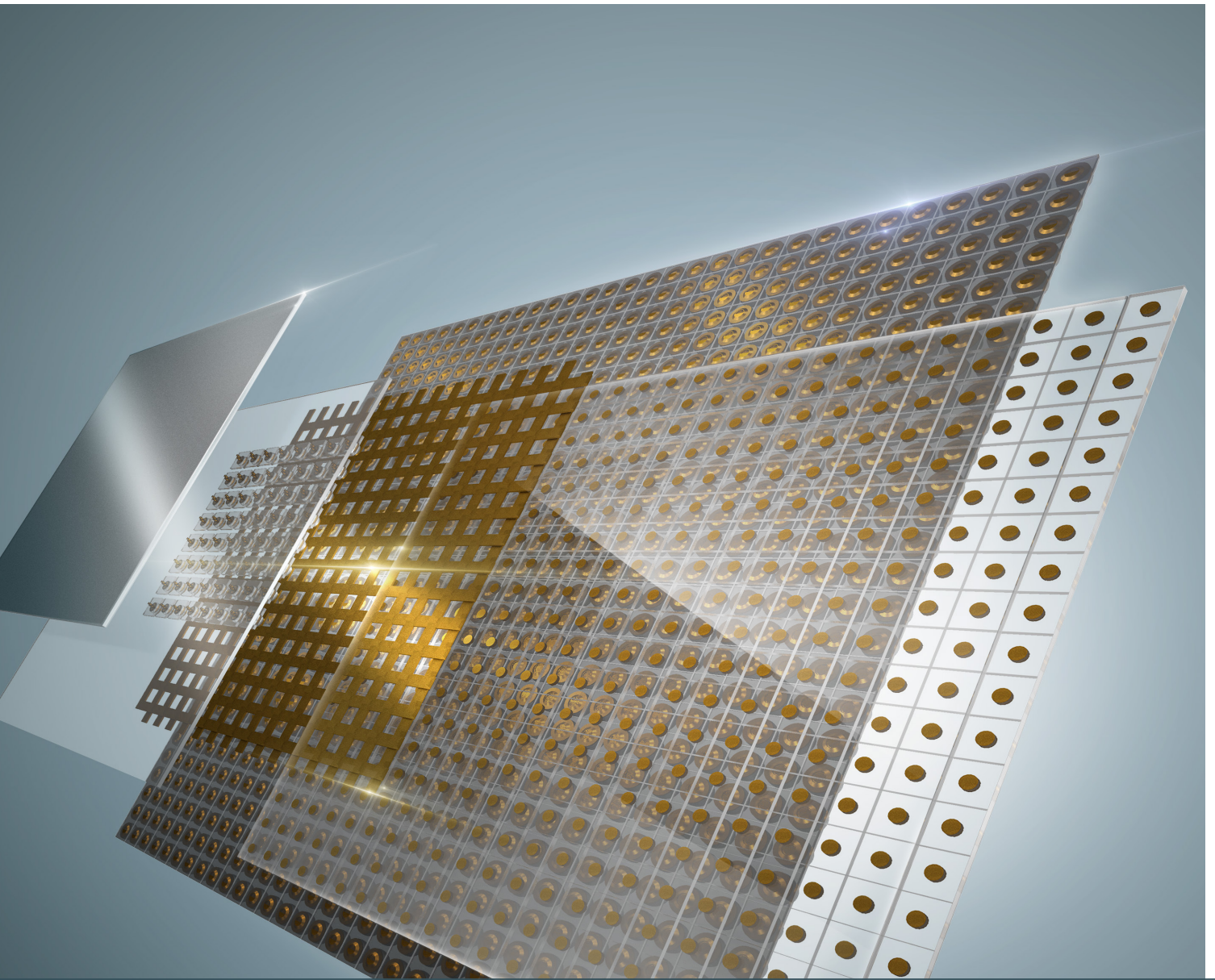


ENGINEERING
TOMORROW'S
PRODUCTION



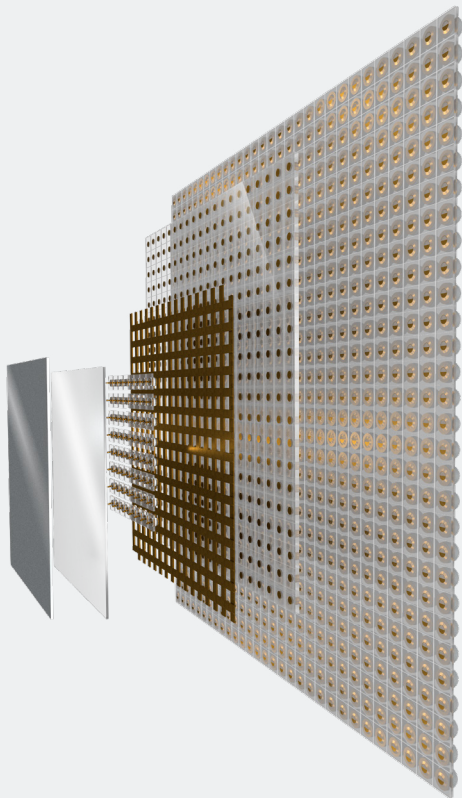
Semiconductor Panel-Level Packaging Technology

Panel-Level Packaging & Through-Glass Via (TGV)
metallization process solutions

RDL technology driving seamless connectivity in various packaging formations

High-density panel-level packaging, an extension of wafer-level packaging technology, optimizes the metal layers through a RDL process. This enhances the circuit interconnection layout between different conductive layers and materials.

» RDL Fabrication : The key to high-performance Panel-Level packaging. «



RDL (Redistribution Layer) fabrication is essential for bridging the chip, substrate, and PCB, forming the backbone of Panel-Level packaging. By reconfiguring chip I/O distribution, RDL enables high-density integration, enhances signal transmission, and minimizes package size. This technology optimizes overall packaging space and supports the advancement of high-speed, low-power devices.

The key to stable signal transmission : TGV in glass substrates

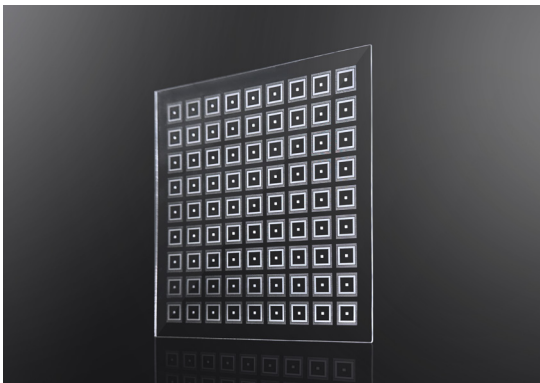
High-density packaged chips require exceptional heat dissipation and signal integrity. Glass substrates, known for their high-temperature resistance, low thermal expansion, and superior electrical insulation, provide an ideal platform for advanced semiconductor packaging. Compared to organic substrates, glass offers improved thermal management and mechanical stability, making it perfect for next-generation applications.

Through-Glass Via (TGV) technology enables vertical interconnections within the glass core, transforming it into a high-performance substrate for advanced packaging. By incorporating metal-filled vias, TGV ensures efficient signal and power transmission, enhancing connectivity for superior performance.

When paired with TGV-enabled glass substrates, RDL technology serves as the parallel metal layer that connects the top and bottom layers of the glass, enabling interconnections across various materials and conductive layers. RDL is crucial for precise circuit routing and the seamless integration of Panel-on-Substrate (Glass) into advanced packaging processes. Innovations in glass substrates, coupled with RDL, are paving the way for next-generation technologies in AI, 5G, and HPC.

TGV technology driving high-performance glass substrates for advanced integration

With 40 years of expertise in glass handling and metallization, we are a trusted partner in RDL and TGV fabrication. Our proficiency in wet chemistry, electroplating, automation, and inkjet printing enables customers to enhance productivity and optimize packaging solutions.



Manz capabilities

Enabling high aspect ratio glass substrates

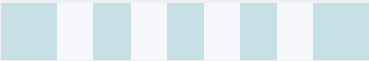
Leveraging Manz’s expertise in glass handling and wet chemical processing, we provide advanced glass substrate solutions that ensure superior stability and precise control. Our expertise in through-hole etching and double-sided electroplating guarantees exceptional uniformity and high aspect ratios, driving enhanced electrical and thermal performance for demanding applications.



Laser Modification
Laser equipment



Through Glass Etching
Glass etching equipment



Substrate Cleaning
Cleaning equipment



Substrate Treatment
Cleaning equipment



Electroless Plating
Plating Through Hole equipment



TGV Plating
Double-sided copper plating

Manz Equipment
Manz Integrated

Coreless Panel-Level Packaging Ultra-thin × Electro-thermal Management

PLP uses square substrates instead of wafers, making the panel size more flexible. This allows for better compatibility with different chip sizes and quantities, boosting production capacity and manufacturing flexibility to meet diverse market demands.

As AI chips continue to grow in size, semiconductor packaging faces new challenges and opportunities. PLP technology enhances area utilization by shifting from circular wafers to square substrates, increasing production capacity and efficiency while reducing costs. This breakthrough opens new possibilities for advanced semiconductor packaging.

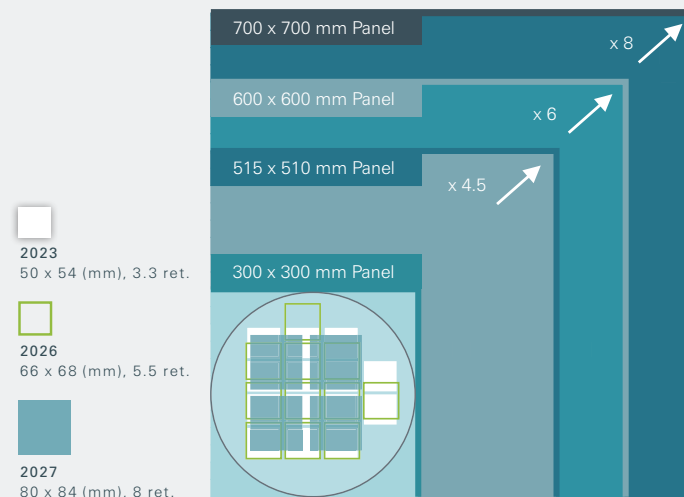
AI Chip growth challenges packaging limitations

The rapid advancement of AI demands higher computing performance, driving the integration of GPUs, SoCs, and memory. However, as chip complexity increases, their sizes continue to expand. While 12-inch wafer-level packaging (WLP) is widely used, it faces challenges in accommodating larger chips, which can limit production capacity.

Expanding capacity, reducing costs, and enabling large-scale packaging

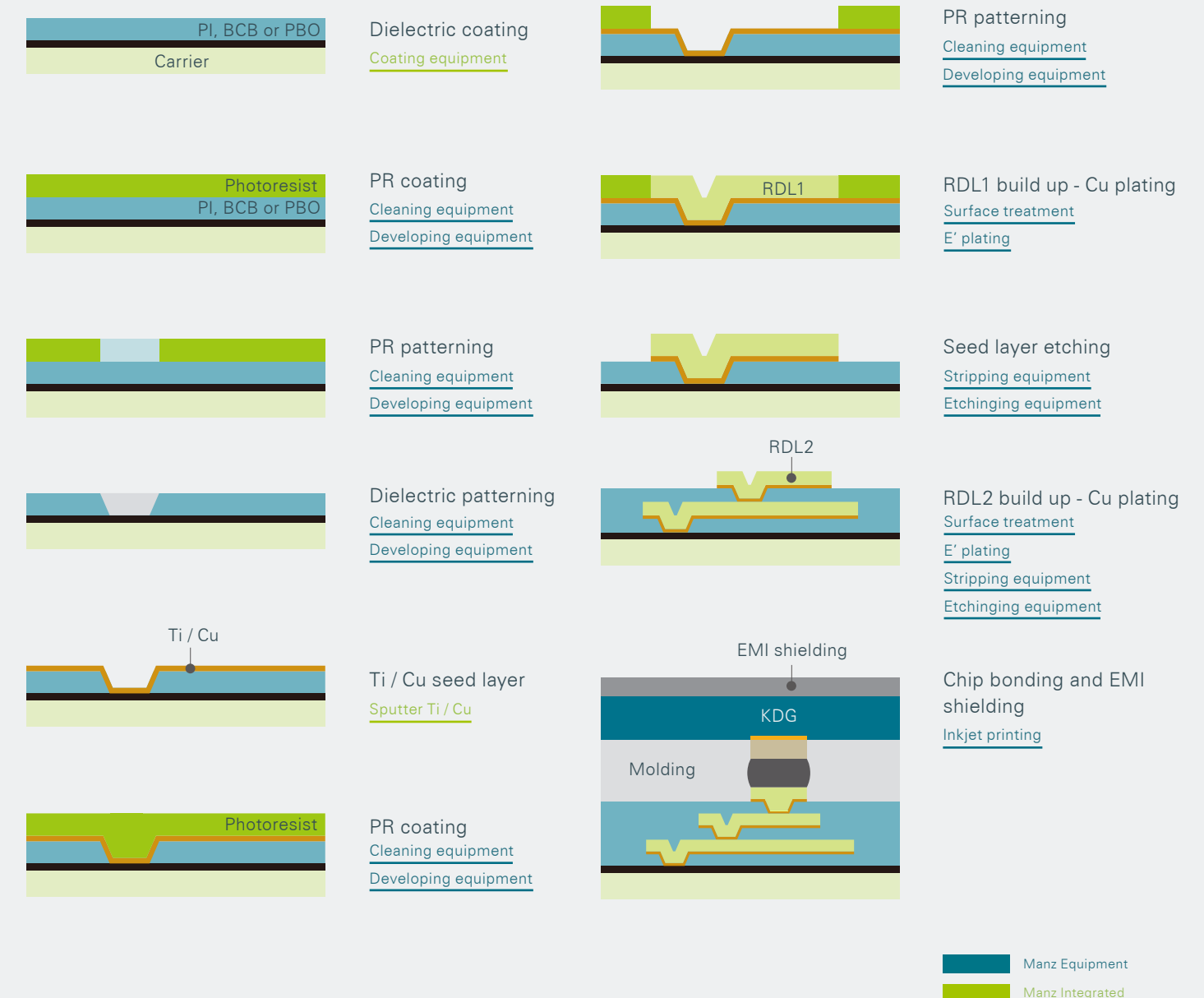
To overcome these limitations, the industry is shifting to square panel substrates. By arranging chips on rectangular substrates and integrating them through advanced packaging processes, PLP supports larger chip sizes while maintaining efficiency. The substrate area has expanded from 510mm×515mm and 600mm×600mm to 700mm×700mm, achieving nearly 8 times the yield of a 12-inch wafer. This high-throughput panel-level packaging technology significantly boosts chip production efficiency and lowers unit costs, accelerating innovation in semiconductor packaging.

We optimize production processes to enhance capacity and drive competitive efficiency, enabling customers to stay ahead in a fast-evolving market. Our flexible, high-yield production lines meet growing demands and foster industry progress.



Panel-Level Packaging Concept Futures:

- ✓ Supports both chip first and chip last configurations
- ✓ Accommodates panel-form substrates from 300mm to 700mm in size
- ✓ Reduces cost and waste with efficient manufacturing
- ✓ Larger footprint fits more chips for future AI trends



New R&D center for digital printing – Leading semiconductor manufacturing innovation

Strengthening partnerships to establish an ecosystem for developing high-performance, scalable digital printing solutions. From lab innovation to mass production, our maskless processes enhance performance and application value in semiconductor metallization.



» Functional printing delivers efficient and flexible solutions for semiconductor metallization processes. «

Launching innovation in semiconductor manufacturing

Inkjet printing technology converts functional materials into ink, using precision printheads to print directly onto substrates like PI, ABF, EMC, silicon wafers, and glass. This maskless process simplifies circuit formation, enhances material utilization, and increases process flexibility—advancing sustainable manufacturing practices.

To accelerate the validation and industrialization of digital printing technology for advanced semiconductor packaging and metallization applications, Manz has established a new R&D center in Taiwan. This facility serves as a hub, equipped with comprehensive lab equipment and process development capabilities to ensure stability and drive mass production.

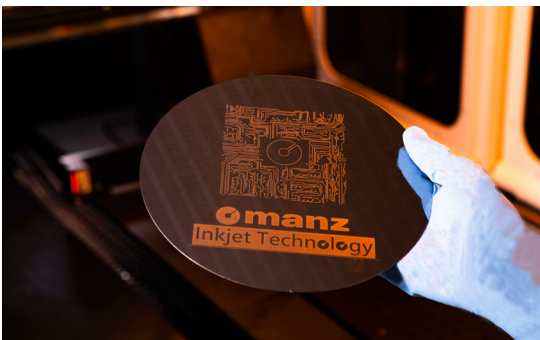
Industrial inkjet printing solutions for mass production

The SDC series supports both front-end and back-end semiconductor processes, enabling wafer- and panel-level packaging. With inline measurement for precise process control and quality monitoring, it enhances efficiency and drives greater productivity and competitiveness in semiconductor packaging.

- Tailored for diverse semiconductor manufacturing needs.
- Achieves exceptional drop accuracy in X/Y, ensuring precise dot and space definition.
- Supports *.TIFF and DXF formats, with a 5400 dpi resolution and user-friendly GUI.
- Precision design with automatic nozzle calibration for consistent accuracy.
- HEPA assembly meets class 100–1000 standards, ideal for semiconductor applications.

Functional inkjet printing – Enabling efficient and sustainable manufacturing

Inkjet printing lowers process costs and environmental impact, offering a sustainable and high-performance solution for semiconductor packaging.



From the project’s initial stages, we collaborate closely with customers to design tailored solutions through continuous process discussions.

R&D inkjet printing solutions equipment for laboratory

Specially designed for advanced semiconductor packaging processes, this equipment is supported by a skilled R&D team and strong supply chain partners. We focus on validating new functional inks and various substrates, providing comprehensive laboratory solutions and technical support to help customers achieve precise and efficient process development. Features of RDjet:

- Quick Installation: Engineered with a single home plug for hassle-free setup and minimal installation time.
- Compact & Space-Saving Design: Optimized for efficient use of space.
- Open Architecture: Designed for maximum flexibility, seamlessly integrating with various components and workflows.
- Versatile: Highly adaptable to different processes and applications, providing solutions for diverse needs.
- Automatic Alignment: Automatically adjusts the table position to ensure optimal alignment and accuracy.

Our production portfolio:

- Compatible with diverse materials
 - PI, ABF, EMC, silicon wafers, and glass.
- Enhances cost-effectiveness
 - Reduces ink usage and process steps.
- Boosts production efficiency
 - Completes coating in just 1 to 5 minutes.

Manz Taiwan Ltd.

4F., No. 168-1,
Zhongyuan Rd., Zhongli Dist., Taoyuan City
320021, Taiwan
Phone +886 3452 9811

www.manz.com.tw
info.tw@manz.com

Manz China Suzhou Ltd.

No. 405 Jialingjiang Rd., Suzhou New District,
Jiangsu Province, 215153, China
Phone +8651262782607

www.manz.com.cn
info.cn@manz.com