China's CXMT Is Set to Challenge DRAM Incumbents

中国长鑫存储向 DRAM 行业巨头发起挑战

CXMT IPO, SK Hynix, Micron, Samsung Competition, Process Node Deficit, China HBM, Wafer Adds, Memory LTAs

长鑫存储 IPO、SK 海力士、美光、三星竞争、制程节点差距、中国 HBM、晶圆新增产能、存储器长期协议

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JUN 23, 2026 2026 年 6 月 23 日 · PAID · 付费

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We were the first to describe the memory shortage coming from AI's insatiable usage in reasoning and agentic flows in late 2024 on the newsletter. We have since previously published multiple in-depth pieces on memory, as well as detailed coverage of CXMT and China's compute. With CXMT set to IPO in the coming months, we believe a dedicated deep dive on them specifically is warranted. The company is likely to become the largest semiconductor IPO in China and mark a major milestone for the country's leading memory manufacturer, which is also destined to compete only more fiercely with the leading memory suppliers of Samsung, SK Hynix, and Micron from here.

我们在 2024 年底的新闻通讯中率先描述了人工智能在推理和智能体工作流中的大规模应用所引发的内存短缺问题。此后，我们陆续发布了多篇深度分析内存行业的文章，并对 CXMT 及中国算力进行了详细报道。随着 CXMT 未来数月内即将启动 IPO，我们认为有必要对该企业进行专项深度剖析。这家公司有望成为中国规模最大的半导体 IPO，标志着本土领先存储器制造商的重大里程碑，同时也注定将在此后与三星、SK 海力士、美光等头部存储器供应商展开更为激烈的竞争。

Our latest on memory can be seen here:

我们最新的内存相关内容可以在这里看到：



Memory Mania: How a Once-in-Four-Decades Shortage Is Fueling a Memory Boom

内存狂潮：四十年一遇的短缺如何催生存储芯片繁荣

DYLAN PATEL, RAY WANG, AND 3 OTHERS

DYLAN PATEL、RAY WANG 以及其他 3 人 · 2月7日 2 月 7 日

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2. Huawei AI CloudMatrix 384 – China's Answer to Nvidia GB200 NVL72

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3. Scaling the Memory Wall: The Rise and Roadmap of HBM

   突破存储瓶颈：高带宽存储器（HBM）的崛起与发展路线图

4. The Memory Wall: Past, Present, and Future of DRAM

   存储瓶颈：DRAM 的过去、现在与未来

5. Scaling Laws - O1 Pro Architecture, Reasoning Training Infrastructure, Orion and Claude 3.5 Opus "Failures", Inference Tokenomics of Test Time Compute

   规模定律——O1 Pro 架构、推理训练基础设施、Orion 与 Claude 3.5 Opus 的"失败"、测试时计算的推理代币经济学

CXMT, established in 2016, is going to be listed on China's STAR Market. Now the leading DRAM player in China, its history shows an interesting path of technology transfer, talent flows, and the patience of state-venture capital, together of which are

turning the company toward indigenous innovation.

成立于 2016 年的长鑫存储（CXMT）即将在中国科创板上市。作为中国目前领先的 DRAM 厂商，其发展历程展现了技术转移、人才流动与国有风险资本耐心的有趣轨迹，这些因素正共同推动该公司走向自主创新。

The Silicon Valley Returnee

硅谷归国人才

Zhu Yiming, the founder of CXMT, earned his undergraduate degree in physics at Tsinghua University in 1994 and came to SUNY Stony Brook for his graduate study in electrical engineering. He then worked in Silicon Valley and became a project lead at MoSys (Monolithic System Technology) around 2001. In 2005, he went back to China with a set of SRAM patent and US$100,000 in seed money, founding GigaDevice, which later became well known for its SPI NOR flash and microcontrollers, a fabless design house that grew into one of the world's top NOR flash suppliers. But the global NOR flash market is much smaller compared to DRAM or NAND flash. Zhu Yiming always dreams big, and not surprisingly he chose to march into the DRAM business.

长鑫存储创始人朱一明于 1994 年在清华大学获得物理学学士学位，随后赴纽约州立大学石溪分校攻读电子工程研究生。此后他曾在硅谷工作，2001 年前后成为 MoSys（单片系统技术公司）的项目主管。2005 年，他带着一组 SRAM 专利和 10 万美元种子资金回国，创立了兆易创新。该公司后来凭借 SPI NOR 闪存和微控制器闻名，是一家无晶圆厂设计公司，成长为全球顶级 NOR 闪存供应商之一。然而全球 NOR 闪存市场规模远小于 DRAM 或 NAND 闪存。朱一明始终怀揣远大抱负，毫不意外地选择了进军 DRAM 产业。

DRAM, however, is not a design-house game in which one can stay fabless. DRAM is capital-devouring, IP-fortified, and manufacturing-bound, and by 2016 the whole industry was dominated by three survivors, Samsung, SK Hynix, and Micron, fortified by four decades of patents and capital that no newcomer had breached. Zhu's SRAM patents and GigaDevice's NOR franchise gave him neither a DRAM cell, nor a DRAM process, nor any cover from the incumbents' patents. Thus, when Zhu and the Hefei municipal government launched the DRAM venture in 2016, the "506" project that

became CXMT, the core technology had to come from somewhere else entirely.

然而，DRAM 并非那种可以保持无晶圆厂模式的芯片设计行业。DRAM 领域是资本密集型、知识产权壁垒高筑且高度依赖制造能力的产业。到 2016 年，整个行业已被三星、SK 海力士和美光三大幸存者垄断，它们凭借四十年来积累的专利和资本构筑的防线，令任何新入局者都望而却步。朱一明拥有的 SRAM 专利和兆易创新的 NOR 闪存业务，既未赋予他 DRAM 存储单元技术、DRAM 制造工艺，也无法提供任何规避现有巨头专利保护的方案。因此，当朱一明与合肥市政府于 2016 年启动 DRAM 项目——即后来成为长鑫存储的"506"工程时，核心技术必须完全另寻来源。

It came from a dead company in Germany.

这些核心技术来自一家已经倒闭的德国企业。

The DRAM Foundation: Inheriting Qimonda

DRAM 基石：继承奇梦达遗产

The dead company was Qimonda. Though the company went bankrupt in January 2009 due to the 2008 Global Financial Crisis and the following dramatic memory downcycle, it was then the leading DRAM player in Europe. A subsidiary of Infineon, which originated from Siemens, it offered a rare alternative: a deep DRAM patent base and a cell architecture, both originating outside the dominant Samsung-SK Hynix-Micron triangle. In June 2015, Polaris Innovations, a subsidiary of WiLAN, a Canadian patent-monetization firm, bought roughly 7,000 Qimonda patents and applications from Infineon for about 30 million euros. In December 2019, Polaris and CXMT signed an agreement: a license to a large set of DRAM patents. CXMT leaders once publicly claimed that they obtained roughly 2.8 TB of Qimonda technical documentation,

which became the basis for CXMT's DRAM business.

倒闭的公司是奇梦达。尽管该公司因 2008 年全球金融危机及随后的严重内存下行周期于 2009 年 1 月破产，但它曾是欧洲领先的 DRAM 企业。作为源于西门子的英飞凌旗下子公司，奇梦达提供了一种罕见的替代选择：深厚的 DRAM 专利基础与存储单元架构，这两者均源于三星、SK 海力士和美光三巨头主导格局之外。2015 年 6 月，加拿大专利变现公司 WiLAN 的子公司北极星创新以约 3000 万欧元从英飞凌收购了约 7000 项奇梦达专利及专利申请。2019 年 12 月，北极星创新与长鑫存储签署协议：授权一系列 DRAM 专利的使用权。长鑫存储高层曾公开宣称，他们获得了约 2.8TB 的奇梦达技术文档，这成为长鑫存储 DRAM 业务的技术基石。

A major technology CXMT inherited from Qimonda and then developed its 46nm-class BWL (buried wordline) cell, which CXMT scaled toward the 10nm class. BWL is the load-bearing idea. Instead of routing the access transistor's gate across the wafer surface, BWL sinks it into a trench beneath the bitline. It pulls the gate off the surface so the cell collapses to a $6F^2$ layout (versus $8F^2$). It also lengthens the channel without spending surface area, suppressing the short-channel leakage that wrecks retention. And it cuts gate-to-bitline parasitic capacitance. Buried wordline plus stacked capacitor is the architecture all three leading players run today. The trench holdout died holding the stacked/BWL escape hatch, and that is exactly what CXMT picked up.

长鑫存储从奇梦达继承并发展了一项核心技术——46 纳米级掩埋字线（BWL）单元，随后将其微缩至 10 纳米级。BWL 是支撑性设计理念：它不再将存取晶体管的栅极布设在晶圆表面，而是将其沉入位线下方的沟槽中。栅极被移出表面后，存储单元面积可压缩至 $6F^2$（相较于 $8F^2$）。该设计还能在不占用表面积的情况下延长沟道长度，有效抑制破坏数据保持能力的短沟道漏电流，同时降低栅极与位线间的寄生电容。掩埋字线加堆叠电容的架构，正是如今三大行业巨头共同采用的技术方案。坚持沟槽式电容的厂商最终被淘汰，而长鑫存储恰恰抓住了堆叠式电容与掩埋字线这一技术路径。

Talent Flows: From a Frozen Blueprint to Living R&D

人才流动：从冻结的蓝图到活态技术体系

Besides patents, the more durable thing CXMT pulled out of Qimonda's collapse was its engineers. Qimonda's Xi'an R&D center, with 400-500 engineers, was one of the largest Qimonda built outside Germany. After Qimonda's collapse, though the whole Xi'an R&D center was acquired by Tsinghua Unigroup, the wider diffusion of

individual talents benefited CXMT. In addition, CXMT successfully attracted Karl-Heinz Kuesters, a senior engineer, from Qimonda's German site to Hefei, China. Kuesters had spent 24 years as a VP of technology and pre-development across Siemens, Infineon, and Qimonda. The pre-development line Kuesters ran was the stacked-capacitor work, the architecture CXMT actually builds on. He joined CXMT as a technical consultant, for which the EE Times called Kuesters the company's "ace in the hole." What Kuesters brought was the part of Qimonda's legacy that neither the patents nor the 2.8 TB of documents carry: the tacit know-how. Having led DRAM development for two decades, Kuesters could tell CXMT's engineers which of Qimonda's design choices to keep and which to discard, and how to move a cell that worked only in the lab into volume production, the integration and yield judgments that no patent records.

除了专利，CXMT 从奇梦达破产中获得的更持久的资产是其工程师团队。奇梦达西安研发中心拥有 400 至 500 名工程师，是其在德国以外规模最大的研发基地之一。虽然该中心整体被紫光集团收购，但个体人才更广泛的流动最终惠及了 CXMT。此外，CXMT 成功将奇梦达德国总部的资深工程师卡尔-海因茨·屈斯特斯吸引至中国合肥。屈斯特斯曾在西门子、英飞凌和奇梦达担任技术及预研发副总裁 24 年。他主导的预研发方向正是叠层电容架构——这也是 CXMT 当前技术路线的根基。屈斯特斯以技术顾问身份加入 CXMT，《EE Times》将其称为该公司的"王牌"。他带来的不仅是奇梦达的专利和 2.8TB 技术文档，更是那些无法被载入文档的隐性知识。 在领导 DRAM 研发二十年后，库斯特能够指导长鑫存储的工程师们，哪些奇梦达的设计方案应当保留、哪些应当舍弃，以及如何将实验室阶段可行的存储单元推进至量产阶段——这些整合与良率判断能力，在专利文献中无从体现。

The American side shows the same pattern. Ping Er-xuan, CXMT's VP for future-technology assessment and the public face of its roadmap (the "46nm to the 10nm class" framing), came not from Qimonda but from a US career at Micron, SanDisk, and Applied Materials, where he ran memory and materials technologies. Ping brought process-and-materials depth and an emerging-memory view: individual mobility.

美方也呈现相同模式。负责未来技术评估并担任技术路线图对外发言人的长鑫存储副总裁平尔宣（其提出的"从 46 纳米到 10 纳米级"框架），并非奇梦达出身，而是在美光科技、闪迪及应用材料公司等美企任职，负责存储技术与材料研发。平尔宣带来了工艺与材料领域的深厚积淀，以及新兴存储技术视角——即个体化移动计算理念。

CXMT has also recruited heavily from Korea and Taiwan. Korean prosecutors have charged former Samsung employees with leaking technology to CXMT, and dozens of Korean engineers are reported to have worked there. Similarly in Taiwan, there is constant talent poach with attractive compensation package for top-tier engineer across equipment and process development.

长鑫存储也从韩国和台湾大量招揽人才。韩国检方已指控前三星员工向长鑫存储泄露技术，据称有数十名韩国工程师曾在此工作。在台湾同样如此，该公司持续以优厚待遇挖角顶尖设备及工艺研发工程师。

This is the part that bears on where CXMT is heading. The Qimonda patents were always a finite, expiring asset. What lets CXMT keep moving, from G4 to G5 and now into HBM, is the assembled capability of domestic talent, Chinese nationals who worked at foreign companies and returned, as well as some experts from foreign firms, not the documents. The inheritance only got it started. The talent turned a foreign legacy into in-house R&D juggernaut. However, it took nearly a decade for CXMT to generate profits. The question is who has patiently funded CXMT's development and borne its near-decade losses?

这正是决定长鑫存储（CXMT）未来走向的关键所在。奇梦达的专利始终是有限且会过期的资产。让长鑫存储从第四代制程推进到第五代制程，如今又进军高带宽存储器（HBM）的，是本土人才的聚集——那些曾在海外公司工作的中国籍人才回国效力，以及部分外企专家的加入——而非那些文件。这份遗产仅仅是一个起点。人才将外来的技术遗产转化为了强大的内部研发力量。然而，长鑫存储用了近十年才实现盈利。问题在于，是谁耐心地为长鑫存储的发展提供了资金支持，并承担了这近十年的亏损?

The Patience of State-Venture Capital

国家风险资本的耐心

It is difficult to not attribute at least part of CXMT success to the strong support of local and central government in China. Hefei municipal government is one of the great examples. Hefei is one of the tech innovation hubs in China, well known for its patient state-venture capital nurturing successful companies over the past two decades, from BOE (the world's leading display panel maker) to NIO (a leading EV maker) and now to

CXMT. In particular, the Hefei municipal government did two things for CXMT. First, the Hefei government helped CXMT build a local supply chain around its fab. Hefei's playbook is to take a large equity stake in an anchor "link-leader" and then draw the rest of the chain in around it. The city did that for BOE in displays and NIO in EVs, and from 2016 it replicated the same playbook for CXMT. Surrounding CXMT's plant in Hefei's airport-zone industrial park, the government produced a dense local cluster. Two packaging-and-test houses, Peyton and Xinfeng, are located within a street or a wall of CXMT's fab, with Xinfeng booking over 99% of its revenue from CXMT. An on-site bulk-gas plant run by Guanggang supplies most of CXMT's needs, while wafer-reclaim capacity from Zhiwei Semiconductors a subsidiary of Zhichun Technology (至纯科技), is located in Hefei's Xinzhan Hi-Tech District. The state-venture-capital vehicles have also taken outright control of an upstream chip-molding equipment maker, Wenyi Technology. Such a local supply-chain cluster gives CXMT a localized industrial base.

很难不把长鑫存储的成功，至少部分归功于中国地方和中央政府的强力支持。合肥市政府就是最好的例证之一。作为中国科技创新枢纽之一，合肥以耐心培育成功企业的国有风险投资而闻名——过去二十年间，从全球显示面板领军企业京东方，到电动汽车巨头蔚来，如今又有了长鑫存储的崛起。合肥市政府为长鑫存储做了两件关键的事：首先，帮助其在晶圆厂周边构建本地供应链。合肥的策略是对"链主"企业进行大额股权投资，再围绕它吸引上下游企业形成产业生态。这种模式在京东方（显示面板）和蔚来（电动汽车）身上已屡试不爽，自 2016 年起，合肥再次如法炮制推动长鑫存储发展。在合肥机场园区工业园中，围绕长鑫存储的工厂，政府培育了密集的本地产业集群：沛顿和新封两家封测企业就毗邻长鑫存储的晶圆厂，其中新封超过 99%的营收都来自长鑫存储。 广钢运营的一家现场大宗气体厂满足了长鑫存储的大部分需求，而来自至纯科技子公司至微半导体的晶圆再生产能则位于合肥新站高新区。国有风险资本工具还直接控股了上游芯片封装设备制造商文一科技。这种本地供应链集群为长鑫存储提供了本土化的产业基础。

In addition, Hefei's state-venture capital could afford to lose money for a very long time. Unlike a private venture-capital fund answerable to LPs that expect a return on a fixed timetable, Hefei's state-venture capital, ultimately backed by the city's municipal and development-zone state entities, faced no such clock. They kept funding a company that, even after turning its first annual profit in 2025, still carried an accumulated deficit of roughly RMB 36.65 billion built up over nearly a decade. The original "506" project, launched in 2016, began with Hefei's state-venture capital

funding about 80% of the project's first phase (RMB 14.4bn of 18bn). Across successive rounds Hefei's vehicles were diluted, but they never sold down and never walked away. By the IPO, the largest holder, Hefei's Qinghui Jidian, at 21.67% and state-venture capital vehicles together holding over 30%. That willingness to treat a fab as a decade-long bet rather than a fund-cycle return is the catalyst that the technology and the talent both depended on.

此外，合肥的国有风险资本能够承受长期亏损。不同于需要向有限合伙人（LP）负责、按固定时间表寻求回报的私募风投基金，合肥的国有风险资本——最终由该市市级及开发区国有实体支撑——不存在这样的时间压力。它们持续向一家公司注资，即便该公司在 2025 年首次实现年度盈利后，仍背负着近十年积累的约 366.5 亿元人民币累计亏损。2016 年启动的原始“506”项目，最初由合肥国有风险资本承担了一期项目约 80%的资金（在 180 亿元总额中出资 144 亿元）。后续轮次中，合肥国有资本持股虽被稀释，但从未减持或退出。至 IPO 时，最大股东合肥清辉机电持股 21.67%，而国有风险资本合计持股超过 30%。这种将晶圆厂视作十年长线投资而非基金周期回报的意愿，正是技术突破与人才集聚的共同催化剂。

From Inheritance Toward Independence

从继承迈向独立

Put the three threads together and CXMT's first decade resolves into a single arc. Qimonda supplied the foundation, with a licensed patent base and a cell architecture from outside the incumbent triangle. Talent supplied the motion, with key figures like Kuesters and Ping as well as the returnees from the American majors, and the contested hires out of Korea. Those people turned a frozen blueprint into a process that could keep scaling. Then the Hefei government supplied what the other two needed but could not generate on their own: capital, patience, and a localized supply chain. None of the three would have produced a DRAM maker alone; together they

did.

将三条线索结合在一起，CXMT 的第一个十年便呈现出清晰的轨迹。奇梦达提供了基础——一套获得许可的专利基数和一种独立于三巨头之外的内存单元架构。人才提供了动力，例如屈斯特斯、平以及从美国巨头回流的归国人士，还有从韩国引进的争议性人才。这些人将一张停滞的蓝图转化为可持续推进的工艺。最后，合肥政府提供了其他两者需要但无法自行生成的东西：资金、耐心以及本地化的供应链。单独来看，任意一方都无法造就一家 DRAM 制造商；而三者结合，便做到了。

In the following section, we will be discussing CXMT's financials, technology, equipment ecosystem.

在下一部分，我们将讨论 CXMT 的财务状况、技术以及设备生态系统。

Next Step after 10 Years: An IPO in the Supercycle

十年后的下一步：在超级周期中上市

The past decade of CXMT's history, while impressive, may prove to be only an early chapter in the company's longer-term story. The company is now preparing for what will become one of China's largest semiconductor IPOs of the past decades, and potentially the most closely watched semiconductor listing globally this year. In December 2025, CXMT officially entered the IPO filing stage when the Shanghai Stock Exchange accepted its STAR Market listing application, following a prolonged period of market reports throughout 2024 and 2025 suggesting that the company was preparing to go public. More recently, CXMT's application advanced further through the review process by submitting the formal CSRC (China Securities Regulatory Commission) registration on May 27 and currently under final review, moving closer to

a landmark listing.

长鑫存储过去十年的发展历程虽令人瞩目，但或许仅是其长远故事的序章。如今，该公司正筹备成为过去几十年来中国规模最大的半导体 IPO 之一，也可能成为今年全球最受瞩目的半导体上市案。2024 至 2025 年间市场屡传其上市计划后，2025 年 12 月，上交所正式受理其科创板上市申请，长鑫存储由此进入 IPO 申报阶段。近期，该公司于 5 月 27 日向中国证监会提交正式注册申请，目前正处于最终审核阶段，正稳步迈向这场里程碑式的上市。

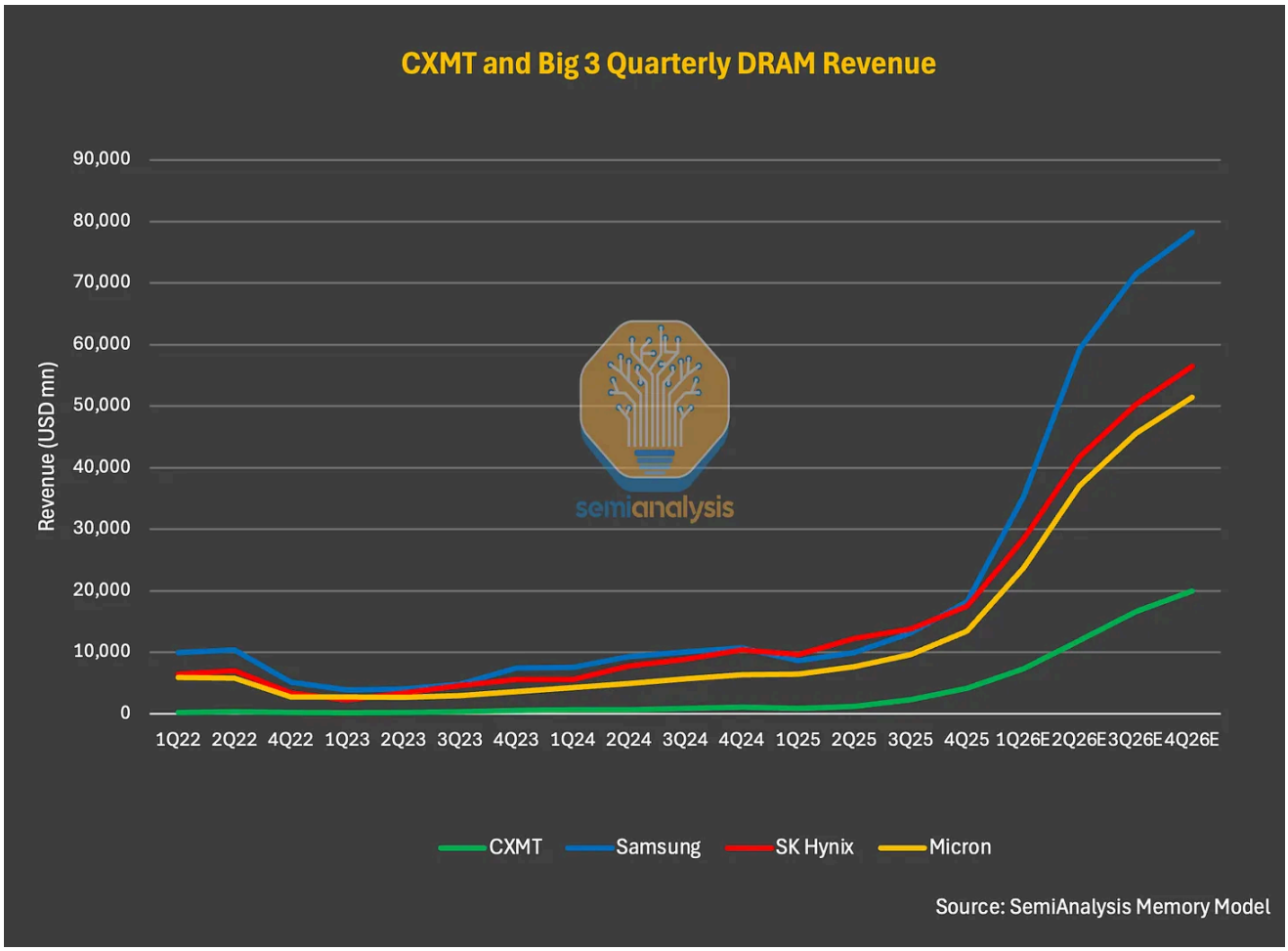
While understanding strategically important, unlisted Chinese companies such as CXMT and YMTC has never been easy, CXMT's move toward a public listing has been helpful for us to understand more details about the company given its IPO prospectuses that have shed meaningful light on the company's historical performance, future trajectory, financial profile, market positioning, and technology roadmap. By combining these disclosures with our **Memory Model**, we can develop a more accurate view of CXMT's current position and a more robust forecast of its future performance.

尽管理解诸如长鑫存储（CXMT）和长江存储（YMTC）这类具有战略重要性的中国未上市公司向来不易，但长鑫存储走向公开上市的步伐，通过其招股说明书披露的历史业绩、未来规划、财务状况、市场定位及技术路线图等关键信息，使我们得以更深入地了解该公司。将这些披露信息与我们的存储芯片模型相结合，可以更准确地评估长鑫存储的当前地位，并对其未来表现做出更可靠的预测。

At a high level, CXMT is clearly the fourth biggest DRAM maker globally by almost every metrics while expanding its lead over legacy memory suppliers. For the full year, CXMT revenue increased 156% YoY to ~$8.6 billion, up from ~$3.3 billion in 2024 and ~$1.2 billion in 2023. Net income also turned positive for the first time, reaching $1 billion, underscoring the company's rapid scale-up and improving profitability. Even with such impressive results, CXMT's CY25 revenue is still materially behind

Samsung (~$72.3B), SK Hynix (~$52.1B), and Micron's (~$37.2B) DRAM revenue.

从宏观层面来看，无论以何种标准衡量，长鑫存储（CXMT）显然已是全球第四大 DRAM 制造商，并且正持续扩大其对传统存储供应商的领先优势。全年来看，长鑫存储营收同比增长 156%，达到 86 亿美元，而 2024 年与 2023 年分别为 33 亿美元和 12 亿美元。净利润也首次实现扭亏为盈，达到 10 亿美元，凸显出公司快速放量扩张与盈利能力提升的趋势。尽管业绩表现亮眼，长鑫存储 2025 年的 DRAM 营收仍大幅落后于三星（约 723 亿美元）、SK 海力士（约 521 亿美元）和美光（约 372 亿美元）。



Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：SemiAnalysis 存储模型 - Sales@SemiAnalysis.com

In 1Q26, CXMT reported revenue of $7.3 billion, representing roughly 700% YoY growth and already approaching the company's full-year revenue in 2025. Operating margins also expanded sharply, reaching approximately 70%.

2026 年第一季度，长鑫存储营收达 73 亿美元，同比增长约 700%，已接近公司 2025 年全年营收水平。营业利润率也大幅攀升，达到约 70%。

But we think this is just the beginning. We estimate the company to do even better if not explosive in the next two years at least. Just based on its filing, the company's 1H26 revenue is expected to be 7x y/y and reached to more than 16 billion. For full-year 2026, we believe CXMT's revenue could exceed $50 billion. If achieved, this would suggest the company has more than doubled revenue every year since 2023, and more than 6x its revenue in 2026 year over year basis, with its earnings trajectory accelerating meaningfully as both scale and profitability improve.

但我们认为这只是开始。我们预计该公司至少在未来两年内会有更出色的表现，甚至可能实现爆发式增长。仅根据其申报文件，公司 2026 年上半年的营收预计将同比增长 7 倍，达到 160 亿元以上。就 2026 年全年而言，我们相信长鑫存储的营收有望超过 500 亿美元。若实现这一目标，意味着该公司自 2023 年以来每年营收翻倍有余，且 2026 年营收同比将增长 6 倍以上，随着规模与盈利能力的双重提升，其盈利增长轨迹将显著加速。

In our view, such significant upside to CXMT's earnings is clearly driven more by the cycle itself than company's technology or market positioning. When we take a closer look into the correlation of CXMT's ASP trajectory and bit shipment. Company's bit shipments increased by only 11% in 1Q26, while ASPs rose by roughly 57%, following QoQ ASP increases of 63% and 68% in 3Q25 and 4Q25, respectively. In other words, what really drove up company's earnings is really the explosive ASP growth rather than significant market share gains over its peers in global DRAM end-market. By bit shipment, we model CXMT's market share will increase from 9% in 2025 to 12% in 2027. While a 3% market share gain sounds minimal, it is significant for a market we size at close at $1T in 2027.

在我们看来，长鑫存储盈利的显著增长显然更多是由行业周期本身推动，而非公司技术或市场定位所致。当我们深入分析长鑫存储平均售价走势与芯片出货量的关联性时发现：2026 年第一季度公司芯片出货量仅增长 11%，而平均售价却环比飙升约 57%——此前 2025 年第三、四季度平均售价已分别实现 63%和 68%的环比增长。换言之，真正驱动公司盈利暴增的是平均售价的爆炸式增长，而非其相较全球 DRAM 终端市场同行所获得的市场份额显著提升。按芯片出货量计算，我们预计长鑫存储的市场份额将从 2025 年的 9%增至 2027 年的 12%。虽然 3%的份额增幅看似微小，但考虑到我们测算 2027 年该市场规模将接近 1 万亿美元，这已是重大突破。

CXMT Revenue Projection									
	unit	1Q26	2Q26	3Q26	4Q26	1Q27	2Q27	3Q27	4Q27
Revenue	M USD	7,339	11,898	16,623	19,997				
Bit Shipment	M Gb	8,739	8,855	10,574	11,257				
ASP	$/Gb	0.84	1.34	1.57	1.78				
Cost per Bit	$/Gb	0.20	0.23	0.23	0.22				

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

数据来源：SemiAnalysis 存储模型 - Sales@SemiAnalysis.com

Surprising enough, the strong pricing uplift coming to CXMT is not an exception. We have been observing similar dynamics across both leading-edge and legacy memory suppliers in the DDR5, DDR4, and even DDR3 markets over the past year or so. As noted in our February memory piece, where we described the memory market as entering a “once-in-four-decades shortage,” we believe DRAM pricing remains on track to double again this year driven by sustained supply-demand imbalance across these product categories. Since February, we have become even more confident in this view and believe it could potentially exceed our expectations by year-end.

令人惊讶的是，长鑫存储（CXMT）价格的大幅上涨并非个例。过去一年左右，我们观察到 DDR5、DDR4 甚至 DDR3 市场中，前沿和成熟制程存储供应商均出现了类似动态。正如我们在 2 月存储行业报告中指出“存储市场正进入四十年一遇的短缺周期”，我们相信，受这些产品类别持续供需失衡驱动，DRAM 价格今年有望再次翻倍。自 2 月以来，我们对这一判断的信心进一步增强，甚至认为到年底实际涨幅可能超出预期。

What may be more interesting to readers who have not yet followed CXMT or the memory market closely is how the company’s pricing compares with industry leaders. Based on our Memory Model, CXMT’s DRAM ASP challenges the common misconception that Chinese memory is structurally cheaper and will flood the market, thereby pressuring global pricing. While this may have been true in some cases in the past, we believe it is somehwat inaccurate in this cycle, and the latest company data

points support the same conclusion.

对于尚未深入了解长鑫存储或存储市场的读者而言，更有趣的或许是该公司的定价与行业领先者相比如何。根据我们的存储模型，长鑫存储的 DRAM 平均售价（ASP）挑战了一个常见误解——即中国存储产品会结构性低价倾销并冲击全球市场。尽管过去某些情况下确实如此，但我们认为在本轮周期中这一说法并不准确，最新公司数据也印证了这一点。

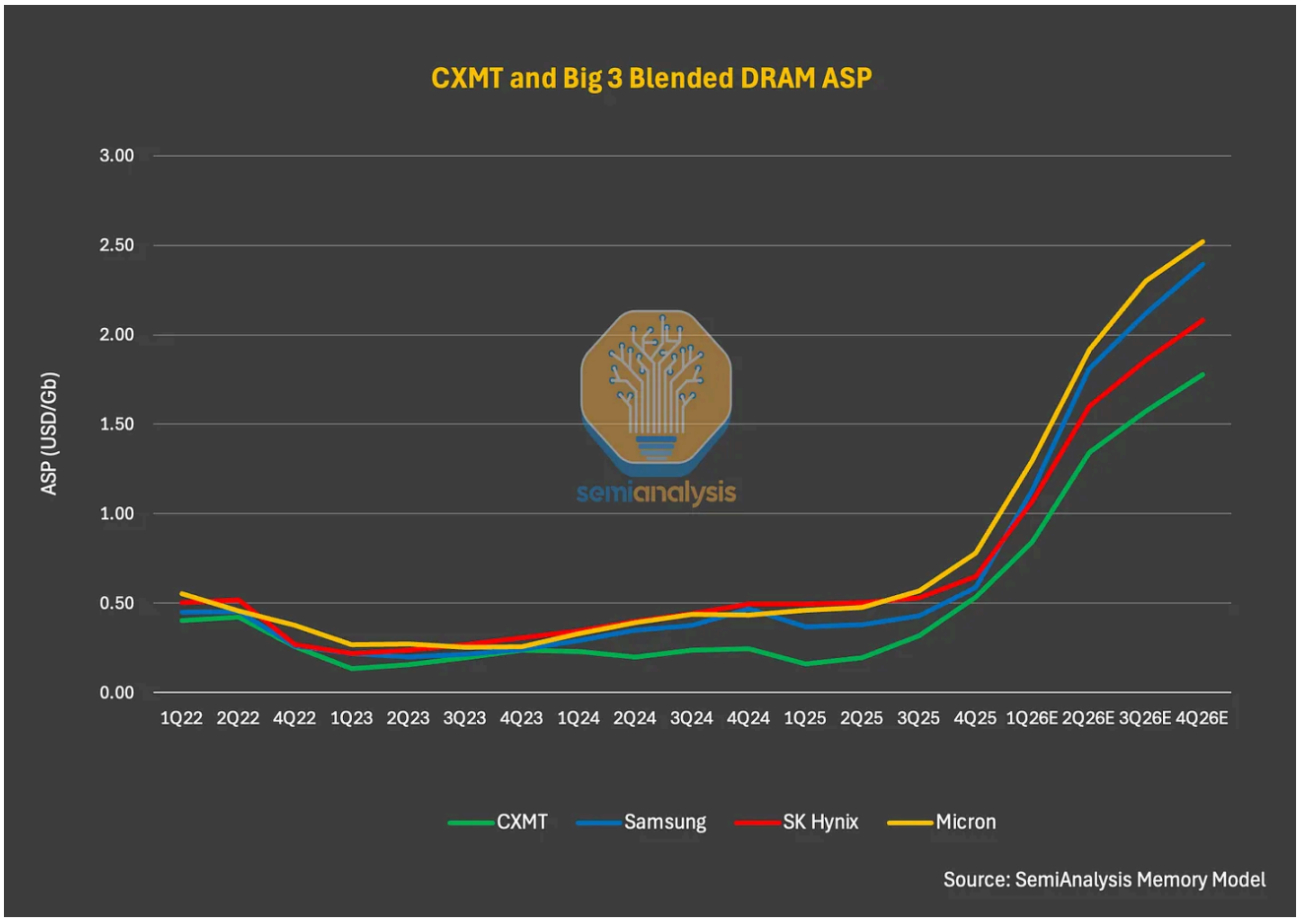
Taking 1Q26 as an example, CXMT's DRAM ASP was only slightly below Samsung, SK Hynix, and Micron — by roughly 5–10% — in the same quarter. And as we model it out throughout 2026, we think this will still to be the case directionally although the gap will gradually expand. We believe this widening gap over the coming quarters will be driven less by inherent pricing differences but more by the change of product mix. Leading suppliers continue to benefit from a higher server DRAM mix in their bit shipments, as well as a more favorable pricing outlook for server DRAM compared with consumer DRAM.

以 2026 年第一季度为例，长鑫存储的 DRAM 平均售价仅比同季度的三星、SK 海力士和美光低约 5%至 10%。根据我们对其 2026 年全年的模拟推演，我们认为这一趋势仍将延续，尽管价差会逐步扩大。我们认为，未来几个季度价差扩大主要并非源于固有定价差异，而更多是产品组合变化所致。头部供应商持续受益于其比特出货量中服务器 DRAM 占比更高，以及服务器 DRAM 相比消费级 DRAM 更有利的定价前景。

As such, we expect this mix to increase further over the coming quarters as server becomes a larger share of DRAM end-market demand. By the end of 2027, we expect server DRAM and HBM account for well more than 50% of the total DRAM end-market. Given that server DRAM and HBM carry higher $/GB than other memory end markets, this should allow leading memory suppliers widen their ASP gap versus CXMT as server DRAM mix increases, especially considering the expected material price increase for HBM in 2027 (we have 2027 HBM pricing in our Accelerator & HBM Model and Memory Model). We also have details on LTAs for major memory buyers

such as hyperscalers and Nvidia.

因此，我们预计随着服务器在 DRAM 终端市场需求中所占份额持续增长，这种组合将在未来几个季度进一步上升。到 2027 年底，我们预计服务器 DRAM 和 HBM 合计将占整个 DRAM 终端市场的 50%以上。考虑到服务器 DRAM 和 HBM 的单位存储价格（$/GB）高于其他存储终端市场，随着服务器 DRAM 占比提升，这将使得领先存储供应商能够拉大其与 CXMT 之间的平均售价差距——尤其是在 2027 年 HBM 材料价格预期上涨的背景下（我们在《加速器与 HBM 模型》及《存储模型》中已纳入 2027 年 HBM 定价预测）。此外，我们还掌握了超大规模云服务商和英伟达等主要存储买家长期协议的详细信息。



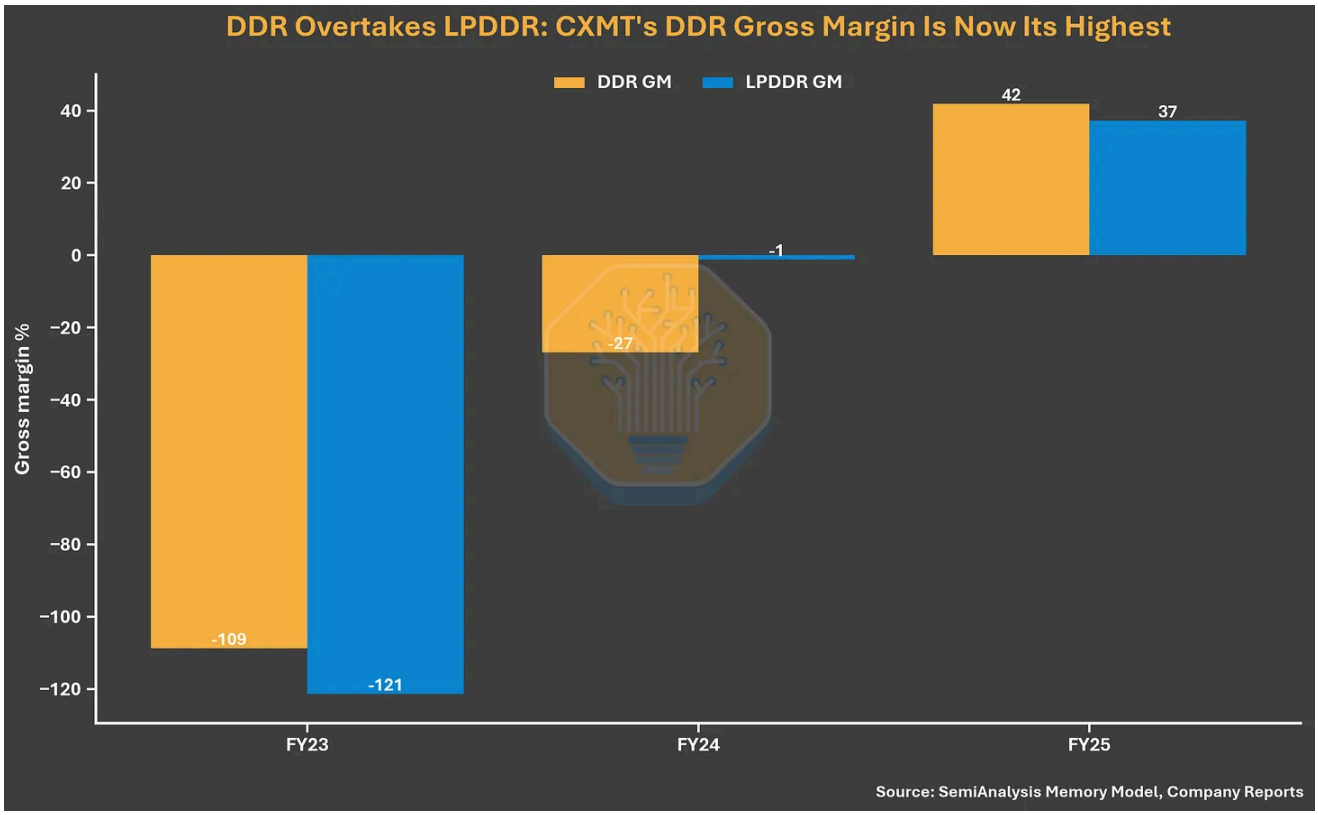
Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：SemiAnalysis 存储模型 - Sales@SemiAnalysis.com

Strong ASP tailwind has materially improved the company's margin profile. CXMT's FY25 gross margin reached 37.8%, moving closer to Samsung at 39.4% and Micron at 39.8%. However, it remains far below SK Hynix at 60.4%, as SK Hynix benefits from a much higher HBM mix, which carries higher ASPs and margin last year. CXMT's ~38% margin is a significant swing from -113% in FY23 and -4.7% in FY24. Last year is not

only the year CXMT reaches a record-high gross margin, but also the first year that the company achieves a positive margin profile.

强劲的均价（ASP）顺风显著改善了公司的利润率。长鑫存储（CXMT）2025 财年毛利率达到 37.8%，接近三星的 39.4%和美光的 39.8%。但远低于 SK 海力士的 60.4%，后者因 HBM（高带宽内存）产品组合占比更高，去年享受了更高的均价和利润率。长鑫存储 38%的毛利率（截至 2025 年 10 月第一周）较 2023 财年的-113%和 2024 财年的-4.7%实现大幅逆转。去年不仅是长鑫存储毛利率创历史新高的一年，也是该公司首次实现正利润率的一年。



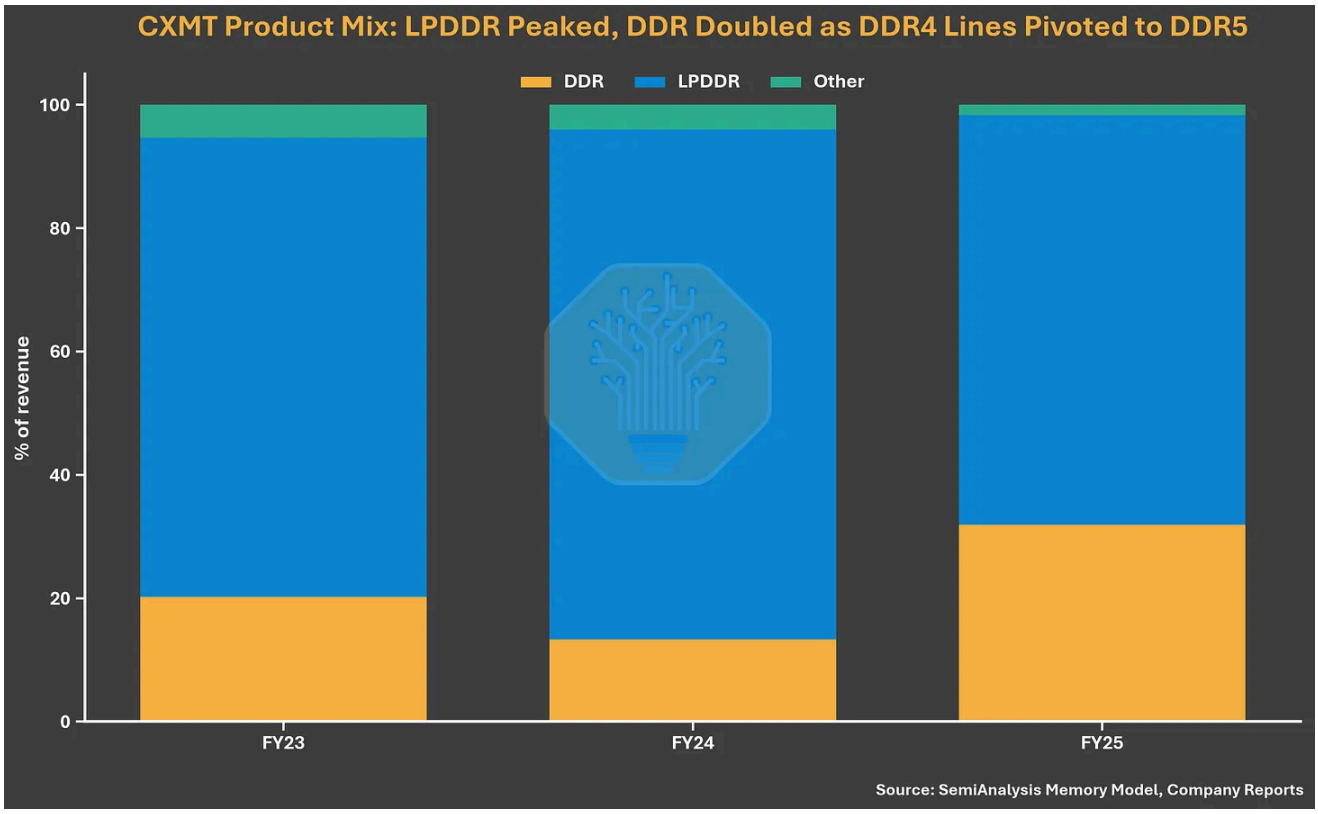
Source: SemiAnalysis Memory Model, Company Reports - Sales@SemiAnalysis.com

来源：SemiAnalysis 存储器模型，公司报告 - Sales@SemiAnalysis.com

With DRAM ASP continues to increase in 2026, CXMT's margin profile has improved further. Its operating margin reached 70% in 1Q26, compared with SK Hynix at 73%, Samsung at 81%, and Micron at 84% in the same period. Besides the strong ASP growth, firm's margin improvement also needs to thanks to company's near-total exposure to commodity DRAM, which effectively has higher margin now vs. HBM. Based on its filing, nearly all of company's bit sales are conventional LPDDR and DDR products. HBM is still a very minimal contributor to the company's revenue and

earnings.

随着 2026 年 DRAM 平均售价持续上涨，长鑫存储的利润率进一步改善。其 2026 年第一季度的营业利润率达到 70%，而同期 SK 海力士为 73%、三星为 81%、美光为 84%。除了强劲的平均售价增长外，公司利润率的提升还要归功于其几乎完全专注于普通 DRAM 业务，这类产品目前的利润率实际上高于 HBM。根据其提交的文件，公司近 100%的比特销量都来自传统的 LPDDR 和 DDR 产品。HBM 目前对公司的收入和盈利贡献仍然非常微小。



Source: SemiAnalysis Memory Model, Company Reports - Sales@SemiAnalysis.com

来源：SemiAnalysis 存储器模型，公司报告 - Sales@SemiAnalysis.com

This becomes clearer when we run a simple cost-per-bit analysis on DDR5 products across four memory suppliers. For DDR5, we find that CXMT's cost per bit remains meaningfully higher than that of the three leading suppliers, by more than 30%. However, because DDR5 pricing was already exceptionally strong in 1Q26, we believe this still lifted CXMT's gross margin to over 70%.This suggests that the improvement in CXMT's margin profile is primarily driven by pricing, rather than by a material

improvement in product competitiveness or cost structure.

通过对四家存储供应商的 DDR5 产品进行简单的每比特成本分析，这一点就更加清晰了。在 DDR5 领域，我们发现长鑫存储的每比特成本仍比三大领先供应商高出 30%以上。然而，由于 DDR5 价格在 2026 年第一季度已异常强劲，我们认为这仍将长鑫存储的毛利率推高至 70%以上。这表明长鑫存储利润率提升主要源于定价因素，而非产品竞争力或成本结构的实质性改善。

1Q26 DDR5 Cost/Bit Analysis by Memory Suppliers				
Company	Cost/Gb	Cost/Gb Premium vs Big Three	ASP ($/Gb)	Gross Margin
CXMT	0.27		1.10	75%
Samsung	0.21	32%	1.10	81%
SK Hynix	0.21	32%	1.10	81%
Micron	0.20	36%	1.10	81%

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：SemiAnalysis 内存模型 - Sales@SemiAnalysis.com

In addition to printing record-level earnings, we believe company is gaining ground from the capacity perspective. By the end of 2026, we expect CXMT to reach roughly **350 kwspm**, which is only modestly below Micron's estimated ~**385 kwspm**. This would position CXMT close to becoming the industry's third-largest memory supplier, if ranked only by wafer capacity.

除了创纪录的盈利水平，我们认为该公司在产能方面也在不断取得进展。到 2026 年底，我们预计长鑫存储（CXMT）的月产能将达到约 35 万片晶圆（以 300 毫米等效晶圆计算），仅略低于美光预计的 38.5 万片。如果仅按晶圆产能排名，这将使长鑫存储接近成为行业第三大内存供应商。

CXMT Wafer Capacity Projection	2026	2027	2028
Base Case			
Heifei Fab 1	100	100	100
Heifei Fab 2	100	100	100
Total Wafer Capacity	350	420	500
YoY %		*20%*	*19%*

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

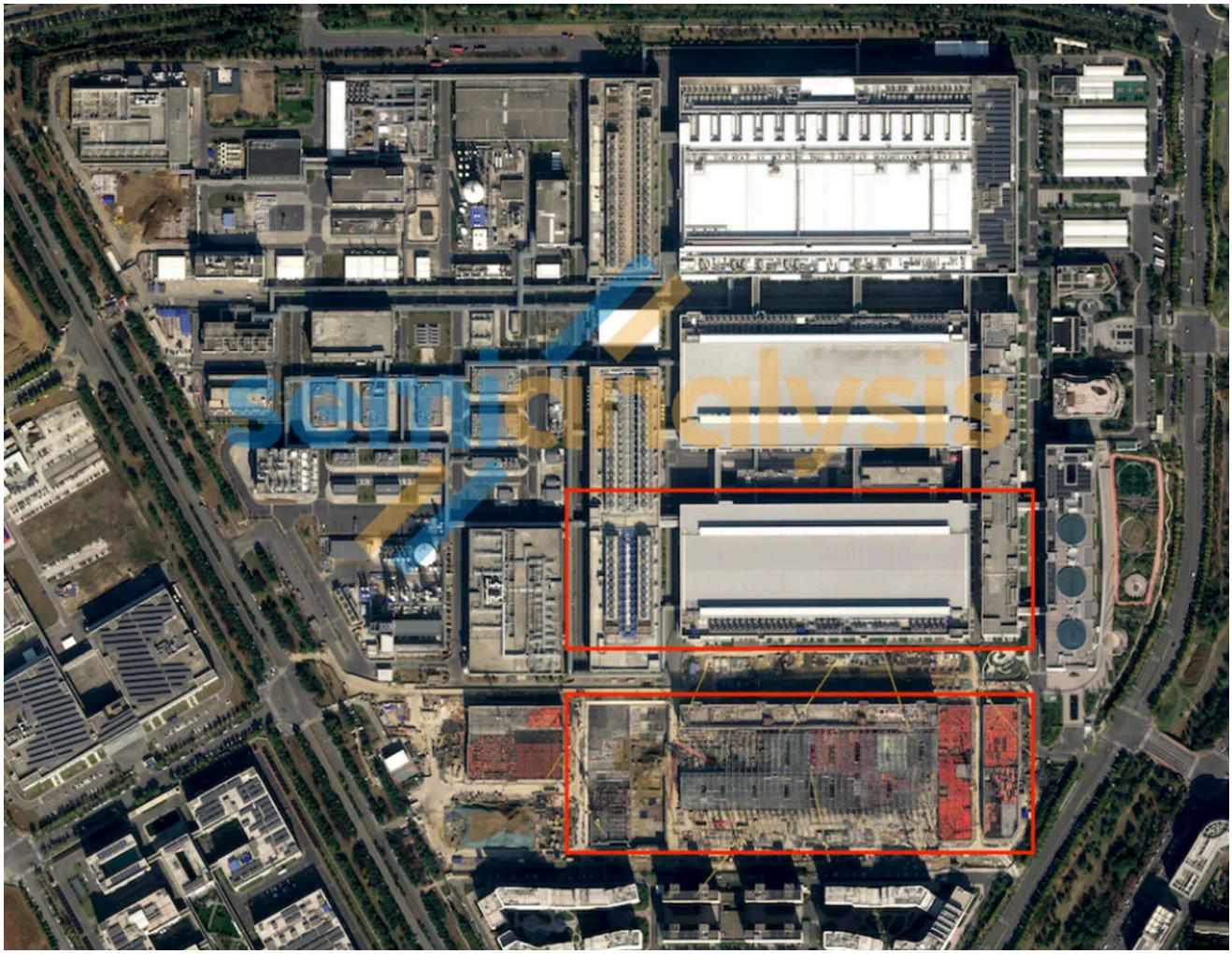
来源：SemiAnalysis 内存模型 - Sales@SemiAnalysis.com

However, CXMT remains materially behind the two leading DRAM suppliers, Samsung and SK Hynix, which we estimate at approximately **720 kwspm** and **595 kwspm**, respectively. Next year, with the initial ramp of Shanghai Phase 1 and the full ramp of Hefei and Beijing, CXMT capacity could reach the **420kwspm range if capacity in year-end**, representing ~**17% of global DRAM capacity**, up from ~**13% in 2025.** In terms of bit shipments, CXMT's share of global bit shipment is expected to rise from **9% to 12% in 2027.**

然而，长鑫存储仍大幅落后于两大 DRAM 供应商三星和 SK 海力士——我们估计这两家公司的月产能分别约为 72 万片和 59.5 万片。明年，随着上海一期项目的初步量产以及合肥、北京项目的全面投产，若以年底产能计算，长鑫存储的月产能可能达到 42 万片左右，相当于全球 DRAM 产能的 17%，高于 2025 年的 13%。在出货量方面，预计长鑫存储的全球出货占比将从 9%上升至 2027 年的 12%。

CXMT's global capacity share could increase further as its Hefei site reaches full operation and the two phases of its Shanghai site continue ramping through 2028. We believe the company will reach 500kwspm of wafer capacity by the end of 2028, accounting for ~17% of global DRAM supply, up from 11% in 2025.

随着合肥厂区全面投产、上海厂区两期产能至 2028 年持续爬坡，CXMT 的全球产能份额将进一步扩大。我们预计该公司将在 2028 年底达到每月 50 万片晶圆产能，届时将占全球 DRAM 供应的 17%（2025 年为 11%）。



Source: CXMT's Heifei Site, SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：长鑫存储（CXMT）合肥厂区，SemiAnalysis 内存模型 - Sales@SemiAnalysis.com

Given CXMT's expanding role in global DRAM capacity, as in past cycles, investors are concerning about potential supply-demand disruption from Chinese players. While these concerns are understandable, we believe they are likely overplayed at least for the next two years. We factor in incremental wafer capacity and bit shipments from CXMT and other memory suppliers—and assuming utilization rates in the high-90% range—we continue to see DRAM as extremely supply constrained. We constantly update our wafer add numbers, demand numbers, and pricing assumptions in our

memory model, much faster than trendforce or sell side banks.

鉴于长鑫存储在全球 DRAM 产能中日益扩大的角色，如同以往的周期一样，投资者担忧中国厂商可能带来供需失衡。虽然这些担忧可以理解，但我们认为至少在接下来两年内，这种担忧可能被过度放大了。我们将长鑫存储及其他存储供应商的增量晶圆产能和位元出货量纳入考量——假设产能利用率维持在 90%以上的高位——我们依然认为 DRAM 供应将极度紧张。我们持续更新存储模型中的晶圆增量数据、需求预测及定价假设，其更新速度远快于 TrendForce 或卖方银行。

Incoming DRAM Incremental Wafer Capacity			
	2026	2027	2028
Samsung	15K	50K	110K
SK Hynix	60K	60K	90K
Micron	30K	90K	115K
CXMT	85K	70K	80K

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

SemiAnalysis 内存模型 - sales@SemiAnalysis.com

Looking solely at CXMT's wafer additions, we do see meaningful capacity expansion when compared with other suppliers. We expect CXMT to add roughly 85kwspm, 70kwspm and 80k each year from 2026 to 2028, versus Samsung at 15k/50k/110k, SK Hynix at 60k/60k/90k, and Micron at 30k/90k/115k. Even with these wafer additions, we expect DRAM to remain undersupplied by a high-single-digit percentage this year, widening to a low- to mid-teens in bit undersupply next year. We addressed in detail in our previous piece why DRAM is likely to remain undersupplied through potentially 2028, even with these incoming incremental wafer additions.

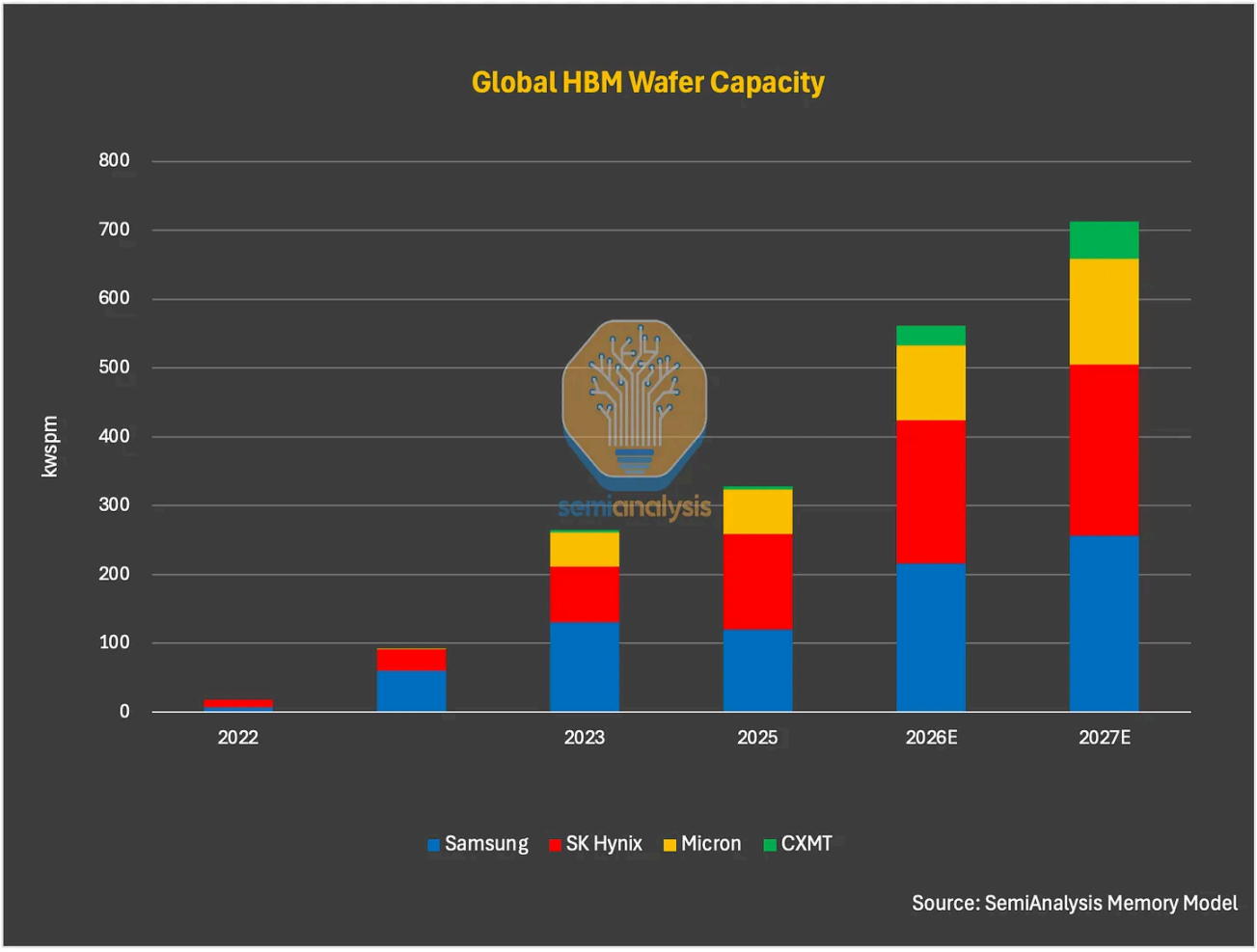
仅从长鑫存储的晶圆增量来看，与其他供应商相比，其产能扩张确实显著。预计 2026 年至 2028 年间，长鑫存储每年将分别新增约 8.5 万片/月（kwspm）、7 万片/月（kwspm）和 8 万片/月（kwspm）产能——同期三星、SK 海力士、美光的年增量分别为 1.5 万/5 万/11 万片、6 万/6 万/9 万片和 3 万/9 万/11.5 万片。即便考虑这些晶圆增量，我们预计今年 DRAM 市场仍将维持高个位数百分比的供应短缺，明年供应缺口将扩大至低至中双位数百分比。我们此前已详细论证，即便面对这些新增产能，DRAM 供应偏紧的格局可能延续至 2028 年。

We see little ability for the company to irrationally accelerate capacity expansion beyond its current pace in a way that would meaningfully disrupt a market now providing an extremely favorable pricing environment because fab construction timelines are so long. This pricing backdrop has been the primary driver of the company's explosive earnings growth–which the company hopes to see it continues. Based on the fab buildout we are tracking, we also not yet see the sign of this possibility although we would like to stress that the total wafer capacity of Shanghai site could have over 400kwspm of wafer capacity in a full-ramp status.

我们认为，由于晶圆厂建设周期漫长，该公司目前几乎没有能力以超出当前速度的方式不合理地加速产能扩张，从而显著破坏这一目前提供极为有利定价环境的市场。这一定价背景正是该公司盈利爆发式增长的主要驱动力——而公司希望这一趋势能够延续。根据我们跟踪的晶圆厂建设进度，我们目前也尚未看到这种可能性出现的迹象，不过我们要强调，上海厂址在全面达产后，总晶圆产能可能超过 40 万片/月（以等效 12 英寸晶圆计）。

Specifically on its wafer capacity, we see quite limited wafer allocation toward HBM. By reconciling with CXMT's IPO-related filings to date, we find that wafer allocation to HBM has been very limited, even until today. By the end of 2025, we believe only ~5 kwspm of CXMT's ~265 kwspm of capacity is allocated to HBM. We think this figure will increase to nearly ~30 kwspm and ~55kwspm by the end of 2026 and 2027 respectively. This capacity trajectory seems better align with CXMT's filings indicate that roughly 99% of revenue consists of DDR and LPDDR products in 2025, as discussed earlier.

具体看晶圆产能，我们发现其分配给 HBM 的产能非常有限。通过对照长鑫存储至今的 IPO 相关文件，我们发现直至今日，HBM 产能分配仍然极度有限。到 2025 年底，我们预计长鑫存储~265 千片/月的总产能中，仅~5 千片/月用于 HBM。我们认为这一数字将在 2026 年底和 2027 年底分别增至约~30 千片/月和~55 千片/月。这一产能增长路径与长鑫存储文件披露的内容更为吻合——其中显示 2025 年约 99%的营收来自 DDR 和 LPDDR 产品。



Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：SemiAnalysis 内存模型 - Sales@SemiAnalysis.com

This wafer allocation dynamics could change, however. We believe China's broader push for self-sufficiency in AI compute could conflict the company's strategic priorities, and we believe this push could intensify over time, given the HBM supply constraints discussed earlier and government's determination to address this issue.

然而，这种晶圆分配动态可能会发生变化。我们相信，中国在 AI 计算领域更广泛的自主化努力可能与该公司的战略优先级产生冲突，并且我们认为，鉴于之前讨论的 HBM 供应限制以及政府解决这一问题的决心，这种推动力会随时间推移而加强。

To that end, in our estimates, we factor in government influence for CXMT to allocate more wafer capacity to HBM overtime. As a result, we expect CXMT's HBM wafer capacity to accelerate materially in 2027 and 2028 with its HBM technology improvement, supported by continued growth in China's domestic compute market. We estimate CXMT's HBM wafer capacity will reach **55kwspm and 100kwspm in 2027 and 2028**, respectively. This would increase the company's share of global HBM

wafer supply from **1% in 2025** to **12% in 2028**.

为此，在我们的估算中，我们考虑了政府的影响力，使长鑫存储随着时间的推移将更多晶圆产能分配给 HBM。因此，我们预计长鑫存储的 HBM 晶圆产能将在 2027 年和 2028 年随着其 HBM 技术的改进而显著加速，这得益于中国国内计算市场的持续增长。我们估计，长鑫存储的 HBM 晶圆产能将在 2027 年和 2028 年分别达到 5.5 万片/月和 10 万片/月。这将使该公司在全球 HBM 晶圆供应中的份额从 2025 年的 1%增加到 2028 年的 12%。

It is important to remember that CXMT, unlike other memory suppliers, is not only an economically and technologically important company for China, but also a strategic asset that the country can leverage to advance prioritized policy objectives.

重要的是要记住，与其他内存供应商不同，长鑫存储对中国来说不仅是一家经济和技术上重要的公司，而且还是国家可以用来推进优先政策目标的战略资产。

Strategically though, it does make sense for CXMT to allocate more DRAM wafer capacity to commodity DRAM over HBM in near term. The commodity DRAM currently offers materially higher margins than CXMT's HBM products, while also delivering more than 3x the bits per wafer on a like-for-like basis.

从战略角度看，长鑫存储（CXMT）短期内将更多 DRAM 晶圆产能分配给通用型 DRAM 而非 HBM 确实有其合理性。目前通用型 DRAM 的利润率远高于其 HBM 产品，且在同等条件下每片晶圆可产出的比特数超过 HBM 的三倍以上。

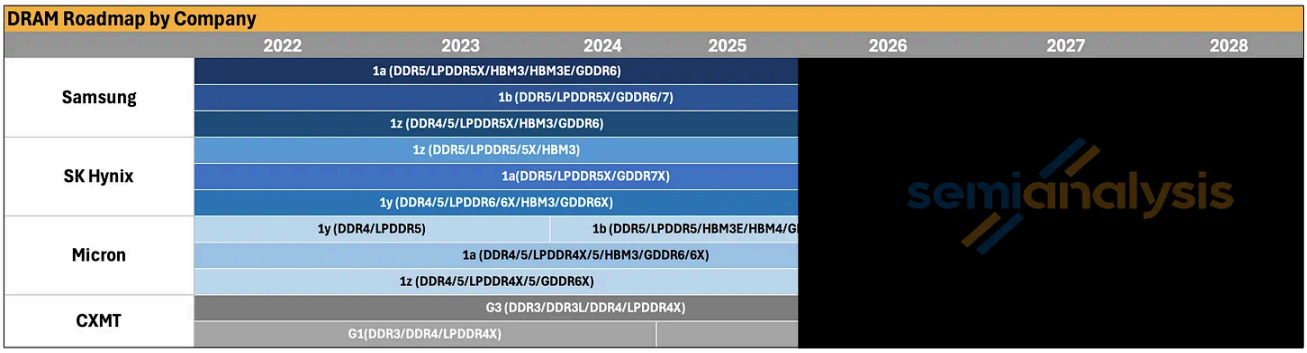
Given that CXMT has not yet fully matured its HBM technology, allocating significant wafer capacity to HBM would likely generate limited profit while consuming scarce DRAM wafer capacity that could otherwise support higher-margin commodity DRAM at greater volume. In this context, prioritizing commodity DRAM is both economically rational and better aligned with CXMT's current manufacturing capabilities and pricing environment. China must allocate to HBM though as sales of HBM to China are somewhat limited besides some loopholes that allow Korean vendors to keep

shipping to China.

考虑到长鑫存储的 HBM 技术尚未完全成熟，将大量晶圆产能分配给 HBM 不仅利润空间有限，还会挤占稀缺的 DRAM 晶圆产能——这些产能本可用于大规模生产利润更高的通用型 DRAM。在此背景下，优先发展通用型 DRAM 既是经济理性的选择，也更契合长鑫存储当前制造能力与定价环境。不过中国必须将部分产能投入 HBM 领域，因为尽管存在允许韩国供应商继续向中国供货的某些灰色渠道，但 HBM 对中国的整体出口仍受到明显限制。

On technology readiness, we believe CXMT is still struggling to stabilize supply for **HBM3 8-hi**, with even greater challenges in **12-hi.** On the front end, the company appears to have made progress stabilizing production of its **Gen 4** (**G4**), or **1z-equivalent** DRAM. We believe the majority of CXMT's DRAM output this year will be fabricated on the company's G4 process node. Yet, front-end wafer-sort yield should still be materially lower for the core DRAM die used in HBM, given its larger die size, more demanding cell performance, overall performance requirements versus commodity DRAM. We think the front-end wafer sort yield remain a major challenge for the company, and its gap versus its peers here is still large. While we believe yields on CXMT's G4 node have improved, we suspect it still lower than industry standard of 85-90% mature yield level for 1z given the lower margin we saw throughout 2024 and 2025. This might suggest that equipment limitations and manufacturing know-how remain persistent obstacles that CXMT will need to overcome.

在技术成熟度方面，我们判断长鑫存储仍难以稳定供应 HBM3 8 层堆叠产品，而 12 层堆叠产品的挑战更为艰巨。在晶圆制造前端环节，该公司在第四代（G4）制程（相当于 1z 级 DRAM）的稳定量产方面取得进展。我们认为今年长鑫存储的 DRAM 产出大部分将采用其 G4 工艺节点。然而，相较于普通 DRAM，HBM 核心存储晶粒因芯片面积更大、单元性能要求更严苛及整体性能指标更高，其前端晶圆良率仍将显著偏低。我们认为晶圆良率仍是该公司面临的主要挑战，与同行差距依然明显。尽管长鑫存储 G4 节点良率有所提升，但基于 2024 至 2025 年期间持续偏低的利润率判断，其良率可能仍低于 1z 级 DRAM 行业 85%-90%的成熟良率标准。这或许意味着设备限制与制造技术瓶颈仍是长鑫存储需要持续突破的障碍。



Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

来源：SemiAnalysis 内存模型 - 销售@SemiAnalysis.com

For its next process node, the company's G5, or 1a-equivalent DRAM node, while can theoretically continue advancing without EUV akin to Micron in 1a process node, but it will face increasing fabrication and design challenges. These challenges will only add further manufacturing and design pressure when the node is applied to both DRAM dies for HBM. The lower yield and more challenging ramp-up schedule could impact company's bit output as well despite the company can compensate the yield loss by adding more wafers.

对于其下一个工艺节点，即公司的 G5（相当于 1a 级 DRAM 节点），虽然理论上可以在无需 EUV 光刻技术的情况下继续推进，类似于美光在 1a 工艺节点上的做法，但将面临日益严峻的制造与设计挑战。当该节点被应用于 HBM 所需的 DRAM 芯片时，这些挑战将进一步加剧制造与设计压力。良率下降及爬坡周期延长可能影响公司的位元产出量，尽管公司可以通过增加晶圆投片量来弥补良率损失。

On top of this, we believe die stacking remains the major obstacle for CXMT's HBM. HBM stacking usually introduces significant technical hurdles, including thermal stress, die cracking, warpage, bonding defects, and yield loss across multiple stacked dies. Our understanding is that these issues become even more severe as the company attempts to move from HBM3 8-hi to HBM3 12-hi, and eventually HBM3E, given company's yet sufficient enough of know-how and manufacturing experience for 12hi

or above HBM.

除此之外，我们认为芯片堆叠仍是长鑫存储 HBM 面临的主要障碍。HBM 堆叠通常会引发显著的技术难题，包括热应力、芯片开裂、翘曲、键合缺陷以及多层堆叠芯片的良率损失。据我们所知，当公司试图从 HBM3 8 层堆叠向 HBM3 12 层堆叠乃至最终实现 HBM3E 技术演进时，这些问题将愈发严峻——因为该公司在 12 层及以上堆叠技术方面尚缺乏足够成熟的技术诀窍与制造经验。

Die stacking is not a challenge unique to CXMT. Even leading memory suppliers are encountering difficulties. For 12-high HBM4, we understand that suppliers continue to face significant stacking-related issues, including die cracking, thermal management challenges, and yield loss.

堆叠技术并非 CXMT 独有的挑战，即便是顶级存储供应商也面临困难。对于 12 层 HBM4，我们了解到供应商仍持续面临显著的堆叠相关问题，包括芯片开裂、热管理难题及良率损失。

These challenges become even more pronounced as memory suppliers seek to manufacture 16-high or even 20-high HBM. For next-gen HBM4E, we note that one reason Rubin Ultra is expected to use 12-high HBM4E rather than 16-high is supply: 16-high HBM requires higher DRAM wafer intensity and involves a more difficult manufacturing process, which can lead to greater wafer loss and lower effective supply of DRAM bits. These conditions put both memory suppliers and customer in a very tough spot given highly supply-constrained environment in DRAM.

当存储供应商试图制造 16 层甚至 20 层 HBM 时，这些挑战愈发凸显。针对下一代 HBM4E，我们注意到 Rubin Ultra 预计采用 12 层 HBM4E 而非 16 层的一个原因是供应限制：16 层 HBM 需要更高的 DRAM 晶圆强度，且涉及更复杂的制造工艺，这可能导致更大的晶圆损耗及有效 DRAM 比特供应量下降。在 DRAM 供应高度紧张的环境下，这些状况使存储供应商与客户都陷入困境。

We think there is an increasing possibility that CXMT will skip HBM3 and focus instead on HBM3E 8-hi and 12-hi. We believe this potential roadmap change is driven by two factors: 1) customer demand for more competitive HBM products in ’27 timeframe, and 2) mainstream accelerators will equip with HBM3E, HBM4, and

HBM4E.

我们认为 CXMT 跳过 HBM3 直接研发 HBM3E 8 层与 12 层产品的可能性正在增加。这一潜在路线图调整主要受两个因素驱动：1）客户希望在 27 年时间节点获得更具竞争力的 HBM 产品；2）主流加速器将配备 HBM3E、HBM4 及 HBM4E。 }

HBM Technology Roadmap								
Company	2020	2021	2022	2023	2024	2025	2026	2027
SK Hynix	HBM2E		HBM3		HBM3E(1st)	HBM3E	HBM4	HBM4E
Samsung	HBM2E		HBM3		HBM3E	HBM3E	HBM4	HBM4E
Micron	HBM2E				HBM3E	HBM3E	HBM4	HBM4E
CXMT					HBM2	HBM2E	HBM3/3E	HBM3E / Custom

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

半分析内存模型 - 销售@半分析.com

On the back end, while it remains debatable whether CXMT is using MR-MUF or TC-NCF, we believe the packaging challenge should be relatively more manageable, as the company and its back-end partners face fewer export control constraints. CXMT has been working closely with leading OSATs such as Tongfu Microelectronics for some time, and we believe its back-end capabilities should have gradually improved, though a gap likely remains versus leading memory manufacturers.

在后端方面，尽管长鑫存储（CXMT）是否采用 MR-MUF 或 TC-NCF 技术仍存在争议，但我们认为封装挑战相对更易应对，因为该公司及其后端合作伙伴面临的出口管制限制较少。CXMT 与通富微电等领先封测厂商已保持长期紧密合作，我们相信其后端能力应已逐步提升，不过与主流存储器制造商相比仍存在差距。

Given these existing manufacturing challenges, we model CXMT's HBM3 8-hi's front-end and back-end yields at roughly 35% and 70%, respectively, implying an overall yield of only around 25%. We think this number should be lower when company attempts to produce HBM3 12hi or HBM3E 12hi given higher difficulty in die stacking and bonding. At these yield levels, CXMT's HBM output would be even more limited on the same DRAM wafer capacity than leading memory suppliers. More importantly, the resulting HBM would likely carry very low margins, especially compared with

commodity DRAM in the current pricing environment.

基于当前存在的制造挑战，我们测算长鑫存储 HBM3 8 层堆叠产品的前端良率约为 35%、后端良率约为 70%，综合良率仅约 25%。考虑到更复杂的芯片堆叠与键合工艺，我们认为该公司在尝试生产 HBM3 12 层堆叠或 HBM3E 12 层堆叠产品时，其良率数据可能更低。在现有良率水平下，长鑫存储同等 DRAM 晶圆产能所能产出的 HBM 产品，将比主流存储器供应商更为有限。更重要的是，由此产出的 HBM 产品利润率将极低，尤其在当前定价环境下与通用型 DRAM 产品相比更是如此。

CXMT's HBM struggles continue to be reflected in its limited product presence and slow penetration within China's AI accelerator market. We think only Huawei, Cambricon, and select emerging Chinese AI chip startups are likely to adopt CXMT's HBM, though we suspect adoption rates will be large. We actually believe domestic AI accelerator vendors would still prefer foreign HBM3, or even HBM3E, if they can secure supply through any available channel or stockpiled inventory before the export controls in December 2024. As China's domestic CSP capex and broader compute buildout are surging, there is little doubt that domestic HBM demand is also growing rapidly and should continue to increase.

长鑫存储（CXMT）在 HBM 领域的困境，持续体现在其有限的产品存在感以及在中国 AI 加速器市场的缓慢渗透上。我们认为，可能只有华为、寒武纪以及部分中国新兴 AI 芯片初创企业会采用长鑫的 HBM，不过我们猜测其采用率将相当可观。实际上，我们相信，如果能赶在 2024 年 12 月出口管制生效之前，通过任何可用渠道或库存储备确保供应，国内 AI 加速器供应商仍会优先选择海外 HBM3 甚至 HBM3E 产品。随着中国本土云服务提供商资本支出及更广泛的算力建设激增，国内 HBM 需求无疑也在迅速增长，且这一增长势头应会持续。

With that said Huawei and CXMT will have custom HBM that is not based on the slow JEDEC standards and phys, so it will be able to close the bandwidth disadvantage.

尽管如此，华为与长鑫将共同开发定制化 HBM，这类产品不基于进度缓慢的 JEDEC 标准与物理层设计，因此有望缩短与行业前沿的差距。

We believe China could face a more severe HBM supply constraint than what would be implied by slow domestic HBM development alone. This constraint is likely to be further exacerbated by tight supply across all three major HBM suppliers, each of

which is already restricted from selling HBM2E-equivalent or more advanced HBM products into China under the U.S. export controls announced in December 2024. Given the tight supply environment, these suppliers are likely to have even less willingness to risk violating export controls to sell into China.

我们认为，中国可能面临比单纯的国内 HBM 发展缓慢所预示的更为严重的 HBM 供应限制。在美国 2024 年 12 月宣布的出口管制下，三大主要 HBM 供应商均已禁止向中国销售 HBM2E 等效或更先进的 HBM 产品，而这三家供应商本身供给本就紧张，因此这一限制很可能进一步加剧。在供给紧张的环境下，这些供应商违反出口管制向中国销售的意愿可能更低。

However, HBM re-export and smuggling could complicate this conclusion. We understand that some Chinese companies continue to obtain HBM3 from memory suppliers, a dynamic we reported on last year and that has since been corroborated by other leading media outlets. We believe this remains the case today.

然而，HBM 的再出口和走私活动可能使这一结论复杂化。据了解，部分中国企业仍在从存储供应商处获取 HBM3——我们去年曾报道过这一动态，此后其他主流媒体也予以证实。我们认为这种情况至今依然存在。

Based on our conversations with industry participants, re-export through foreign offices or partner companies located in third countries remains one pathway through which Chinese companies can access HBM. In addition, some downstream OSATs or intermediaries in third countries appear to facilitate these flows. Some entities may ship partially assembled systems or modules in forms that are not treated as fully manufactured GPUs or ASICs and are therefore still permitted to be shipped into China. The HBM can then be recovered and repackaged onto domestic Chinese GPUs or ASICs.

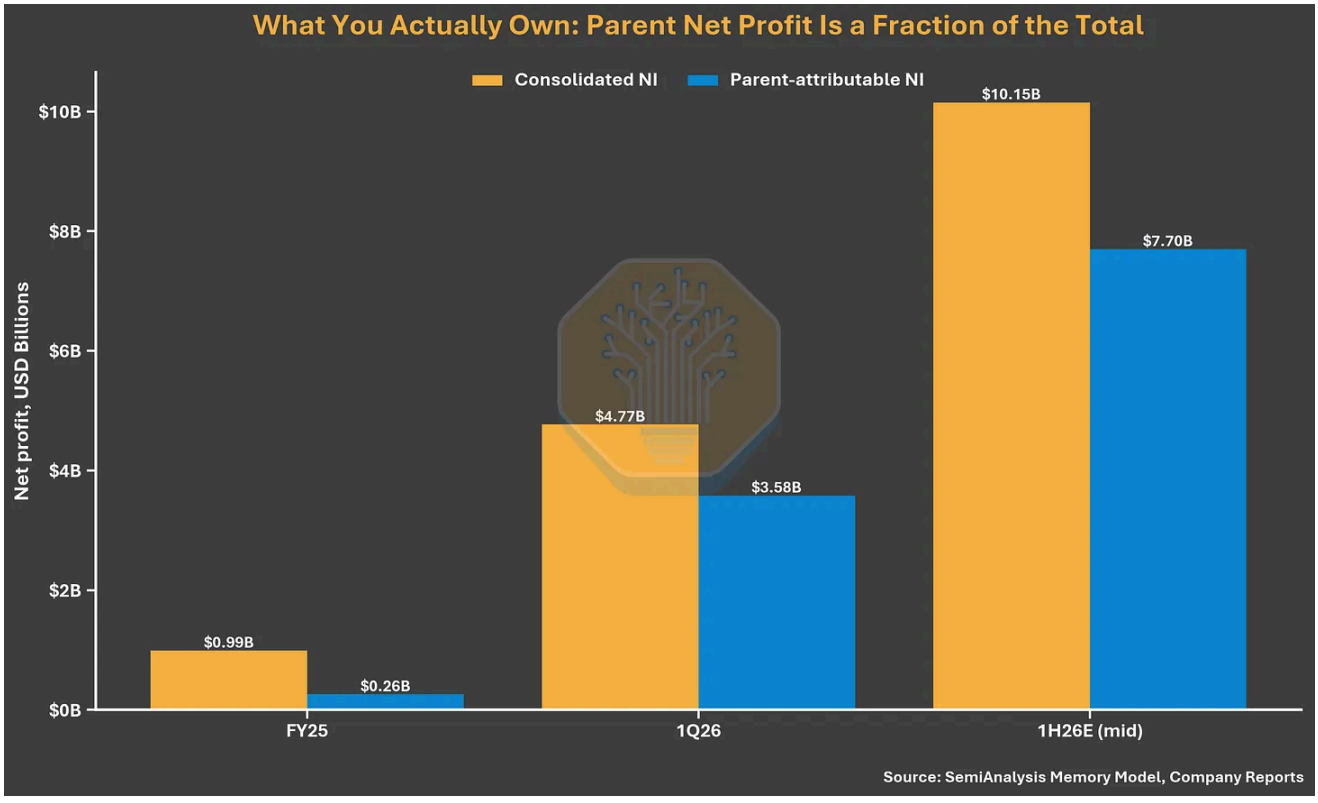
根据我们与行业参与者的交流，通过位于第三国的海外办事处或合作伙伴公司进行转口贸易，仍是中国企业获取 HBM 的途径之一。此外，位于第三国的一些下游封测厂商（OSAT）或中间商似乎也在为这些流通环节提供便利。部分实体可能以未被视为完整 GPU 或 ASIC 的形态，运输部分组装的系统或模块，这类产品目前仍被允许出口至中国。HBM 随后可被提取并重新封装至中国本土自主研发的 GPU 或 ASIC 中。

What the IPO Structure Reveals

IPO 结构揭示的信息

CXMT could become one of China's largest semiconductor IPOs, and its ownership structure matters more than the headline financials. CXMT reported RMB7.14B of consolidated FY2025 net income, yet only RMB1.87B was attributable to parent shareholders, with 74% attributable to minority interests. The reason is the ownership architecture. CXMT holds 30.68% of the economics of Changxin Xinqiao and 31.72% of Changxin Jidian Beijing while controlling 73.01% and 75.32% of the votes through long-term acting-in-concert arrangements. That lets the company consolidate fabs it mostly does not own, so the consolidated figure overstates what public shareholders will actually receive by roughly four times.

长鑫存储（CXMT）可能成为中国最大的半导体 IPO 之一，其股权结构比表面财务数据更具深意。长鑫存储 2025 财年合并净利润为 71.4 亿元人民币，但仅有 18.7 亿元归属于母公司股东，74%归属于少数股东权益。这一现象源于其所有权架构：长鑫存储持有长鑫新桥 30.68%的经济权益和长鑫集电（北京）31.72%的经济权益，但通过长期一致行动安排，分别控制了 73.01%和 75.32%的投票权。这使得公司能够合并其未完全控股的晶圆厂，因此合并数据夸大了公众股东实际获得的收益约四倍。

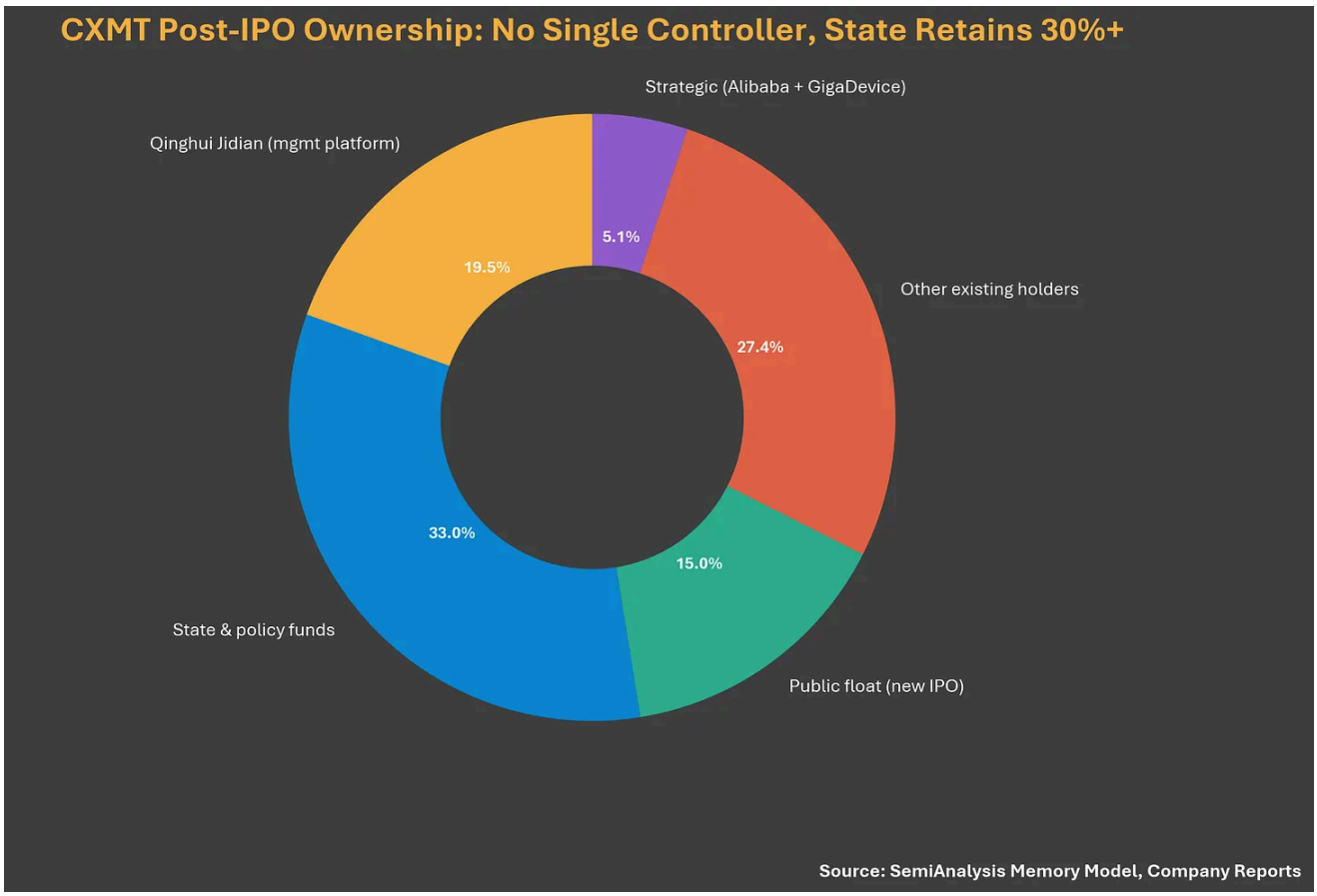


Source: SemiAnalysis Memory Model, Company Reports - Sales@SemiAnalysis.com

来源：SemiAnalysis 存储模型，公司报告 - Sales@SemiAnalysis.com

That same voting structure undercuts the company's declaration that it has no controlling shareholder and no actual controller, which the prospectus lists as a formal governance risk. CXMT exercises majority voting control of its fabs through acting-in-concert pacts, and state vehicles including National IC Fund Phase II, Hefei, and Anhui together hold well over 30% even after the listing. The arrangement looks designed to manage export-control and foreign-investor perception at a moment when CXMT's ties to the Chinese state draw the most scrutiny.

这种投票结构削弱了公司声称无控股股东、无实际控制人的声明，招股说明书将此列为正式治理风险。长鑫存储通过一致行动协议对其晶圆厂行使多数投票权，而包括国家集成电路产业投资基金二期、合肥市及安徽省在内的国有资本，即便在上市后合计持股仍远超 30%。在长鑫存储与国家的关联备受审视之际，这一安排似乎旨在管控出口管制和外国投资者的观感。

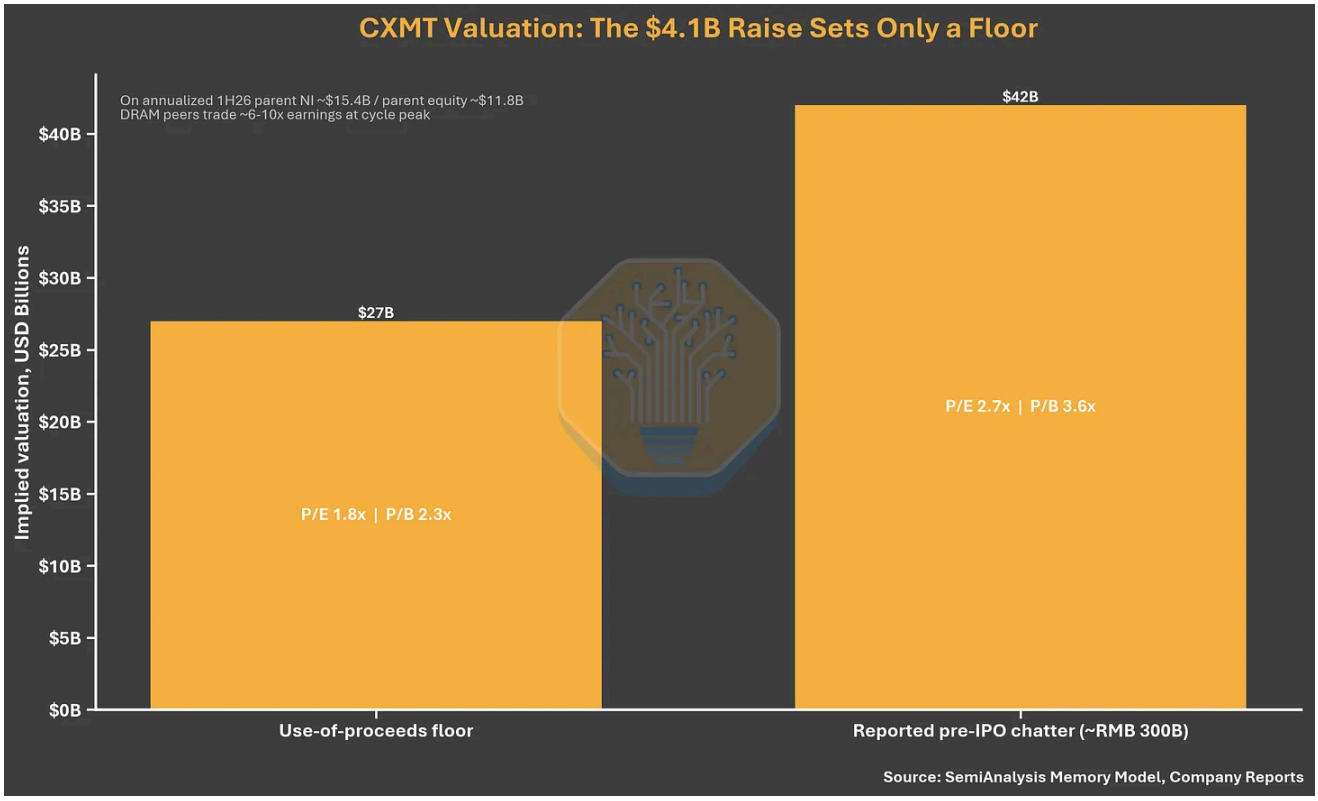


Source: SemiAnalysis Memory Model, Company Reports - Sales@SemiAnalysis.com

资料来源：SemiAnalysis 存储器模型、公司报告 – Sales@SemiAnalysis.com

The raise that will get reported badly understates the listing. CXMT plans to deploy RMB29.5 billion, or about $4.1 billion, while issuing 10% to 15% of its post-IPO shares. Fully funding those uses through the IPO implies a price of roughly RMB4.41 at 10% dilution or RMB2.78 at 15%, versus RMB2.63 in the June 2025 financing. The low end represents barely any per-share appreciation despite 1Q26 revenue of $7.3 billion and net profit of $4.8 billion. At RMB2.78, CXMT would be valued at about RMB197 billion, or $27 billion, equivalent to just 1.8 times annualized first-half 2026 parent earnings. This arithmetic floor sits well below a realistic book-building valuation. This is too cheap and should be much higher valuation in our opinion.

此次募资规模若按常规报道，将严重低估其上市价值。长鑫存储计划部署 295 亿元人民币（约合 41 亿美元），同时发行上市后总股本 10%至 15%的股份。若通过 IPO 全额融资，按 10%稀释比例计算隐含股价约 4.41 元人民币，按 15%稀释比例则为 2.78 元人民币，而 2025 年 6 月融资时的股价为 2.63 元。即便 2026 年第一季度实现 73 亿美元营收和 48 亿美元净利润，该定价区间低端对应的每股溢价几乎可以忽略。按 2.78 元计算，长鑫存储估值约为 1970 亿元人民币（合 270 亿美元），仅相当于 2026 年上半年母公司年化收益的 1.8 倍。这一算术下限远低于实际询价估值区间。我们认为这个价格过于低廉，理应获得远高于此的估值。

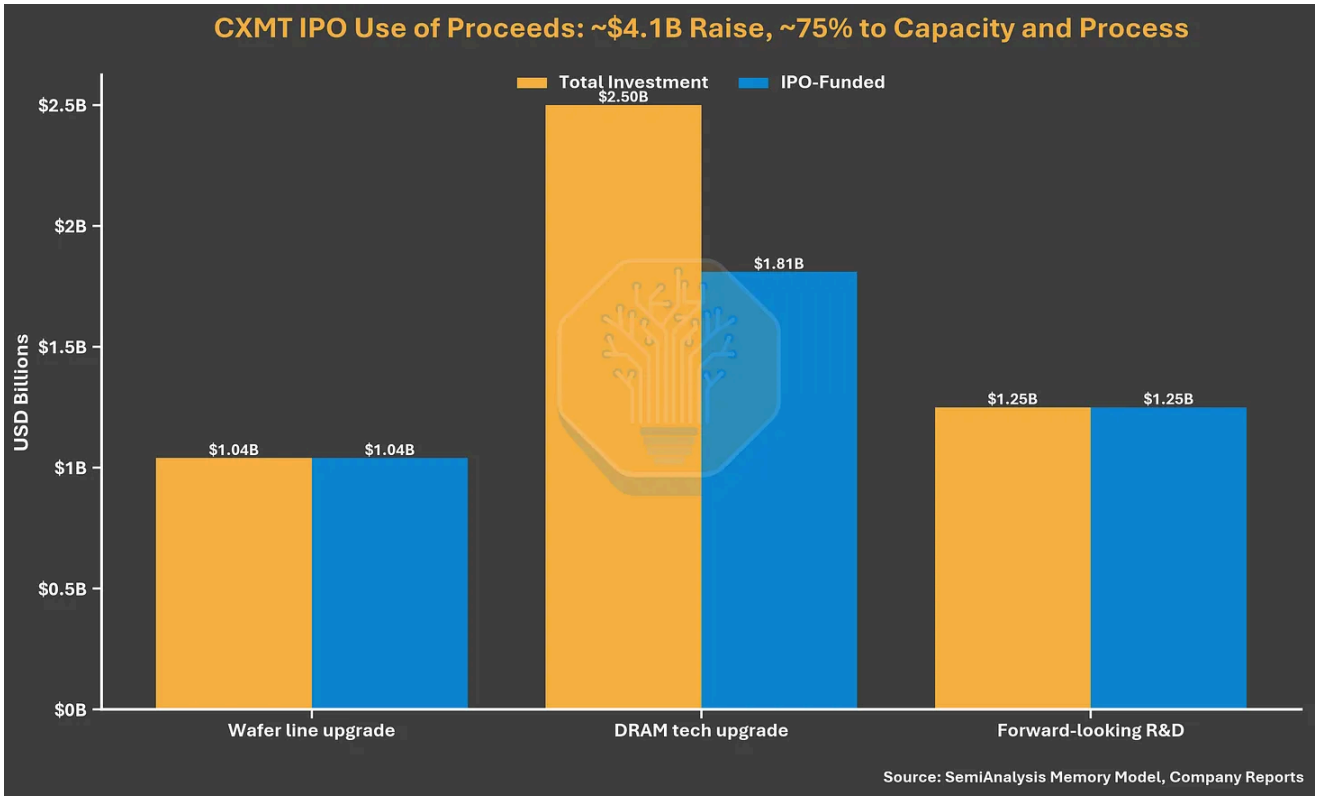


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The allocation reinforces CXMT's current priorities. Of the RMB29.5 billion in planned net proceeds, RMB20.5 billion, or 69.5%, funds wafer-production-line and DRAM technology upgrades, while RMB9 billion, or 30.5%, supports forward-looking DRAM research. The prospectus discloses no dedicated HBM project and does not mention HBM. Its project descriptions focus on newer process platforms, product iteration, and the migration of existing lines toward mid-to-high-end DRAM. The IPO therefore primarily strengthens CXMT's core DRAM manufacturing and technology base, with no disclosed funding commitment to a near-term HBM expansion.

此次资金调配强化了长鑫存储（CXMT）的当前战略重点。在 295 亿元计划募集资金净额中，205 亿元（占比 69.5%）用于晶圆生产线与 DRAM 技术升级，90 亿元（占比 30.5%）支持前瞻性 DRAM 研发。招股说明书未披露任何专门的 HBM 项目，也未提及 HBM 技术。其项目说明聚焦于更新工艺平台、产品迭代以及现有产线向中高端 DRAM 迁移。因此，本次 IPO 主要巩固长鑫存储的核心 DRAM 制造与技术基础，并未披露对近期 HBM 扩产的专项资金承诺。



Source: SemiAnalysis Memory Model, Company Reports - Sales@SemiAnalysis.com

数据来源：SemiAnalysis 存储器模型、公司报告 - Sales@SemiAnalysis.com

The size of the earnings move deserves a flag on cycle timing. CXMT guided in its December 2025 filing to an FY2025 parent loss of RMB 0.6 to 1.6 billion. Five months

later the prospectus reported a RMB 1.87 billion profit, with consolidated income running past double the earlier high-end estimate. It also shows how quickly peak DRAM pricing moves the valuation denominator in either direction.

盈利变动幅度值得关注周期时点。长鑫存储在 2025 年 12 月提交的申报文件中预计 2025 财年母公司净亏损 6-16 亿元。五个月后，招股说明书报告盈利 18.7 亿元，合并收入超过此前最高预期值两倍。这也显示出 DRAM 峰值定价对估值分母的快速影响程度。

Finally, Alibaba's place on the cap table changes how to read CXMT's demand. Alibaba Cloud is at once the anchor hyperscaler customer, a near-4% holder, and an endorser, sitting alongside GigaDevice, chairman Zhu Yiming's own fabless house, at 1.8%. Domestic volume is effectively guaranteed in a way the Korean incumbents did not have in their home markets, which matters more than the small percentages suggest.

最后，阿里巴巴在 CXMT 股东名单中的位置，改变了我们解读其需求的方式。阿里云既是核心超大规模云服务客户，又是持有近 4%股份的股东，同时还扮演着背书者的角色，与代工厂兆易创新（持股 1.8%，董事长朱一明控股的无晶圆厂设计公司）并列。这种模式使得国内出货量实际上获得了保障，这是韩国存储巨头在本土市场所不具备的优势，而这一意义远超其持股比例所示。

For paid subscribers, we will take a deep dive into CXMT, China's broader WFE ecosystem, the impact of export controls, and the implications for China's memory and compute ambitions. We will also discuss HBM in more detail.

针对付费订阅用户，我们将深入剖析 CXMT、中国泛半导体设备生态系统、出口管制的影响，以及这些因素对中国存储与计算雄心的潜在影响。我们还将探讨高带宽存储（HBM）的相关议题。

CXMT's Equipment Ecosystem Under Export Controls: Domestic vs Foreign, and the Domestication Curve

出口管制下的长鑫存储设备生态系统：国产与外资对比，以及国产化曲线

As Beijing intensifies its push for supply-chain self-sufficiency, we believe China's semiconductor equipment and materials industry is entering an unprecedented phase of structural growth. This growth will be driven not only by YMTC, SMIC, and other major domestic chipmakers, but by CXMT's capacity ramp and rising localization rate across its supply chain.

随着北京加大对供应链自主可控的推动力度，我们认为中国的半导体设备和材料行业正进入前所未有的结构性增长阶段。这一增长不仅将由长江存储、中芯国际等国内主要芯片制造商驱动，还将受益于长鑫存储的产能爬坡及其供应链中持续提升的国产化率。

This trend is being further accelerated by successive U.S. export controls on foreign WFE. As access to advanced overseas tools becomes more constrained, domestic equipment and materials suppliers are likely to capture a greater share of incremental fab spending against China's self-sufficiency push. For CXMT specifically, we believe the pursuit of a domestic WFE supply chain is becoming increasingly inevitable over time, given existing export controls and the company's structural constraints in sourcing advanced equipment. In this context, CXMT's ongoing and future expansion should serve as a major demand catalyst for China's broader semiconductor supply chain.

美国对国外晶圆制造设备的连续出口管制进一步加速了这一趋势。随着获取先进海外设备的渠道日益受限，面对中国自主可控的推进，国内设备和材料供应商有望在新增晶圆厂支出中占据更大份额。具体到长鑫存储，我们认为，鉴于现有的出口管制及其在采购先进设备方面的结构性限制，追求国内晶圆制造设备供应链正变得越来越不可避免。在此背景下，长鑫存储当前及未来的扩产应成为中国半导体整体供应链的重大需求催化剂。

Successive export controls have progressively narrowed the company's access to the lithography, deposition, etch, metrology, service, spares, and process support required for advanced DRAM scaling. As a result, CXMT's long-term competitiveness increasingly depends on how quickly it can qualify domestic tools, redesign process flows around equipment constraints, and reduce reliance on restricted foreign

suppliers.

连续的出口管制逐步缩小了该公司在先进 DRAM 制程所需的光刻、沉积、蚀刻、计量、服务、备件及工艺支持方面的获取渠道。因此，长鑫存储(CXMT)的长期竞争力日益取决于其本土设备的验证速度、围绕设备制约重新设计工艺流程的能力，以及减少对受限外国供应商依赖的进展。

We've written before on the long-term effects of export controls and the inevitable localization of China's chipmaking supply chain:

我们此前已撰文分析出口管制的长期影响及中国芯片制造供应链的必然本土化趋势：

Fab Whack-A-Mole: Chinese Companies are Evading U.S. Sanctions

《晶圆厂打地鼠：中国企业正在规避美国制裁》

DYLAN PATEL, JEREMIE ELIAHOU ONTIVEROS, AND SRAVAN KUNDOJJALA

迪伦·帕特尔、杰里米·埃利亚胡·翁蒂韦罗斯、斯拉万·昆多贾拉

• 2024年10月28日 2024 年 10 月 28 日



Huawei Fab Network, WFE Vendors Cry Wolf, Framework for Future Controls

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The first and most important constraint is lithography. Since 2019, restrictions on ASML EUV exports to China have prevented CXMT from accessing the lithography platform that leading DRAM makers rely on for advanced nodes. This directly limits

CXMT's front-end scaling capability. If CXMT wants to pursue more efficient and cost-effective 1a or more advanced DRAM nodes, the absence of EUV creates a significant bottleneck.

首要且最关键的制约因素是光刻技术。自 2019 年起，ASML EUV 光刻机对华出口受限，导致长鑫存储无法获取全球主要 DRAM 厂商用于先进制程的光刻平台，这直接限制了其前端工艺的微缩能力。若长鑫存储希望开发更高效且更具成本效益的 1a 制程或更先进的 DRAM 节点，EUV 设备的缺失将构成重大瓶颈。

Samsung and SK Hynix have already used EUV for the most critical layers at 1a, 1b, and 1c, and EUV usage will likely expand further at 1d and subsequent nodes. CXMT, by contrast, must attempt to pattern comparable features using DUV immersion combined with increasingly complex self-aligned multipatterning schemes such as SADP and SAQP. This path has limited potential. It requires more masks, more deposition and etch passes, more metrology loops, longer cycle time, tighter overlay budgets, more defect opportunities, and higher cost per bit.

三星和 SK 海力士已在 1a、1b 及 1c 制程的关键层采用 EUV 技术，且随着 1d 及后续节点的推进，EUV 的应用范围将进一步扩大。反观长鑫存储，只能尝试通过 DUV 浸没式光刻结合日益复杂的自对准多重图形化方案（如 SADP 和 SAQP）来实现同等尺寸的图案化。这条路潜力有限，需要更多掩模、更多沉积与刻蚀步骤、更多量测循环，生产周期更长，套刻精度控制更严，缺陷风险更高，且单比特成本更高。

Long-term, scaling will require either a domestic advanced litho tool or alternative scaling approaches like 3D DRAM. Without them, there is a structural ceiling on CXMT's ability to scale efficiently against Samsung, SK Hynix, and Micron

长期来看，要实现规模化生产，国内必须拥有先进的光刻机或采用像 3D DRAM 这样的替代性微缩方案。否则，长鑫存储在追赶三星、SK 海力士和美光的过程中，其规模化效率将面临结构性天花板。

The October 2022 BIS package tightened the constraint further by controlling WFE capable of producing DRAM at or below 18nm half-pitch, directly capturing CXMT's G4 (~1z) and future G5 (~1a) node. It also restricted U.S. persons from supporting such activities. This effectively limited CXMT's access to new leading-edge deposition, etch, metrology, and process-support capability from suppliers such as Applied Materials, Lam Research, and TEL. From that point, CXMT's advanced-node progress

became increasingly dependent on its pre-restriction installed base or pre-control equipment purchases, inventory of parts and spares, and the pace of domestic tool substitution.

2022 年 10 月的 BIS（美国商务部工业与安全局）一揽子法规进一步收紧了限制：凡是能制造半节距 18 纳米及以下 DRAM 的晶圆制造设备（WFE）均被管制，直接卡住了长鑫存储第四代（约 1z）及未来第五代（约 1a）制程节点。该法规同时禁止美国公民为这类活动提供支持。这实际上限制了长鑫从应用材料、泛林半导体和东京电子等供应商获取新一代沉积、刻蚀、量测及工艺支持设备的能力。自此之后，长鑫往先进制节点推进的进程越来越依赖受限前的已装机设备、预先采购的设备、备品备件库存，以及国产化工具的推进速度。



Source: Federal Register 来源：《联邦公报》

The October 2023 controls added even more pressure to the company's access to foreign WFE by adding node-agnostic tool restrictions, expanding controls on components and parts, tightening technical parameters, and widening the country scope to reduce trans-shipment. Not only did this control restrict new tool purchases but also increased uncertainty around service continuity, spare-parts availability, field support, and long-term process stability. For a memory manufacturer, the success of yield learning and high-volume manufacturing could be impacted by tool uptime,

repeatability, and fast engineering support.

2023 年 10 月的管制措施进一步加剧了该公司获取海外晶圆制造设备的压力：新增了与制程节点无关的设备限制、扩大了零部件管控范围、收紧了技术参数指标，并扩展了受管制国家范围以减少转口运输。这些管控不仅限制了新设备的采购，还增加了设备服务连续性、备件供应、现场支持及长期工艺稳定性的不确定性。对存储芯片制造商而言，设备运行时长、重复性及快速工程支持等因素，将直接影响良率爬坡和规模化生产能否成功。

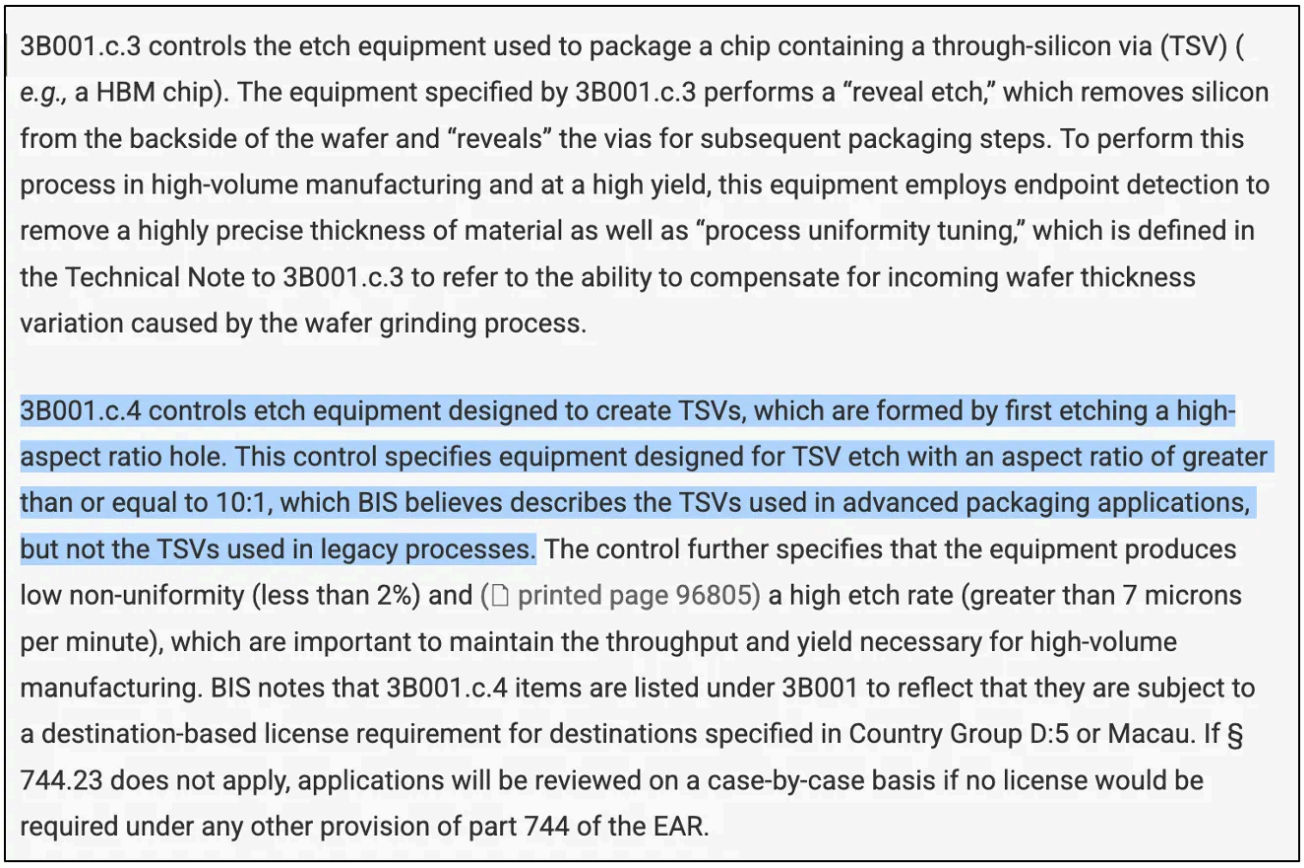


Source: Federal Register 来源：联邦公报

The December 2024 control focuses on limiting China's access to foreign HBM by restricting HBM shipment to China. But for CXMT, what's more important is the control on WFE end. The package added 24 types of semiconductor equipment and three software tools, introduced a new semiconductor manufacturing equipment foreign-direct product rule (FDPR), and added 140 entities, including domestic toolmakers such as NAURA, ACM Research, and Piotech. These measures directly affect the process modules CXMT needs for advanced DRAM and HBM, including DUV multipatterning, TSV formation, wafer thinning, bonding, stacking, inspection,

and advanced packaging process control.

2024 年 12 月的管控重点在于限制 HBM 出口至中国，从而削弱中国获取海外 HBM 的能力。但对长鑫存储而言，更重要的是对晶圆制造设备端的管控。该政策新增了 24 种半导体设备及三种软件工具的管制，引入新的半导体制造设备外国直接产品规则，并将包括北方华创、盛美半导体、中微公司等国产设备商在内的 140 个实体列入清单。这些措施直接影响了长鑫存储开发先进 DRAM 和 HBM 所需的工艺模块，包括深紫外多重图形化、硅通孔成型、晶圆减薄、键合、堆叠、检测及先进封装工艺等环节。



3B001.c.3 controls the etch equipment used to package a chip containing a through-silicon via (TSV) (*e.g.*, a HBM chip). The equipment specified by 3B001.c.3 performs a "reveal etch," which removes silicon from the backside of the wafer and "reveals" the vias for subsequent packaging steps. To perform this process in high-volume manufacturing and at a high yield, this equipment employs endpoint detection to remove a highly precise thickness of material as well as "process uniformity tuning," which is defined in the Technical Note to 3B001.c.3 to refer to the ability to compensate for incoming wafer thickness variation caused by the wafer grinding process.

3B001.c.4 controls etch equipment designed to create TSVs, which are formed by first etching a high-aspect ratio hole. This control specifies equipment designed for TSV etch with an aspect ratio of greater than or equal to 10:1, which BIS believes describes the TSVs used in advanced packaging applications, but not the TSVs used in legacy processes. The control further specifies that the equipment produces low non-uniformity (less than 2%) and (printed page 96805) a high etch rate (greater than 7 microns per minute), which are important to maintain the throughput and yield necessary for high-volume manufacturing. BIS notes that 3B001.c.4 items are listed under 3B001 to reflect that they are subject to a destination-based license requirement for destinations specified in Country Group D:5 or Macau. If § 744.23 does not apply, applications will be reviewed on a case-by-case basis if no license would be required under any other provision of part 744 of the EAR.

Source: Federal Register 来源：《联邦公报》

With these export controls coming into play over the past few years, the WFE landscape in China has become more complicated. Below are the WFE vendors across the eight major manufacturing processes that CXMT requires for HBM and DRAM production, mapping out the potential foreign and domestic vendors the company

could be working with.

过去几年中，随着这些出口管制措施的实施，中国的晶圆制造设备格局变得更加复杂。以下是 CXMT 在 HBM 和 DRAM 生产中所必需的八大制造工艺所需的 WFE 供应商，勾勒出该公司可能合作的外国及本土供应商版图。

For Oxidation and Diffusion, we think CXMT is working with domestic equipment leader NAURA, which has oxidation/diffusion equipment sitting in its core product portfolio. In RTP, Mattson is the likely the domestic supplier for CXMT given that its parent E-Town has disclosed CXMT as a customer, and on the foreign side the global vertical furnace duopoly of Kokusai and TEL could be its foreign suppliers.

在氧化与扩散工艺方面，我们认为 CXMT 正与国内设备龙头企业北方华创合作，其核心产品组合中拥有氧化/扩散设备。在快速热处理环节，北京屹唐半导体很可能是 CXMT 的本土供应商——其母公司亦庄国投已披露 CXMT 为其客户；而在外国供应商方面，全球立式炉管双巨头 Kokusai 和东京电子可能为其提供设备支持。

Process	Key DRAM/HBM Suppliers	
	Domestic	Foreign
Oxidation and Diffusion	NAURA, mattson technology	KOKUSAI ELECTRIC, TEL
Photolithography	SMEE	ASML
Etch	AMEC, BEST 屹唐半导体	Lam RESEARCH, TEL
Deposition	拓荆科技 PIOTECH CO.,LTD, NAURA	APPLIED MATERIALS, JUSUNG ENGINEERING, ASM
Ion Implantation	CETC 中国电科, Semiconductor KINGSTONE, NAURA	axcelis, APPLIED MATERIALS
Metallization	ACM RESEARCH	APPLIED MATERIALS, Lam RESEARCH
CMP and Clean	HWATSING, ACM RESEARCH, SCREEN SCREEN Semiconductor Solutions	APPLIED MATERIALS, Lam RESEARCH, TEL, EBARA
Inspection, Metrology, and Test	中科飞测 SKYVERSE, JINGCE ELECTRONIC	NEXTIN, Park SYSTEMS, Mirae, TERADYNE, ADVANTEST, Camtek See Beyond

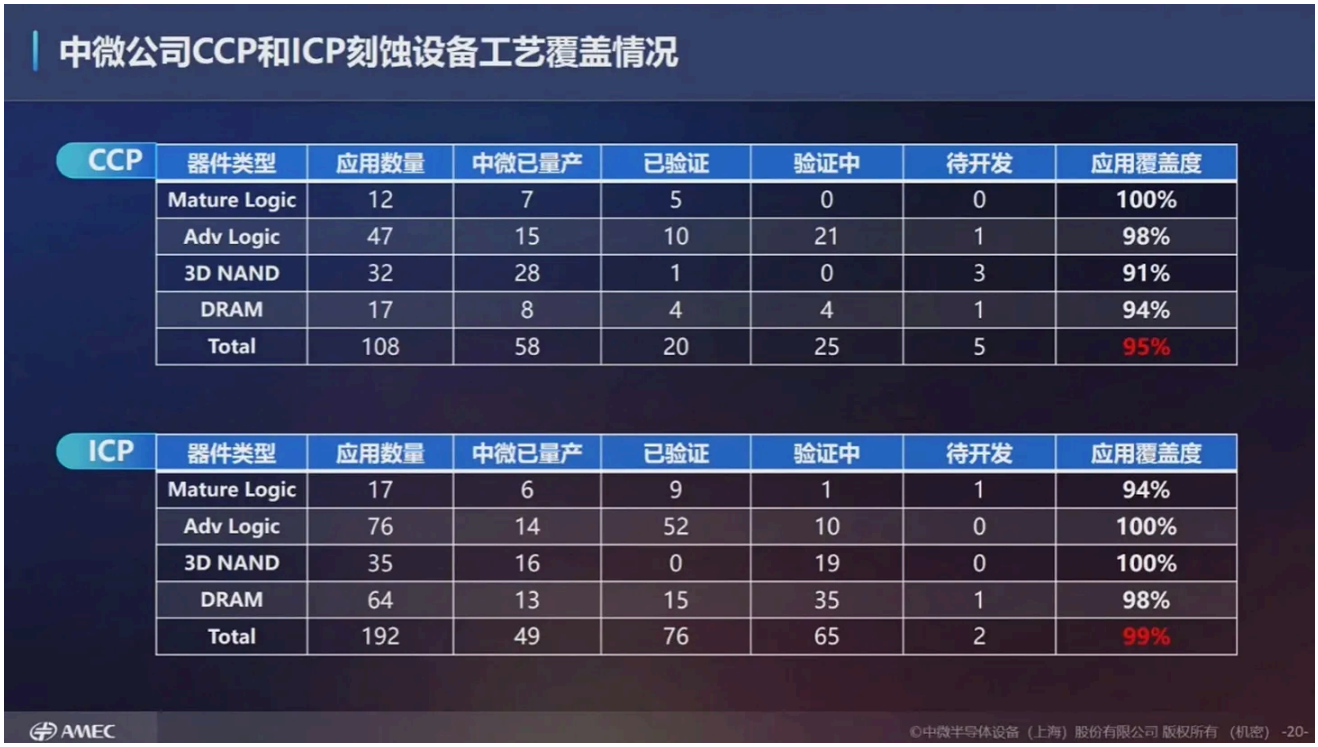
semianalysis

On Photolithography side, ASML DUV immersion equipment is for now the only lithography equipment allowed for Chinese chipmakers since the restriction on EUV since 2019. Domestically SMEE DUV still lag behind ASML's tools.

在光刻技术领域，自 2019 年起对极紫外光刻机实施限制后，ASML 的深紫外沉浸式光刻设备目前是中国芯片制造商唯一获准使用的光刻设备。国内方面，上海微电子的深紫外光刻机仍落后于 ASML 同类产品。

Etching is one area that we think China has made notable improvement. CXMT is confirmed as choosing AMEC as a domestic etch supplier, and BEST (Yitang), focused on 14nm and below etch, based on its public disclosure. On the foreign side, Lam Research, TEL, and Applied Materials very likely remain as the pre-restriction installed base, with possible residual supply of non-controlled tools and service given reported gaps in current export controls.

在蚀刻领域，我们认为中国已取得显著进展。据公开信息确认，长鑫存储（CXMT）已选择中微公司（AMEC）作为国产蚀刻设备供应商，而专注于 14 纳米及以下制程蚀刻的屹唐半导体（BEST）也基于其披露信息被采用。海外方面，泛林半导体（Lam Research）、东京电子（TEL）和应用材料（Applied Materials）极大概率仍保留受限前已安装的设备基础，考虑到当前出口管制存在的报道漏洞，可能仍有非管制工具和服务的残余供应。



中微公司CCP和ICP刻蚀设备工艺覆盖情况

CCP

器件类型	应用数量	中微已量产	已验证	验证中	待开发	应用覆盖度
Mature Logic	12	7	5	0	0	100%
Adv Logic	47	15	10	21	1	98%
3D NAND	32	28	1	0	3	91%
DRAM	17	8	4	4	1	94%
Total	108	58	20	25	5	95%

ICP

器件类型	应用数量	中微已量产	已验证	验证中	待开发	应用覆盖度
Mature Logic	17	6	9	1	1	94%
Adv Logic	76	14	52	10	0	100%
3D NAND	35	16	0	19	0	100%
DRAM	64	13	15	35	1	98%
Total	192	49	76	65	2	99%

Source: AMEC 来源：中微公司（AMEC）

On deposition, Piotech and Naura are CXMT's two main domestic suppliers, with Korea's Jusung Engineering reported to supply ALD. A large pre-restriction Applied Materials CVD/ALD/PVD installed base are likely still a major part of CXMT's production line, with some possible residual supply of non-controlled tools and service that are allowed under the restriction.

在沉积工艺方面，拓荆科技（Piotech）和北方华创（Naura）是长鑫存储（CXMT）的两大本土供应商，而韩国周星工程（Jusung Engineering）据称为其提供原子层沉积（ALD）设备。在限制措施实施前引进的大量应用材料（Applied Materials）的化学气相沉积（CVD）、原子层沉积（ALD）及物理气相沉积（PVD）设备，很可能仍是长鑫存储产线的重要组成部分，同时根据限制政策，可能还保留部分非管制设备及服务的残余供应。

Ion Implantation most likely runs on the pre-restriction installed base of Axcelis and Applied Materials (Varian), the global implant duopoly. Domestic vendors appear to be moving quite slow in this space, and mostly stuck at the development and qualification stage. This is probably one of most difficult WFE obstacle for domestic vendor to overcome besides lithography. Today, CETC, KingStone, and NAURA are among the leading domestic suppliers that could potentially challenge foreign dominance in this

segment though the gap seem still distant for now.

离子注入工艺极大概率仍依赖限制措施前安装的应用材料（旗下瓦里安（Varian））与亚舍利（Axcelis）的存量设备——这两家即全球离子注入设备双寡头。本土供应商在这一领域的发展明显迟缓，大多仍停留在研发和验证阶段。这或许是除光刻机外，本土设备厂商最难攻克的晶圆制造设备（WFE）壁垒。目前，中国电科（CETC）、凯世通（KingStone）与北方华创（NAURA）虽已成为有望挑战该领域外企主导地位的本土主力供应商，但差距似乎依然遥远。

In metallization, ACM Research likely covers part of the copper fill ECP step given its ECP line, alongside a probable pre-restriction Lam Research ECP installed base, while barrier and seed PVD likely remains on the Applied Materials installed base. For both, possible residual supply of non-controlled tools and service cannot be ruled out.

在金属化环节，盛美上海凭借其电化学沉积（ECP）产品线很可能覆盖部分铜填充 ECP 工序，同时可能存在泛林半导体原有的 ECP 设备存量基础，而阻挡层和种子层物理气相沉积（PVD）工序可能仍应用材料现有的设备系统。针对这两个环节，不能排除存在未受管制的工具和服务的残余供应可能性。

CMP and Cleaning are typically dominated by the usual foreign suppliers, including Applied Materials, EBARA, Lam Research, and TEL. On the domestic side, China's Hwatsing appears to have broken into CXMT's supplier ecosystem, with the company naming CXMT as a CMP customer. Other potential domestic suppliers include ACM Research, while SCREEN is also a probable supplier. On the foreign side, CMP supply most likely remains concentrated among Applied Materials, EBARA, Lam Research, and TEL.

化学机械抛光（CMP）和清洗环节通常由包括应用材料、荏原制作所、泛林半导体和东京电子在内的传统外资供应商主导。在国产供应商方面，中国的华海清科似乎已进入长鑫存储的供应商体系，该公司已将其列为 CMP 客户。其他潜在的本土供应商包括盛美上海，而迪恩士也是可能的供应商之一。在海外供应商方面，CMP 供应很可能仍集中在应用材料、荏原制作所、泛林半导体和东京电子手中。

In Inspection, Metrology, and Test, Sky verse and Jingce are probable domestic vendors but it remains unclear on its direct link to CXMT. Nextin's AEGIS-II delivered roughly KRW 14.8 billion and 7.4 billion respectively in 2022 to CXMT's Anhui and Beijing entities. Mirae Industry's packaged chip inspection supply has been

reported. Park Systems is likely as well given its broad AFM footprint across Chinese fabs, KLA is likely on inspection dominance and installed base grounds, and Advantest and Teradyne likely supply final test given their ATE duopoly.

在检测、计量和测试领域，星微电子和精测电子可能是国内供应商，但尚不确定它们与长鑫存储的直接关联。Nextin 的 AEGIS-II 在 2022 年向长鑫存储安徽和北京实体分别交付了约 148 亿韩元和 74 亿韩元的产品。据报道，未来产业的封装芯片检测设备已有供货。鉴于 Park Systems 在多家中国晶圆厂广泛部署原子力显微镜，它很可能也是供应商；科磊由于在检测领域的市场主导地位和现有装机基础，可能同样参与其中；而爱德万测试和泰瑞达凭借其在自动测试设备领域的双头垄断地位，可能提供最终测试设备。

Process	Key DRAM/HBM Suppliers (Packaging)	
	Domestic	Foreign
TCB	CETC 中国电科	HANMI ASMPT SEMES Hanwha Semitech
TSV - HAR	AMEC	Lam RESEARCH TEL KLA
TSV - Bosch/DRIE	NAURA	Lam RESEARCH KLA
Grinding/Thining	HWATSING	DISCO ACCRETECH TOKYO SEIMITSU
Compression Molding		TOWA YAMAHA YAMAHA ROBOTICS CO.,LTD.

Source: SemiAnalysis Memory Model - Sales@SemiAnalysis.com

数据来源：SemiAnalysis 存储模型 - Sales@SemiAnalysis.com

Finally, across the back-end and packaging process, foreign suppliers still maintain meaningful share due to competitive cost and service channels without import/export restrictions. In the TSV and TCB, Hanmi Semiconductor delivered multiple TC bonders to CXMT in 2024, and is likely to keep supplying going forward. ASMPT and Hanwha Semitech are also probable names. As well notably, compression molding also lacks domestic competition where Towa and Yamaha Robotics dominate the module

share at CXMT for LPDDR and HBM molding processes.

最后，在后端和封装环节，由于具备有竞争力的成本和服务渠道且没有进出口限制，外国供应商仍占据可观的市场份额。在硅通孔技术和热压键合领域，韩美半导体在 2024 年向长鑫存储交付了多台热压键合机，且可能继续供货。ASMPT 和韩华半导体设备也是可能的供应商。此外值得注意的是，在压缩成型领域，由于缺乏国内竞争者，Towa 和雅马哈机器人在长鑫存储的 LPDDR 和 HBM 模组中占据了主导份额。

However, one of the key domestic targets for localization would be TSVs required by advanced devices and integrations, from HBMs, image sensors, to hybrid bonding. Therefore, localizing TSV equipment is more than just cost and sufficiency considerations, but technological development and potential leaderships towards 3D integrations. China's domestic TSV-for-HBM equipment chain is led by NAURA and AMEC.

然而，国内实现本地化的关键目标之一，将是先进器件和集成所需的高密度硅通孔技术，涵盖高带宽存储器、图像传感器以及混合键合等领域。因此，实现 TSV 设备的本地化，不仅仅关乎成本与自给自足，更关系到技术发展以及在三维集成领域潜在的领先地位。国内面向 HBM 的 TSV 设备产业链由北方华创和中微公司引领。

NAURA is the broadest supplier, covering deep-silicon TSV via-etch, barrier/seed PVD, ALD, furnace anneal, cleaning, and its own copper-electroplating tool for TSV fill. AMEC is a major CXMT supplier centered on etch, especially providing the high-aspect-ratio dielectric etch used on CXMT's DRAM array and fine-pitch TSV-last process on the roadmap. The two suppliers have been competing for TSV module share at CXMT, and under the broader policy goal of balancing market dynamics, we believe AMEC to gain more share at CXMT while NAURA will continue to reinforce its leadership in logic and interposers by working with SMSC and HPC customers.

北方华创是覆盖面最广的供应商，提供深硅 TSV 通孔刻蚀、阻挡层/种子层 PVD、原子层沉积、炉管退火、清洗，以及用于 TSV 填充的自研铜电镀设备。中微公司则是长鑫存储的主要供应商，聚焦刻蚀领域，尤其为长鑫存储的 DRAM 阵列提供高深宽比介质刻蚀，并为其路线图上的精细间距后 TSV 工艺提供支持。这两家供应商一直在争夺长鑫存储的 TSV 模块份额，而在平衡市场动态的更广泛政策目标下，我们认为中微公司将在长鑫存储获得更多份额，而北方华创将继续通过与中芯国际及高性能计算客户合作，强化其在逻辑芯片和中介层领域的领导地位。

Specialists fill the remaining module steps, with Hwatsing in wafer thinning and grinding, ACM in copper electroplating and TSV cleaning, Piotech in PECVD, and emerging vendors in temporary and hybrid bonding. Nevertheless, foreign suppliers remain dominant across the core TSV process, including Lam Research, KLA (SPTS) and Applied Materials in deep-silicon etch, PVD, and copper electrodeposition, EVG and SUSS MicroTec in temporary bond/debond and RDL, and TEL in coat/develop and etch.

专业人员在剩余模块步骤中提供支持，华海清科负责晶圆减薄与研磨，盛美半导体承担铜电镀及硅穿孔清洗，中微公司从事等离子体增强化学气相沉积，新兴供应商专注于临时键合与混合键合工艺。然而，在核心硅通孔工艺环节，外国供应商仍占据主导地位：泛林半导体、科磊（SPTS）及应用材料主导深硅刻蚀、物理气相沉积和铜电化学沉积技术；EVG 和 SUSS MicroTec 掌控临时键合/解键合及重布线层工艺；东京电子主导涂胶显影与刻蚀环节。

China is Going to Be Structurally HBM Constrained

中国将面临结构性 HBM 供应紧张

As both the U.S. and China aggressively build out compute capacity, the key gating factors are spreading across different segments of the increasingly complex semiconductor supply chain. Memory, and HBM in particular, remains one of the key bottlenecks for China's AI compute buildout. We have argued several times over the past two years that HBM would become a critical constraint for China, and that view has not changed; if anything, it has been further reinforced.

随着中美两国竞相扩建计算基础设施，半导体供应链中日益复杂的各环节逐渐成为关键制约因素。内存（尤其是 HBM）仍是中国 AI 计算能力建设的主要瓶颈之一。过去两年我们多次强调 HBM 将成为中国关键制约因素，这一判断至今未变——事实上，该观点反而得到了进一步强化。

Looking at China's HBM supply environment, both internally and externally, the situation appears to be worsening. Internally, CXMT's progress in HBM still looks limited. While the company is reportedly aiming to produce HBM3, or even HBM3E as

we believe, tangible progress has yet to materialize at meaningful scale.

审视中国 HBM 供应环境，内外形势似乎正在恶化。对内而言，长鑫存储（CXMT）在 HBM 领域的进展仍显有限。尽管该公司据称计划量产 HBM3，甚至我们认为可能推进至 HBM3E，但切实的规模化进展尚未出现实质性突破。

Externally, the supply backdrop is also deteriorating due to 1) existing U.S. restrictions on HBM exports to China, 2) declining foreign HBM inventory, and 3) tightening HBM supply across the three major memory suppliers. Combining these internal and external developments, we believe China's HBM constraint will only worsen over the next 18 months unless there is a major technology improvement in domestic HBM or a change in export control rules. This will likely impact on country's pace in deploying compute domestically. We think this is a very fair conclusion since even leading accelerator players also gated by HBM supply by three suppliers, which ultimately limits data center buildout.

对外而言，供应形势同样因以下因素持续恶化：1）美国现行对华 HBM 出口限制措施；2）海外 HBM 库存持续下降；3）三大存储供应商对 HBM 的供应持续收紧。综合这些内外因素，我们认为除非国内 HBM 技术实现重大突破或出口管制规则发生变化，否则未来 18 个月内中国面临的 HBM 供应瓶颈只会加剧。这很可能影响该国部署本土算力的进度。我们认为这是非常公允的结论——即便是最顶尖的加速器厂商，其数据中心建设也受制于这三家供应商的 HBM 供应能力。

On commodity DRAM, however, we do think Chinese suppliers are making material progress. At a high level, whether measured by wafer capacity or bit shipments, CXMT is gradually gaining share albeit quite slowly. This is increasingly evident at the product level. CXMT's DDR5 and LPDDR5 products can already be found, and are appearing more frequently, especially in consumer products from both domestic and foreign brands, spanning smartphones, wearables, and other end devices. We have also learned that CXMT's memory products are either in qualification (some have been approved already) or under consideration by several other major foreign PC and consumer electronics brands. This is likely driven by the increasingly maturity of its

product as well as extreme tight DRAM supply environment.

然而，在普通 DRAM 领域，我们认为中国供应商确实取得了实质性进展。总体来看，无论是从晶圆产能还是比特出货量衡量，长鑫存储正在逐步扩大市场份额——尽管进程较为缓慢。这一趋势在产品层面愈发明显：其 DDR5 和 LPDDR5 产品已实现商用，且正越来越多地出现在国内外品牌的消费类产品中，涵盖智能手机、可穿戴设备及其他终端设备。我们还了解到，长鑫存储的存储产品正在通过多家海外主要 PC 及消费电子品牌的质量认证（部分已获批准），或已被纳入采购评估。这很可能得益于其产品日趋成熟，以及 DRAM 市场供应极度紧张的现状。

Even so, we think CXMT's market presence remains largely concentrated in China, based on both its filings and our observations of consumer products globally. Nevertheless, considering the global constraints on memory supply and the capacity allocation shift by leading memory suppliers toward server DRAM and HBM, we believe CXMT could further gain share in China's consumer DRAM space. This is especially likely as other suppliers prioritize DRAM demand from domestic and global CSPs over consumer applications.

即便如此，我们认为根据其申报文件以及对全球消费电子产品的观察，CXMT 的市场份额仍主要集中在中国。然而，考虑到全球内存供应受限以及主要内存供应商将产能分配转向服务器 DRAM 和 HBM，我们相信 CXMT 在中国消费级 DRAM 领域的份额有望进一步提升。尤其是当其他供应商优先满足国内外云服务提供商的 DRAM 需求而减少消费级应用时，这种趋势将更为明显。

We are also observing incremental momentum in the company's server DDR5 products, which have historically been a weaker part of its portfolio. We believe one reason CXMT's DDR5 mix has materially increased to over 30%, from the low-20% range previously, is broader tightness in global server DRAM supply, alongside incremental demand growth from domestic hyperscalers such as Alibaba, ByteDance, and Tencent. As we noted in our institutional report a month ago, we believe CXMT is currently negotiating 3+ year DRAM LTAs with domestic CSPs, as these customers seek to secure as much server DRAM supply as possible beyond volumes available

from foreign suppliers.

我们也观察到该公司的服务器 DDR5 产品呈现逐步增长势头——这一领域此前是其业务组合中的薄弱环节。我们认为 CXMT 的 DDR5 产品占比从过去 20%左右的低位大幅提升至 30%以上的原因之一，是全球服务器 DRAM 供应普遍紧张，同时阿里巴巴、字节跳动和腾讯等国内超大规模云服务商的需求增量持续扩大。正如我们一个月前在机构研报中指出的，CXMT 目前正与国内云服务商洽谈为期三年以上的 DRAM 长期供应协议——这些客户希望在现有供应商产能之外锁定尽可能多的服务器 DRAM 供应。

In the long term, we believe competitive pressure from CXMT on leading memory suppliers will only intensify, both at the product level and from a capacity perspective. Although CXMT is becoming more competitive gradually rather than rapidly, it continues to gain ground. While the company remains meaningfully behind in HBM, leaving the big three memory suppliers with a comfortable lead, competitive pressure in commodity DRAM is already being felt in the Chinese market and could eventually extend globally. In addition, continued improvement in Chinese wafer fabrication equipment could make WFE less of a gating factor for CXMT's DRAM capabilities over the long run, especially as its process technology matures and improves.

长期来看，我们相信 CXMT 对主流存储供应商的竞争压力只会持续加剧，无论是在产品层面还是产能维度。尽管 CXMT 的竞争力是渐进式而非爆发式增强，但其市场份额仍在稳步提升。虽然该公司在 HBM 领域仍显著落后于三大存储巨头，使其保持明显优势，但在通用型 DRAM 市场，其竞争压力已在中国市场显现，未来可能扩展至全球范围。此外，随着中国晶圆制造设备的持续升级，长期来看 WFE 对 CXMT DRAM 能力的制约因素将逐步弱化——尤其当其制程技术日趋成熟并持续迭代时。



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