.7

Source: BofA Global Research estimates

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Exhibit 33: BofAe vs consensus - TUC
We are largely in-line with consensus for 2027E EPS

(NT$mn)	2026E			2027E			2028E		
	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)
Total sales	63,603	60,291	5.5	112,263	104,750	7.2	164,882	174,504	-5.5
Gross profit	19,354	18,463	4.8	36,570	35,562	2.8	55,494	63,849	-13.1
Gross margin	30.4%	30.6%	-0.2 ppt	32.6%	33.9%	-1.4 ppt	33.7%	36.6%	-2.9 ppt
Operating profit	15,367	14,794	3.9	29,897	30,241	-1.1	46,019	53,642	-14.2
Operating margin	24.2%	24.5%	-0.4 ppt	26.6%	28.9%	-2.2 ppt	27.9%	30.7%	-2.8 ppt
Pretax income	15,492	14,900	4.0	29,907	30,216	-1.0	45,989	55,653	-17.4
Pretax margin	24.4%	24.7%	-0.4 ppt	26.6%	28.8%	-2.2 ppt	27.9%	31.9%	-4.0 ppt
Net income	11,653	10,908	6.8	22,240	22,234	0.0	34,181	43,576	-21.6
Net margin	18.3%	18.1%	0.2 ppt	19.8%	21.2%	-1.4 ppt	20.7%	25.0%	-4.2 ppt
EPS (NT$)	40.35	37.77	6.8	77.01	76.99	0.0	118.37	150.90	-21.6

Source: BofA Global Research estimates, Bloomberg

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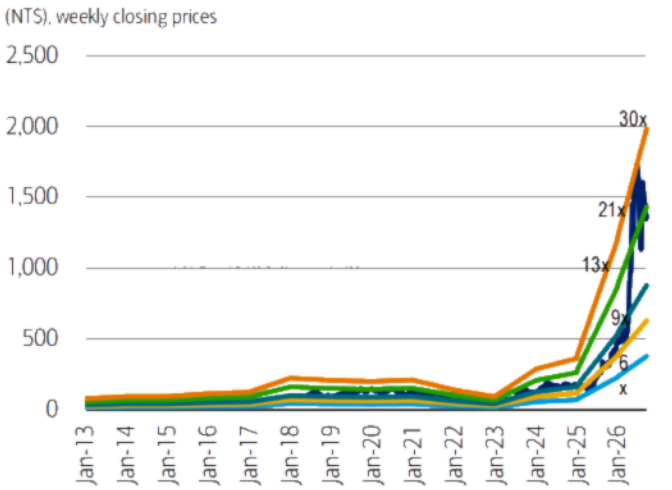
Exhibit 34: Income statement - TUC
We expect the company to record ~60% revenue CAGR during 2026-28

NT$mn; %	1Q26	2Q26	3Q26E	4Q26E	1Q27E	2Q27E	3Q27E	4Q27E	2025	2026E	2027E	2028E
Revenue	10,054	14,301	18,026	21,222	23,641	25,463	29,652	33,507	30,340	63,603	112,263	164,882
Cost of Revenue	(7,525)	(10,051)	(12,348)	(14,325)	(16,135)	(17,251)	(19,941)	(22,366)	(23,442)	(44,250)	(75,693)	(109,388)
Gross profit	2,529	4,250	5,678	6,897	7,506	8,212	9,711	11,141	6,898	19,354	36,570	55,494
Operating exp	(701)	(892)	(1,100)	(1,295)	(1,418)	(1,528)	(1,749)	(1,977)	(2,554)	(3,987)	(6,673)	(9,475)
Operating income	1,828	3,358	4,579	5,603	6,088	6,684	7,962	9,164	4,344	15,367	29,897	46,019
Non-opt net	46	69	5	5	(20)	10	10	10	175	125	10	(30)
Income before tax	1,874	3,427	4,584	5,607	6,067	6,694	7,971	9,174	4,519	15,492	29,907	45,989
Income Tax	(614)	(1,085)	(963)	(1,178)	(1,699)	(1,339)	(2,152)	(2,477)	(1,109)	(3,839)	(7,667)	(11,808)
Net income	1,260	2,342	3,621	4,430	4,369	5,355	5,819	6,697	3,409	11,653	22,240	34,181
EPS (NT$)	4.4	8.1	12.5	15.3	15.1	18.5	20.2	23.2	12.2	40.4	77.0	118.4
Margin; tax rate												
Gross margin	25%	30%	32%	33%	32%	32%	33%	33%	23%	30%	33%	34%
Operating expenses	7%	6%	6%	6%	6%	6%	6%	6%	8%	6%	6%	6%
Operating margin	18%	23%	25%	26%	26%	26%	27%	27%	14%	24%	27%	28%
Pretax margin	19%	24%	25%	26%	26%	26%	27%	27%	15%	24%	27%	28%
Net margin	13%	16%	20%	21%	18%	21%	20%	20%	11%	18%	20%	21%
Tax rate	33%	32%	21%	21%	28%	20%	27%	27%	25%	25%	26%	26%
Sequential growth %												
Revenue	10%	42%	26%	18%	11%	8%	16%	13%	32%	110%	77%	47%
Gross profit	26%	68%	34%	21%	9%	9%	18%	15%	29%	181%	89%	52%
Operating exp	-3%	27%	23%	18%	10%	8%	15%	13%	27%	56%	67%	42%
Operating income	42%	84%	36%	22%	9%	10%	19%	15%	30%	254%	95%	54%
Net income	16%	86%	55%	22%	-1%	23%	9%	15%	31%	242%	91%	54%

Source: BofA Global Research estimates, company data

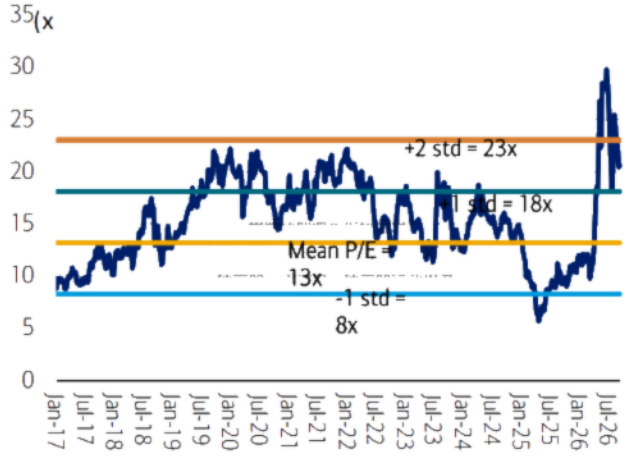
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Exhibit 35: 12-month forward P/E - TUC
The stock is traded at ~20x forward P/E



Source: BofA Global Research estimates, company data

Exhibit 36: 12-month forward P/E with standard deviation - TUC
The multiple (20x) is at mid-high-end range of the trading history



Source: BofA Global Research estimates, company data

Shengyi Technology (600183 CH; U/P; PO CNY99)

We believe revenue contribution from PTFE-based CCL could reach ~10% based on the assumption of US$300-400 ASP per piece, and we expect the ramp of such business to bolster the overall margin profile thanks to ~50% GM by relevant solutions. Yet we also note that the firm's capacity for M6-grade and above CCL remains relatively limited at ~10% mix currently, and further capacity ramp will be dependent on the progress in Thailand and Songshan Lake (for M7-M9), after its Jiangxi phase 2 capacity became fully loaded after 1H26.

We raise 2026/27/28E EPS by 29%/21%/18% after baking in 2Q26 results and the assumptions of stronger revenue growth and margin profiles, which also reflect its further share gain in NVIDIA's AI server system/platforms. Our PO goes to CNY99 (from CNY83), same based on 24x 2027E P/E, and the volatility risk rating is changed to C from B.

Exhibit 37: Earnings estimate change - Shengyi
We raise 2027-28E EPS by 21%/18% after baking in the assumptions of stronger revenue growth and gross margin

(CNYmn)	BofA 26 (E)			BofA 27 (E)			BofA 28 (E)		
	New	Old	Diff (%)	New	Old	Diff (%)	New	Old	Diff (%)
Total sales	**45,054**	**39,066**	15.3	**59,167**	**48,599**	21.7	**74,833**	**61,634**	21.4
Gross profit	**13,930**	**11,306**	23.2	**18,570**	**14,662**	26.7	**24,031**	**19,102**	25.8
Gross margin	*30.9%*	*28.9%*	2.0 ppt	*31.4%*	*30.2%*	1.2 ppt	*32.1%*	*31.0%*	1.1 ppt
Operating profit	**9,749**	**7,826**	24.6	**13,391**	**10,762**	24.4	**17,852**	**14,713**	21.3
Operating margin	*21.6%*	*20.0%*	1.6 ppt	*22.6%*	*22.1%*	0.5 ppt	*23.9%*	*23.9%*	0.0 ppt
Pretax income	**9,976**	**7,876**	26.7	**13,336**	**10,690**	24.8	**17,797**	**14,641**	21.6
Pretax margin	*22.1%*	*20.2%*	2.0 ppt	*22.5%*	*22.0%*	0.5 ppt	*23.8%*	*23.8%*	0.0 ppt
Net income	**7,850**	**6,065**	29.4	**10,056**	**8,338**	20.6	**13,419**	**11,424**	17.5
Net margin	*17.4%*	*15.5%*	1.9 ppt	*17.0%*	*17.2%*	-0.2 ppt	*17.9%*	*18.5%*	-0.6 ppt
EPS (CNY)	**3.23**	**2.50**	29.4	**4.14**	**3.43**	20.6	**5.52**	**4.70**	17.5

Source: BofA Global Research estimates

Exhibit 38: BofAe vs consensus - Shengyi

We are 14%/19% behind consensus for 2027/28E EPS given the assumptions of more conservative revenue growth and gross margin

(CNYmn)	2026E			2027E			2028E		
	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)	BofAe	Consensus	Diff (%)
Total sales	**45,054**	**45,694**	-1.4	**59,167**	**66,864**	-11.5	**74,833**	**89,091**	-16.0
Gross profit	**13,930**	**14,363**	-3.0	**18,570**	**21,933**	-15.3	**24,031**	**30,408**	-21.0
Gross margin	*30.9%*	*31.4%*	-0.5 ppt	*31.4%*	*32.8%*	-1.4 ppt	*32.1%*	*34.1%*	-2.0 ppt
Operating profit	**9,749**	**9,480**	2.8	**13,391**	**14,782**	-9.4	**17,852**	**20,598**	-13.3
Operating margin	*21.6%*	*20.7%*	0.9 ppt	*22.6%*	*22.1%*	0.5 ppt	*23.9%*	*23.1%*	0.7 ppt
Pretax income	**9,976**	**9,615**	3.8	**13,336**	**14,752**	-9.6	**17,797**	**20,579**	-13.5
Pretax margin	*22.1%*	*21.0%*	1.1 ppt	*22.5%*	*22.1%*	0.5 ppt	*23.8%*	*23.1%*	0.7 ppt
Net income	**7,850**	**7,579**	3.6	**10,056**	**11,714**	-14.2	**13,419**	**16,502**	-18.7
Net margin	*17.4%*	*16.6%*	0.8 ppt	*17.0%*	*17.5%*	-0.5 ppt	*17.9%*	*18.5%*	-0.6 ppt
EPS (CNY)	**3.23**	**3.12**	3.6	**4.14**	**4.82**	-14.2	**5.52**	**6.79**	-18.7

Source: BofA Global Research estimates, Bloomberg

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Exhibit 39: Income statement - Shengyi

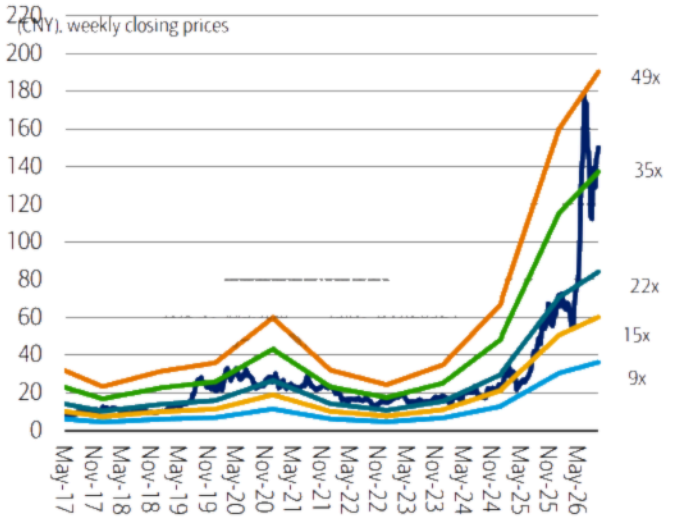
We expect the company to record 25-30% revenue CAGR during 2026-28

(CNY mn)	1Q26	2Q26	3Q26E	4Q26E	1Q27E	2Q27E	3Q27E	4Q27E	2025	2026E	2027E	2028E
Revenue	8,141	#####	12,581	13,447	13,120	14,376	15,489	16,181	28,431	45,054	59,167	74,833
COGS	-5,854	-7,333	-8,700	-9,237	-9,097	-9,877	-10,617	-11,006	-20,905	-31,124	-40,597	-50,802
Gross Profit	2,288	3,552	3,881	4,210	4,024	4,499	4,872	5,175	7,526	13,930	18,570	24,031
Operating expenses	-806	-1,068	-1,146	-1,162	-1,092	-1,219	-1,390	-1,478	-3,075	-4,181	-5,179	-6,179
SG&A	-407	-552	-625	-639	-593	-626	-739	-799	-1,625	-2,223	-2,756	-3,259
R&D	-399	-516	-521	-523	-499	-593	-651	-680	-1,450	-1,958	-2,423	-2,920
Operating income	1,482	2,484	2,735	3,048	2,932	3,280	3,483	3,697	4,451	9,749	13,391	17,852
Non-operating income	48	207	-14	-14	-14	-14	-14	-14	-35	227	-55	-55
Interest income	-30	-30	-15	-15	-15	-15	-15	-15	-102	-89	-60	-60
Investment income	9	24	0	0	0	0	0	0	143	33	0	0
Others	69	212	1	1	1	1	1	1	-76	283	5	5
Pre-tax profit	1,530	2,691	2,721	3,034	2,918	3,266	3,469	3,683	4,416	9,976	13,336	17,797
Tax	-198	-305	-340	-303	-350	-392	-451	-516	-524	-1,147	-1,709	-2,281
Effective tax rate	*13%*	*11%*	*13%*	*10%*	*12%*	*12%*	*13%*	*14%*	*12%*	*11%*	*13%*	*13%*
Minority interests	174	257	260	289	344	385	409	434	558	980	1,572	2,098
Net income	1,158	2,129	2,122	2,441	2,224	2,489	2,609	2,733	3,334	7,850	10,056	13,419
EPS (CNY)	0.48	0.88	0.87	1.00	0.92	1.02	1.07	1.13	1.37	3.23	4.14	5.52
Margin												
Gross margin	28.1%	32.6%	30.8%	31.3%	30.7%	31.3%	31.5%	32.0%	26.5%	30.9%	31.4%	32.1%
Operating margin	18.2%	22.8%	21.7%	22.7%	22.3%	22.8%	22.5%	22.8%	15.7%	21.6%	22.6%	23.9%
Pre-tax margin	18.8%	24.7%	21.6%	22.6%	22.2%	22.7%	22.4%	22.8%	15.5%	22.1%	22.5%	23.8%
Net margin	14.2%	19.6%	16.9%	18.2%	17.0%	17.3%	16.8%	16.9%	11.7%	17.4%	17.0%	17.9%
QoQ growth												
Revenue	4.1%	33.7%	15.6%	6.9%	-2.4%	9.6%	7.7%	4.5%				
Gross profit	13.5%	55.2%	9.3%	8.5%	-4.4%	11.8%	8.3%	6.2%				
Operating profit	27.7%	67.6%	10.1%	11.4%	-3.8%	11.8%	6.2%	6.2%				
Pre-tax profit	29.2%	75.9%	1.1%	11.5%	-3.8%	11.9%	6.2%	6.2%				
Net profit	30.0%	83.8%	-0.3%	15.1%	-8.9%	11.9%	4.8%	4.8%				
YoY growth												
Revenue	45.1%	54.0%	58.6%	72.0%	61.2%	32.1%	23.1%	20.3%	39.4%	58.5%	31.3%	26.5%
Gross profit	65.7%	87.1%	73.8%	108.9%	75.9%	26.7%	25.5%	22.9%	67.5%	85.1%	33.3%	29.4%
Operating profit	104.3%	122.4%	88.8%	162.7%	97.9%	32.0%	27.3%	21.3%	109.9%	119.0%	37.4%	33.3%
Pre-tax profit	113.0%	139.8%	95.6%	156.1%	90.7%	21.4%	27.5%	21.4%	113.6%	125.9%	33.7%	33.5%
Net profit	105.5%	146.7%	108.7%	174.0%	92.1%	16.9%	23.0%	12.0%	91.8%	135.4%	28.1%	33.4%

Source: BofA Global Research estimates, company data

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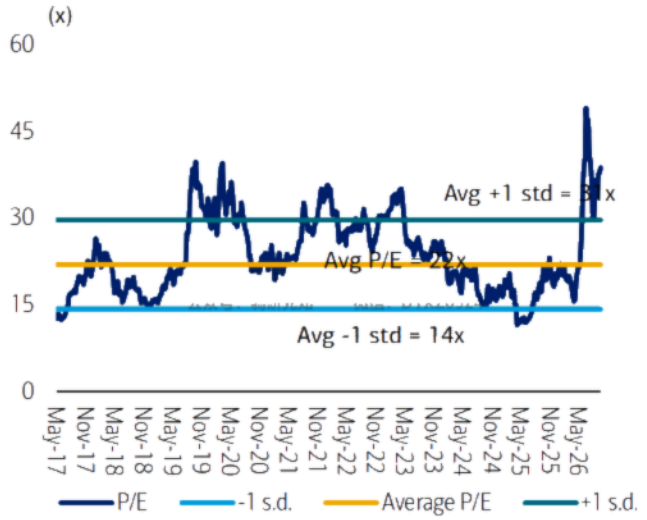
Exhibit 40: 12-month forward P/E - Shengyi
The stock is traded at 38x forward P/E



Source: BofA Global Research estimates, company data

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Exhibit 41: 12-motnh P/E with standard deviation - Shengyi
The multiple (38x) is at high-end range of the trading history



Source: BofA Global Research estimates, company data

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Valuation discussion

Both Buy-rated EMC and TUC are expected to post stronger EPS growth toward 2028 along with a higher dividend yield. However, they trade at lower P/E multiples when compared with peers' average in CCL industry. As for P/B multiples, the premium valuation by these two names, in our view, can be explained by much higher ROE expected in 2027-28. On the other hand, our more conservative view on Shengyi can be supported by its more stretched valuation (for both P/E and P/B) vs milder EPS growth and lower dividend yield, when compared with the peers' average. Overall, we believe the (see report) overhang from CPO proliferation is already largely reflected in the valuation of CCL names, which we believe also renders an attractive opportunity for EMC/TUC, considering their solid earnings growth ahead fueled by continuous mix upgrades and more aggressive capacity expansion.

Exhibit 42: Valuation comparisons
EMC, TUC and Kingboard are traded at lower multiples vs peers' average, but they are expected to record stronger EPS growth vs peers

		Share		Mkt cap	EPS (LC)		PER (X)		PBR (X)		Div. yield (%)		ROE (%)		EV/EBITDA		
Ticker	Company	price (LC)	Rating	(US$mn)	2027E	2028E	2027E	2028E	2027E	2028E	2027E	2028E	2027E	2028E	2027E	2028E	Earnings CAGR 2026-28
CCL suppliers																	
1888 HK	Kingboard	49.4	BUY	18,969	6.1	6.9	7.7	6.8	3.9	3.0	6.3	7.2	63.4	50.1	6.2	5.5	48%
1303 TT	Nan Ya Plastics	260.0	Neutral	58,811	5.7	6.1	41.7	39.0	4.3	4.2	1.8	1.9	10.6	10.9	49.0	43.6	2%
6752 JP	Panasonic	4,568.0	BUY	66,126	209.6	279.9	20.2	15.1	1.7	1.6	1.5	2.0	9.5	11.0	10.0	8.3	86%
2383 TT	Elite/EMC	5,185.0	BUY	54,776	223.1	326.5	21.8	14.9	17.7	12.0	2.7	4.0	96.6	95.8	16.4	11.1	63%
6213 TT	ITEQ	683.0	NC	5,872	30.5	37.7	16.8	13.6	6.0	5.1	3.5	4.8	33.5	33.7	12.4	10.7	53%
6274 TT	TUC	1,620.0	BUY	12,891	77.0	118.4	17.8	11.6	9.8	6.3	3.6	5.4	68.2	66.0	14.0	9.2	71%
000150 KS	Doosan	1,341,000.0	BUY	16,998	50466.1	67771.5	28.8	21.5	7.2	5.6	0.4	0.5	26.8	28.2	12.0	10.2	23%
4004 JP	Resonac	17,280.0	BUY	16,840	872.3	1069.4	15.9	12.9	2.6	2.2	0.6	0.7	20.2	20.7	2.0	1.7	34%
4182 JP	Mitsubishi Gas	3,915.0	BUY	5,121	299.6	311.6	12.7	12.2	1.1	1.0	2.9	3.2	8.8	8.7	10.7	9.8	n.a.
ROG US	Rogers	160.0	NC	2,339	4.5	5.7	29.4	22.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	24%
600183 CH	Shengyi	130.0	U/P	52,018	4.1	5.5	34.7	26.0	11.3	9.0	1.5	2.0	36.2	38.5	24.6	18.8	31%
688519 CH	Nan Ya New Material	272.7	NC	11,153	5.1	7.2	62.0	43.9	n.a.	n.a.	0.7	0.9	17.5	20.6	n.a.	n.a.	55%
Average							25.8	20.0	6.6	5.0	2.3	3.0	35.6	34.9	15.8	12.9	45%

Source: BofA Global Research estimates, company data, Bloomberg

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Exhibit 43: Summary of changes in PO and valuation method
We cut P/E multiples on EMC and TUC in this report

Company	Ticker	PO (local currency)		Valuation method	
		New	Old	New	Old
EMC	2383 TT	8200	8200	30x 2H27-1H28E P/E	34x 2H27-1H28E P/E
TUC	6274 TT	2600	2600	27x 2H27-1H28E P/E	305x 2H27-1H28E P/E
Shengyi Tech	600183 CH	99	83	24x 2027E P/E (unchanged)	

Source: BofA Global Research

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Exhibit 44: Table of recommendation
Stocks mentioned with ratings in this report

BofA ticker	Ticker	Company name	Price (LC)	Rating
ETMCF	2383 TT	EMC	NT$ 5185	C-1-7
TWUNF	6274 TT	TUC	NT$ 1620	C-1-7
DOSAF	000150 KS	Doosan	KRW 1341000	C-1-7
KGBLF	1888 HK	Kingboard	HKD 49.4	C-1-7
DGUNF	600183 CH	Shengyi	CNY 129.96	C-3-7

Source: BofA Global Research, company data

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A list of acronyms on front page

CCL – copper clad laminate

PCB – printed circuit board

S/D – supply/demand

CPO – co-packaged optics

EMC – Elite Material

TUC – Taiwan Union

PTFE – polytetrafluoroethylene

GPU – graphic processing unit

HC - hydrocarbon

PPO/PPE - polyphenylene ether/oxide

SiO2 - silicon dioxide

AI – artificial intelligence

GPU – graphic processing unit

ASIC – application specific integrated circuit

HDI – high density interconnect

GM – gross margin

Price objective basis & risk

Doosan Corp (DOSAF)

Our PO of W1,800,000 is derived from SOTP valuation, which implies a fair market cap of W32tn = W20tn for core businesses (based on 20x 2027-28E P/E, which is in line with

the average of CCL peers) + W12tn in listed equity investments (Doosan Enerbility, Doosan Robotics, and Oricom) + net debt (breakeven) + other investments (W0.25tn, mostly non-listed affiliates). Our W1,800,000 PO implies 8x 2027-28E P/B, which appears much higher than the 2023-25 average of 4x, as well as a relatively high P/E (31x based on 2027-28E EPS) versus other Korea Holdco companies (5-10x). Key reason behind our relatively higher fair multiples compared to its historical average and its peers should be Doosan's rapidly growing CCL business thanks to its dominant market share position within NVIDIA.

Upside risks: (1) further market share gains in high-end CCL for major US hyperscalers, (2) a more favorable CCL pricing environment driven by sustained demand growth and tight industry supply, (3) incremental demand opportunities from emerging technologies such as co-packaged optics (CPO) and other networking equipment, and (4) faster-than-expected capacity ramp-up.

Downside risks: (1) a slowdown in AI infrastructure spending or cuts to US hyperscaler capex, which could weaken demand for high-end CCL used in AI servers and networking equipment, (2) intensifying competition and pricing pressure in the advanced CCL market, and (3) potential delays in Doosan's CCL capacity expansion.

Elite Material (ETMCF)
Our PO of NT$8,200 is based on 30x 2H27-1H28E P/E, at the mid-to-high-end of its historical range of 6-34x since 2016. In our view, the multiple is appropriate, given the market-share expansion in server/networking, where we see structural growth in addressable market.

Upside risks are (1) share gain at substrate CCL, (2) stronger 5G smartphone shipment, (3) greater 5G smartphone spec upgrades, and (4) favorable FX and raw material cost change.

Downside risks are (1) share loss at iPhone, (2) keener competition in high-end CCL, and (3) unfavorable FX and raw material cost change.

Kingboard Laminates (KGBLF)
We set our PO at HK$65, on 13x 2H26-1H27E P/E. 13x is around +0.5SD of KBL's historical trading range, and matches with its last earnings upcycle in 2021 (led by e-glass price hike) while also reflects rising mix from high-end AI-related deliveries.

Downside risks: (1) slower-than-expected CCL price hike, (2) better-than-expected industry supply of upstream materials esp. cloth, (3) slower-than-expected AI server demand, and (4) slower-than-expected external glass fiber cloth sales.

Upside risks: (1) stronger-than-expected CCL price hike, (2) slower-than-expected industry supply of upstream materials esp. cloth, (3) stronger-than-expected AI server demand, and (4) faster-than-expected external glass fiber cloth sales.

Shengyi (DGUNF)
Our PO of CNY99 is based on 24x 2027E P/E, close to the mid-to-high-end range of the historical average of 10-35x in 2017-2024. In our view, such valuation multiple is backed by operating margin and ROE of 23% and 37% in 2026-28E (vs 11% and 12% in 2023-25).

Upside risks to our price objective are: (1) better macro conditions, (2) faster 5G deployment, (3) less-intensive competition, and (4) favorable FX and raw material cost changes.

Downside risks are: (1) worse macro conditions, (2) slower 5G deployment, (3) more severe competition, and (4) unfavorable FX and raw material cost changes.

Taiwan Union Technology Corporation (TWUNF)
Our PO NT$2,600 is based on 27x 2H27-1H28E P/E, which is at the mid-to-high-end of the historical trading range of 8-31x during 2016-2026. In our view, the valuation multiple is justified, given operating margin and ROE expansion toward 26% and 63% in 2026-28E (vs 13% and 16% in 2023-25) along with robust free-cash flow generation in over the same period.

Downside risks are
1) Fluctuation in raw material prices, which could lead to a more volatile gross margin for TUC in the near term
2) More intensified competition in CCL, which could pressure TUC's overall margin profile
3) Adoption of new type of upstream material (e.g., quartz), which could bring business uncertainty for the names in CCL industry, including TUC
4) Worse-than-expected execution by the company, which could cause market-share loss and/or decreased business traction with customers

Analyst Certification

We, Mike Yang and Simon Woo, CFA, hereby certify that the views each of us has expressed in this research report accurately reflect each of our respective personal views about the subject securities and issuers. We also certify that no part of our respective compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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