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Semiconductor packaging industry update

EQUITY: JAPAN ELECTRONIC PARTS

Research Analysts

Japan electronic parts

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Packaging substrate shipments up 68% y-y

TSMC announces roadmap for multilayer core substrates, we expect full-fledged adoption in 2028 or later

Packaging-related monthly statistics: Record-high shipments in July but price per m² falls

According to the *Revised Report of the Current Survey of Production* for July, released on 14 September, shipments of packaging substrates (rigid module substrates) rose 68% y-y to ¥31.3bn, surpassing the previous record high set in June. Shipments on a m² basis rose 19% y-y and the average price per m² rose 41% to ¥1.312mn, below the record high of ¥1.429mn set in June. Ibiden [4062] (Buy) said that at the behest of customers, in Jul–Sep it will be prioritizing production of package substrates for server CPUs (Arm cores) over those for GPUs. We attribute the decline in average price per m² in July to changes in the product mix caused by a decrease in shipments for Rubin and an increase in shipments for Vera. The company said it will resume production increases for Rubin package substrates in Oct–Dec or later.

TSMC updates roadmap for advanced packages at Semicon Taiwan

At Semicon Taiwan, TSMC updated its roadmap for advanced packages. As for advanced packages, the Blackwell and equivalent generation used 3.3x reticle size interposers and 72 × 78mm substrates (core layer was one layer), while the Rubin and equivalent generation uses 5–9x reticle size and 85 × 110mm substrates (core layer is one or multiple (two) layers) and the Feynman and equivalent generation uses 9–14x reticle size and 120 × 128mm substrates (core layer is multiple layers), and for subsequent generations, the company has presented draft plans calling for the reticle size of interposers to be further increased (no details provided) and the use of substrates of 150 × 239mm or greater (core substrate will be multilayer or next-generation core (glass core)). While the company materials do not include the names of the generations of GPUs, based on the GPU product specs released to date, we surmise that they refer to advanced packaging generations using the names of Nvidia's GPU generations and the respective equivalent products from other companies. For the sake of convenience, we use Nvidia's names of GPU generations, as it is a leading company.

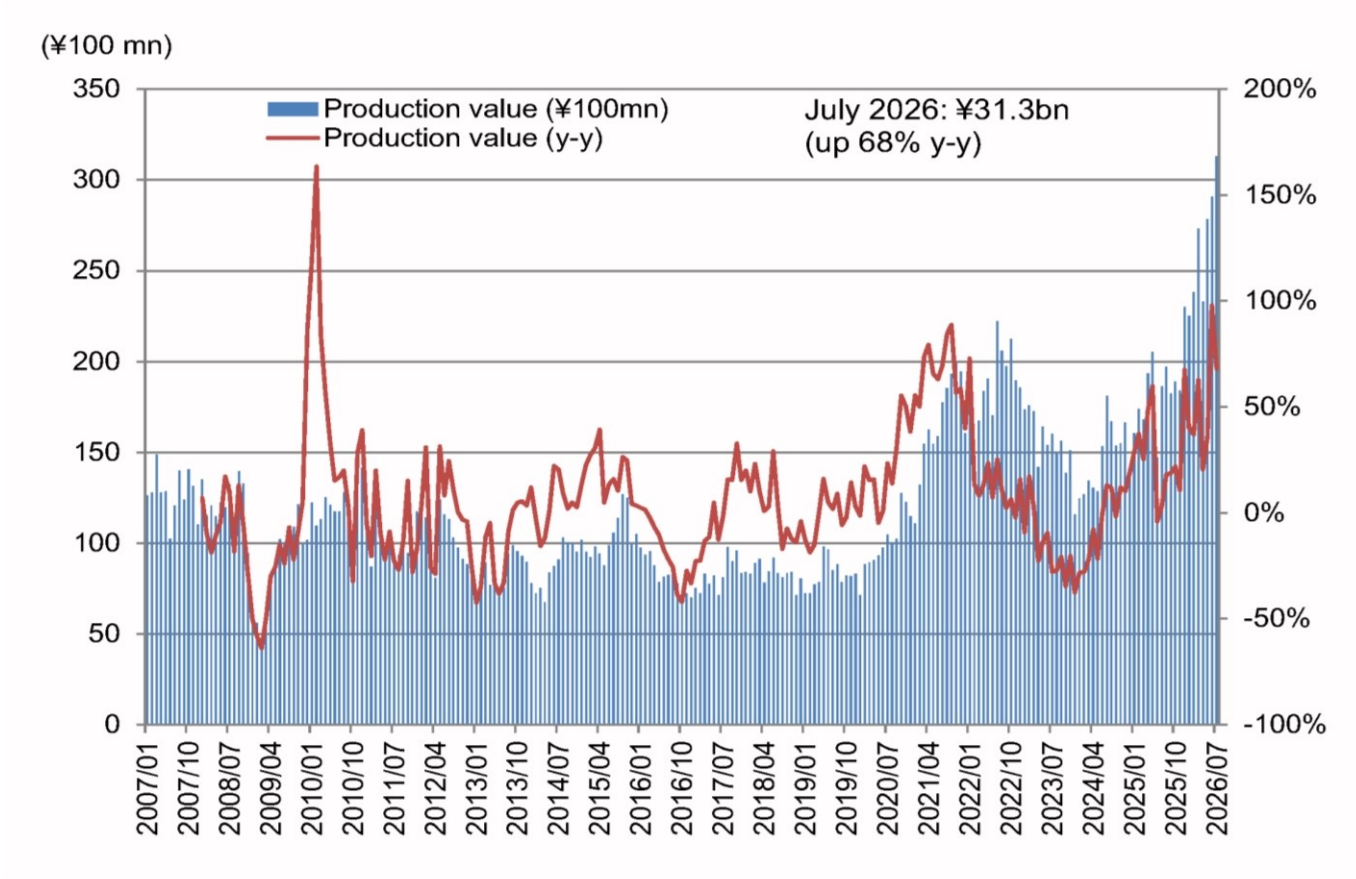
The first notable aspect of this roadmap is the shift to 85 × 110mm substrates in the Rubin generation. Given the GPU and HBM die sizes, we think it will be difficult to install four GPU dies and 12 HBMs in this generation, and we expect two GPU dies and eight HBMs to be the mainstream. Second, with the Feynman generation, the interposers and substrates will both be larger, and we expect four GPU dies and 12 HBMs to be the mainstream. One point to keep an eye on will be whether chip-on-wafer-on-substrate, large interposer (CoWoS-L), or chip-on-panel-on-substrate (CoPoS) will increase in size to the 9x reticle size or larger and be stably mass produced by the second half of 2028, when Feynman will be released. Third is the shift to multilayer (two-layer) core substrates. Core substrates have become increasingly thick in order to boost strength. We think the aim of increasing layer count is to further strengthen the core layer, increase the number of wiring routes, and strengthen power supply functions. As an example, the capacitor could be embedded in the upper layer of the core substrate, the inductor could be embedded directly under it in the lower layer, and the integrated voltage regulator (iVR) circuitry could be placed in the package substrate. Looking ahead, we think that: (1) advanced packaging will evolve by including not only wiring but also power supply circuits and heat dissipation mechanisms; (2) iVR will start to be used in some areas in 2027–28; and (3) this will necessitate multilayer cores, and we envision increased demand for the drills needed to embed glass cloth and parts.

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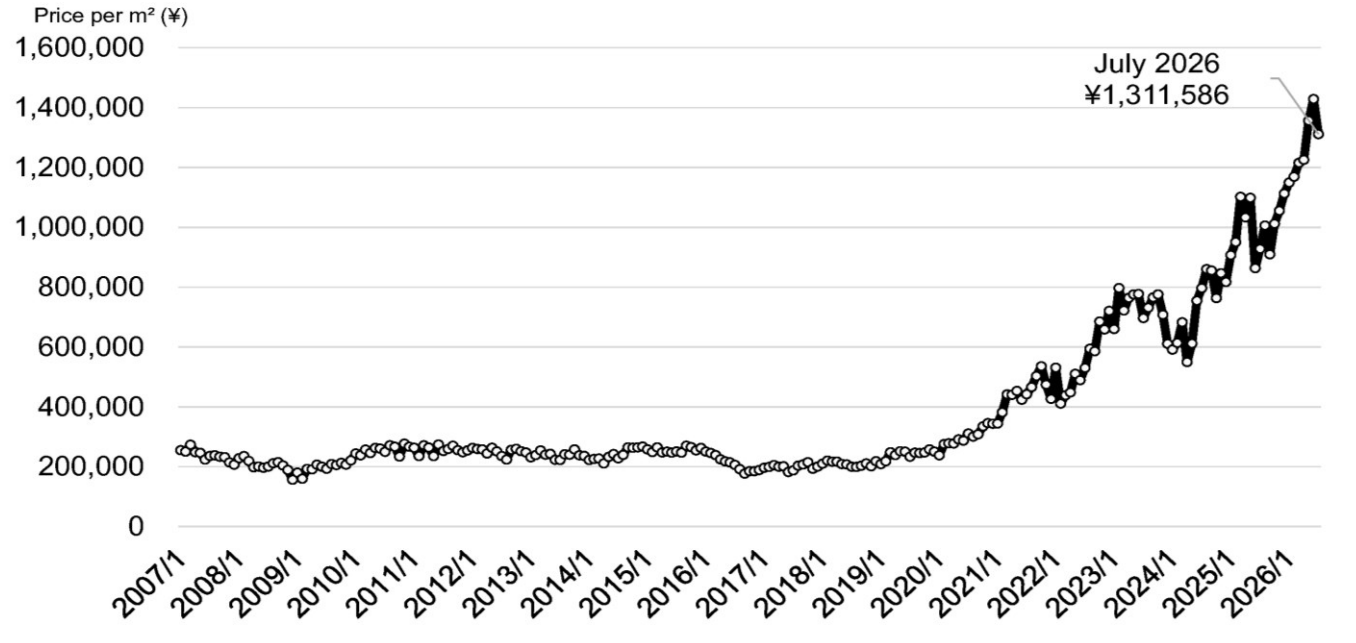
Reference figures

Fig. 1: Rigid PCB production value



Source: Nomura, based on Ministry of Economy, Trade & Industry's Current Survey of Production

Fig. 2: Price per m² for rigid module boards



Note: Module boards have components mounted on the board surface.
Source: Nomura, based on Ministry of Economy, Trade & Industry's Current Survey of Production

Appendix A-1

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In addition, all products carry the risk of losses owing to price fluctuations or other factors. Fees and risks vary by product. Please thoroughly read the written materials provided, such as documents delivered before making a contract, listed securities documents, or prospectuses.

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Transactions involving foreign equities are subject to a domestic sales commission of up to 1.045% (tax included) of the transaction amount (which equals the local transaction amount plus local fees and taxes in the case of a purchase or the local transaction amount minus local fees and taxes in the case of a sale) (for transaction amounts of ¥750,000 and below, maximum domestic sales commission is ¥7,810 (tax included)). Local fees and taxes in foreign financial instruments markets vary by country/territory. When foreign equities are purchased via OTC transactions (including offerings), only the purchase price shall be paid, with no sales commission charged. However, Nomura Securities may charge a separate fee for OTC transactions, as agreed with the customer. Foreign equities carry the risk of losses owing to factors such as price fluctuations and foreign exchange rate fluctuations.

Margin transactions are subject to a sales commission of up to 1.43% (tax included) of the transaction amount (or a commission of ¥2,860 (tax included) for transactions of ¥200,000 or less), as well as management fees and rights handling fees. In addition, long margin transactions are subject to interest on the purchase amount, while short margin transactions are subject to fees for the lending of the shares borrowed. A margin equal to at least 30% of the transaction amount (at least 33% for online transactions) and at least ¥300,000 is required. With margin transactions, an amount up to roughly 3.3x the margin (roughly 3x for online transactions) may be traded. Margin transactions therefore carry the risk of losses in excess of the margin owing to share price fluctuations. For details, please thoroughly read the written materials provided, such as listed securities documents or documents delivered before making a contract.

Transactions involving convertible bonds are subject to a sales commission of up to 1.10% (tax included) of the transaction amount (or a commission of ¥4,400 (tax included) if this would be less than ¥4,400). When convertible bonds are purchased via OTC transactions (including offerings), only the purchase price shall be paid, with no sales commission charged. However, Nomura Securities may charge a separate fee for OTC transactions, as agreed with the customer. Convertible bonds carry the risk of losses owing to factors such as interest rate fluctuations and price fluctuations in the underlying stock. In addition, convertible bonds denominated in foreign currencies also carry the risk of losses owing to factors such as foreign exchange rate fluctuations.

When bonds are purchased via public offerings, secondary distributions, or other OTC transactions with Nomura Securities, only the purchase price shall be paid, with no sales commission charged. Bonds carry the risk of losses, as prices fluctuate in line with changes in market interest rates. Bond prices may also fall below the invested principal as a result of such factors as changes in the management and financial circumstances of the issuer, or changes in third-party valuations of the bond in question. In addition, foreign currency-denominated bonds also carry the risk of losses owing to factors such as foreign exchange rate fluctuations.

When Japanese government bonds (JGBs) for individual investors are purchased via public offerings, only the purchase price shall be paid, with no sales commission charged. As a rule, JGBs for individual investors may not be sold in the first 12 months after issuance. When JGBs for individual investors are sold before maturity, an amount calculated via the following formula will be subtracted from the par value of the bond plus accrued interest: (1) for 10-year variable rate bonds, an amount equal to the two preceding coupon payments (before tax) x 0.79685 will be used, (2) for 5-year and 3-year fixed rate bonds, an amount equal to the two preceding coupon payments (before tax) x 0.79685 will be used.

When inflation-indexed JGBs are purchased via public offerings, secondary distributions (uridashi deals), or other OTC transactions with Nomura Securities, only the purchase price shall be paid, with no sales commission charged. Inflation-indexed JGBs carry the risk of losses, as prices fluctuate in line with changes in market interest rates and fluctuations in the nationwide consumer price index. The notional principal of inflation-indexed JGBs changes in line with the rate of change in nationwide CPI inflation from the time of its issuance. The amount of the coupon payment is calculated by multiplying the coupon rate by the notional principal at the time of payment. The maturity value is the amount of the notional principal when the issue becomes due. For JI17 and subsequent issues, the maturity value shall not undercut the face amount.

Purchases of investment trusts (and sales of some investment trusts) are subject to a purchase or sales fee of up to 5.5% (tax included) of the transaction amount. Also, a direct cost that may be incurred when selling investment trusts is a fee of up to 2.0% of the unit price at the time of redemption. Indirect costs that may be incurred during the course of holding investment trusts include, for domestic investment trusts, an asset

management fee (trust fee) of up to 5.5% (tax included/annualized basis) of the net assets in trust, as well as fees based on investment performance. Other indirect costs may also be incurred. For foreign investment trusts, indirect fees may be incurred during the course of holding such as investment company compensation.
Investment trusts invest mainly in securities such as Japanese and foreign equities and bonds, whose prices fluctuate. Investment trust unit prices fluctuate owing to price fluctuations in the underlying assets and to foreign exchange rate fluctuations. As such, investment trusts carry the risk of losses. Fees and risks vary by investment trust. Maximum applicable fees are subject to change; please thoroughly read the written materials provided, such as prospectuses or documents delivered before making a contract.
In interest rate swap transactions and USD/JPY basis swap transactions ("interest rate swap transactions, etc."), only the agreed transaction payments shall be made on the settlement dates. Some interest rate swap transactions, etc. may require pledging of margin collateral. In some of these cases, transaction payments may exceed the amount of collateral. There shall be no advance notification of required collateral value or collateral ratios as they vary depending on the transaction. Interest rate swap transactions, etc. carry the risk of losses owing to fluctuations in market prices in the interest rate, currency and other markets, as well as reference indices. Losses incurred as such may exceed the value of margin collateral, in which case margin calls may be triggered. In the event that both parties agree to enter a replacement (or termination) transaction, the interest rates received (paid) under the new arrangement may differ from those in the original arrangement, even if terms other than the interest rates are identical to those in the original transaction. Risks vary by transaction. Please thoroughly read the written materials provided, such as documents delivered before making a contract and disclosure statements.
In OTC transactions of credit default swaps (CDS), no sales commission will be charged. When entering into CDS transactions, the protection buyer will be required to pledge or entrust an agreed amount of margin collateral. In some of these cases, the transaction payments may exceed the amount of margin collateral. There shall be no advance notification of required collateral value or collateral ratios as they vary depending on the financial position of the protection buyer. CDS transactions carry the risk of losses owing to changes in the credit position of some or all of the referenced entities, and/or fluctuations of the interest rate market. The amount the protection buyer receives in the event that the CDS is triggered by a credit event may undercut the total amount of premiums that he/she has paid in the course of the transaction. Similarly, the amount the protection seller pays in the event of a credit event may exceed the total amount of premiums that he/she has received in the transaction. All other conditions being equal, the amount of premiums that the protection buyer pays and that received by the protection seller shall differ. In principle, CDS transactions will be limited to financial instruments business operators and qualified institutional investors.
Transfers of equities to another securities company via the Japan Securities Depository Center are subject to a transfer fee of up to ¥11,000 (tax included) per issue transferred depending on volume. No account fee will be charged for marketable securities or monies deposited.

Nomura Securities Co., Ltd.

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