



Greater China Semis: Cambricon: Machine learning, AI chips for Data Center, Software, intelligent computing cluster system as key focus

We talked to Cambricon (688256.SS, NC, Not covered) management recently. The company is a leading Chinese AI chipset supplier, providing (1) AI processor IP (integrated into SoC) for smartphones, (2) AI chipset and accelerator for servers, and (3) AI chipset and accelerator for edge devices, to improve edge devices' computing capability in smart transportation, smart manufacturing, smart retail, smart healthcare, smart financial, etc. The rising listed China semiconductors companies echo our positive view on the industry, with well-established local customers, large home market, and governments' supports. Read across our [China Semiconductors Deep Dive](#) (published on July 13).

Key takeaways

Intelligent computing cluster system (67% of 2019 revenues; 58% GM)

- Cambricon provides AI chipset, accelerator, and IP for smartphones, servers, and edge devices (e.g. cameras for smart transportation, smart manufacturing, smart retail, smart healthcare, smart financial, etc.).
- The intelligent computing cluster system is a total solution, including AI accelerators, software development platform (Cambricon Neuware), and a management system.
- Cambricon Neuware integrates multiple programming library and toolkit for developers to develop machine learning software, including Machine Learning Library, Runtime Library, Bang Language, Toolkits (compiler, profiler, debugger, system monitor, etc.), Driver & Kernel, and Domain-specific SDK (video analysis SDK, video codec SDK, etc.).
- Business model: Cambricon is a fabless, offering their AI chips design to foundry (mainly TSMC) to manufacture and to OSATs (mainly ASE, Amkor) to package and test. Then, the chips pass to motherboard suppliers to make AI accelerators. The accelerators will be used in server, and if the client needs a total solution (intelligent computing cluster system), the company will provide (1) hardware system integration: server with their AI accelerator, storage, and networking, (2) software platform (Cambricon Neuware) to help clients develop machine learning software, and (3) management system to operate the system, allocate resources, and manage applications.

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- Customers: the total solution customers include research entities, government entities, IT services companies, etc.
- Management believes the intelligent computing cluster system market size is at US\$5-10bn, vs. Cambricon's 2019 revenues at US\$45m (Rmb296m).

AI chipset and accelerator for servers (18% of 2019 revenues; 78% GM)

- Products: MLU270 series and MLU100 series are using 16nm. The new product MLU290 series is at 7nm. The product tape out in Mar 2020, and will be in mass production in 2021.
- Customers: including data center customers (e.g. Baidu) or server suppliers. For example, Dawning (603019.SS) Phaneron server series adopt Cambricon MLU100 series.
- Management believes the AI chipsets market size is around US\$1-2bn vs. Cambricon's 2019 revenues at US\$12m (Rmb79m).

AI processor IP (15% of 2019 revenues; 100% GM)

- Management stated the company focuses more on AI chipsets and accelerators rather than IP. Given Huawei Hisilicon Kirin 970 and 980 used their AI IP, the company's IP revenues was large at Rmb117m in 2018 and down to Rmb69m in 2019.
- Management sees fewer opportunities in AI IP for smartphones in the future, given most China smartphones use Qualcomm SoC, which has its own AI IP, thus difficult for Cambricon to penetrate.
- Cambricon also provides IP to UniSoC and Xiaomi's in-house SoC (Pinecore SoC); however, the smartphones volume is relatively smaller compared to previous Huawei projects. Xiaomi Pinecore SoC used in low-end smartphones, wearable or IoT products.

Competition landscape

- Key peers: Huawei Hisilicon (main), Nvidia (main), Intel, AMD, ARM, etc.
- Compared to Verisilicon ([report link](#)), management believes the business model is different, as Verisilicon provides IP and chips design / turnkey services. Compared to Horizon Robotics ([report link](#)), management believes Cambricon is more focus on chipsets, with less vertical integration to end products (cameras) and less focus on automotive markets.
- Compared to Nvidia, management believes Cambricon offers stronger price-to-performance products, with in time services, and customized design. However, the software and ecosystem is clearly behind Nvidia and thus Cambricon is enhancing their R&D in software part.
- Nvidia is the key global leaders in AI chips. Compared to Nvidia, Cambricon's AI chips for servers is at 16nm processing nodes, with 7nm tape out in Mar 2020 vs. Nvidia's products are already in 12nm and 7nm. For R&D expenses, Cambricon is also lower than Nvidia, at Rmb543m (US\$78m) in 2019, vs. Nvidia at US\$2.8bn.

Business outlook

- Management aims at data center and edge computing, across smart transportation, smart manufacturing, smart retail, smart healthcare, smart financial, etc.
- The company has no plan to enter automotive AI market currently, given large investment required and longer customer qualification.
- For 4Q20, management believes the net loss could turn around, considering the stronger seasonality drives the revenues scale; however, 2020 is to remain in loss making.

AI, growing market in China

The AI chipset market could be divided into three parts: (1) AI chipsets for end devices, such as PC, smartphones, wearables, (2) AI chipsets for servers, and (3) AI chipsets for edge devices, such as surveillance cameras, IoT devices. Although some of the devices are already at high penetration rate and thus in a modest shipment growth, such as PC, smartphones, and surveillance cameras, the adoption rate on AI chipsets remains low, supporting the overall AI chipsets market growth.

AI has been used in multiple industries, such as home appliance, financial, transportation, medical, surveillance, manufacturing, etc. It could not only raise the production efficiency and saving costs, but could also bring new business model, generating new market demand. For example, facial recognition, object recognition, gesture recognition, etc. to realize unmanned retail store, or to identify the fashion trend of the year (what colour or fabric for apparel is the most popular), etc. The AI chipset market is expected to grow at +45% CAGR in 2020-24E to Rmb78,500m (US\$11.2bn) in 2024, per Cambricon.

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