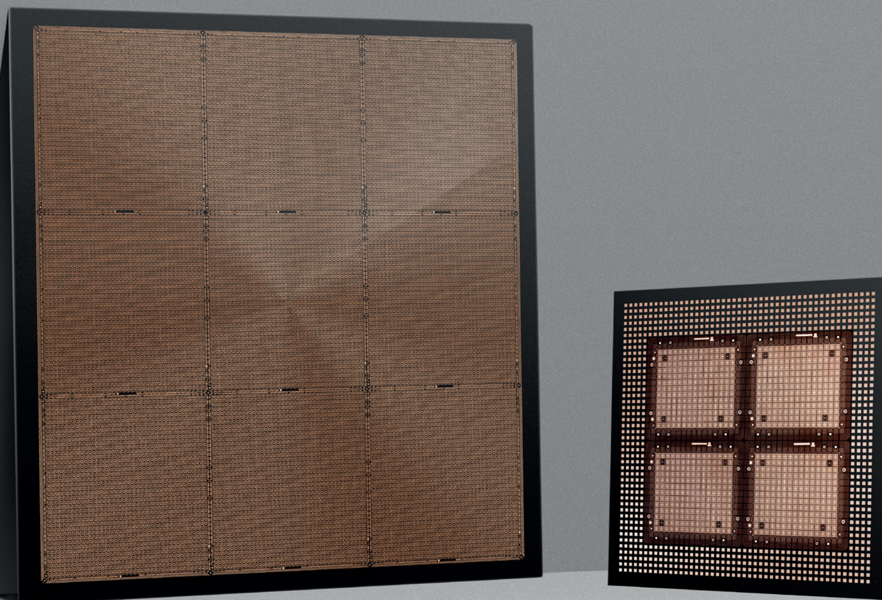
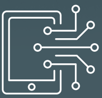
manz

ENGINEERING
TOMORROW'S
PRODUCTION





Panel-Level Packaging RDL Production Solutions

Key technology to achieve semiconductor high-density packaging

Manz AG — Cross-domain innovations unlock new applications

Manz develops and builds innovative and efficient production solutions to set industrial standards in the emerging sectors and industries. Our claim **“Engineering tomorrow’s production”** conveys our aspiration to become a market leader of new products.

With our core technologies, extensive industrial experiences and innovative production solutions, our diversified positioning fulfills customer’s demands and ensures industrial development.

Achieve manufacturing process optimization and productivity improvement

Our well suited product offerings help customers penetrating new markets and make a significant contribution to their success through faster, easier and more economical way to achieve mass production goals and achieve faster time to market.

Advanced production technology enables FOPLP solutions

With our approx. 40 years’ engineering experience in wet chemical technologies, We Manz AG provides product portfolio including both stand-alone systems and fully integrated solutions from a single source for the production of circuit patterns on substrates and other electronic interconnect systems using in high-end IC substrates and display industries.

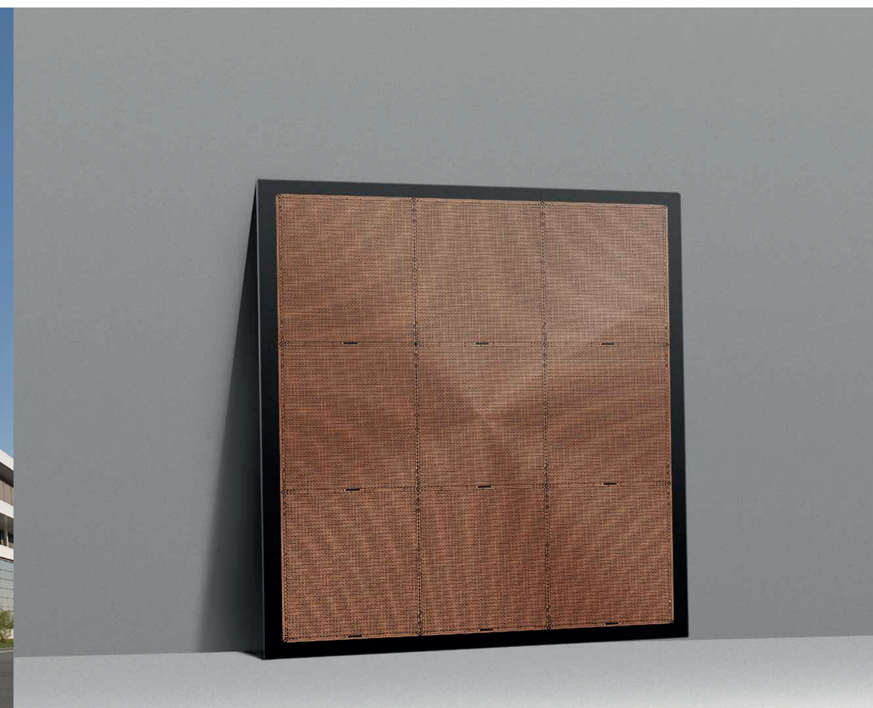
Over the past several decades, we have adeptly addressed a diverse array of customer requirements for Fan-Out Panel Level Packaging (FOPLP) techniques, leveraging our expertise in lithography and electroplating. Moreover, through the strategic integration of software-hardware and industrial plant planning services, we empower our customers with a substantial competitive edge to meet the evolving market demand of medern electronic devices for ever lighter, thinner and better performance.

Manz AG
- Established in 1987
- Headquarters in Reutlingen, Germany
- Other branches in Slovakia, Hungary, Italy, China, Taiwan, the US and India
- Approx. 1,500 employees worldwide, including around 500 engineers

Core technologies
- Automation
- Wet chemistry
- Plating
- Assembly
- Laser
- Inspection systems
- Digital printing

FOPLP — drive industrial momentum by cost and capacity advantages

Surging demand for LEO satellites, AIoT, 5G and smart vehicles, the FOPLP technologies are the forefront of technological progress for power optimized, cost-effective & better heat dissipation silicon chips.



FOPLP show the path to efficiency and further cost reduction

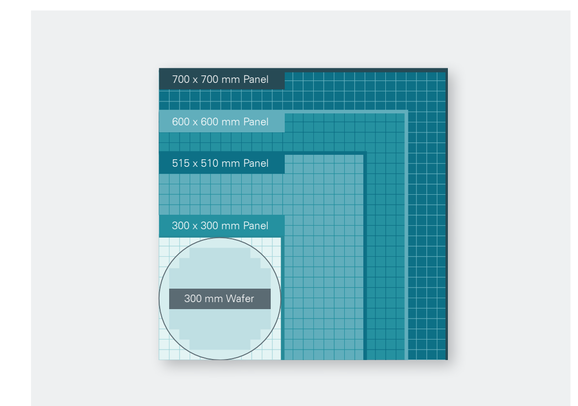
→ Improve packaging features, heat dissipation and performance

→ Derive >95 % process area by shifting to panel substrates

→ Reduce waste in the packaging processes

→ Achieve smaller, lighter packaging sizes and design

The high demand of LEO satellites, AIoT, 5G and smart vehicles give rise to IC chip dynamics. Especially the modern sensor chips and new radio frequency ICs, those are more cost-effective than older generations. The mainstream is going to focus on the manufacturing cost reduction leveraging the integrated packaging technologies of multi-die. This will lead to a boom in FOPLP technologies and widely apply the attractive solutions of multi-die heterogeneous integration. These emerging trends drive the growth towards large sized panel level packaging.



The further reduction of production cost is shifting from round silicon wafers to larger and rectangle sized substrates such as glass, organic material and stainless steel. There are even more valuable to expand manufacturing areas from 510 x 515 mm, 600 x 600 mm to maximized 700 x 700 mm which are more efficient scaling to expand production throughput to 7 times of traditional 300 mm silicon wafer production.

Notably, the effective utilization rate of manufacturing areas of FOPLP has led to more than 95 % compared with 85 % less in FOWLP technologies. FOPLP increases better device efficacy.

FOPLP — Accelerating industry leadership in advanced packaging

With advantages of high integration density, low cost and high reliability, FOPLP has been adopted for power management ICs in automotive applications, and continues to drive adoption in support of next generation radio frequency ICs for LEO satellites.

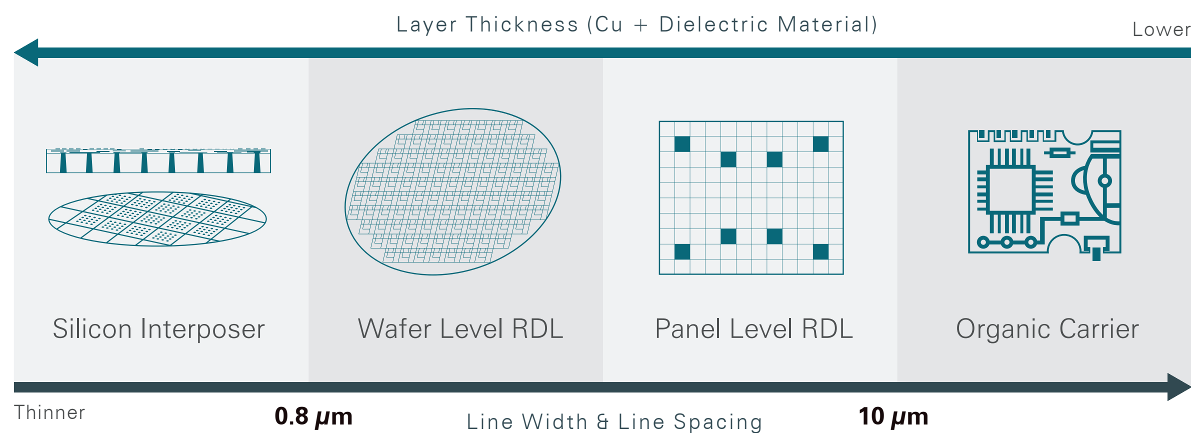
FOPLP gets attractive because it meets the requirements of high electric conductivity, functionality and improved heat dissipation of silicon chips. Establishing several core innovative technologies in FOPLP process and bringing in highly skilled talent teams, Manz provides complete equipment, software and integrated solutions to drive FOPLP production solutions forward. We assist customers to pursue breakthrough production and shorten the time for customized process development by collaborating with industrial partners from IDMs, OSAT, IC Substrates and panel makers.

Targeting PMICs, power electronics and new RFICs

Compared with more FOWLP implementation in packaging CPUs or GPUs, FOPLP is welcomed and used in the cost-effective packaging of high power, high current and low power consumption semiconductor devices and applications, suitable for manufacturing of APE, power ICs and power management chips.

Panel level packaging technology features more I/O pin counts, smaller footprint, excellent performance and lower power consumption advantages. A few key highlights include,

- Slim and small packaging fits modern savvy electronics
- Achieve shrinking dies to drive feature optimization
- More I/O counts ensure better signaling & connectivity
- Excellent thermal dissipation capability



Shorten production development time to accelerate customer success

With the extensive experience in wet chemistry, electroplating equipment and high precision inkjet printing equipment, Manz provides redistribution layers (RDL) technology and solutions to offer customers high density, high volume and low production cost manufacturing lines.

We help customers to optimize production process with a head start in planning and an edge of faster time to market over the competitors.

- Full services from equipment to production fab planning
- Suitable for various substrate
  - FR4 | PI | Stainless steel | Glass | Molded substrate
- Key numbers of production optimization
  - Electroplating uniformity >95 %
  - High precision inline chemistry analyzer reaching 97 % of stability
  - L/S range: 10µm / 10µm to 20µm / 20µm
  - The fab planning with highly integrated, well-tailored equipment and process

Manz holds leadership positions in automation, wet chemistry, electroplating and inkjet printing for RDL production technologies. This enables Manz to offer customized and high efficiency integrated manufacturing solutions..

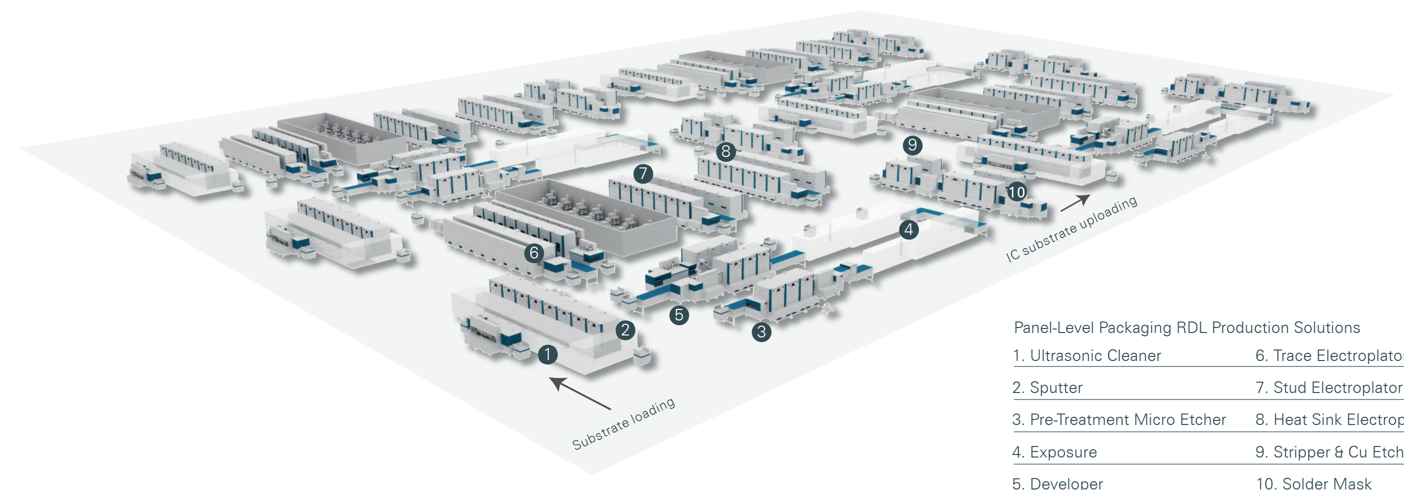
Manz FOPLP RDL production solutions with proven records for mass production

Automation
Loading & Unloading System | Robotics | AGV

Wet chemistry
Cleaner | Developer | Etcher | Stripper

Electroplating
Jig-free Vertical Electroplating

Inkjet printing
Inkjet printing for solder mask application

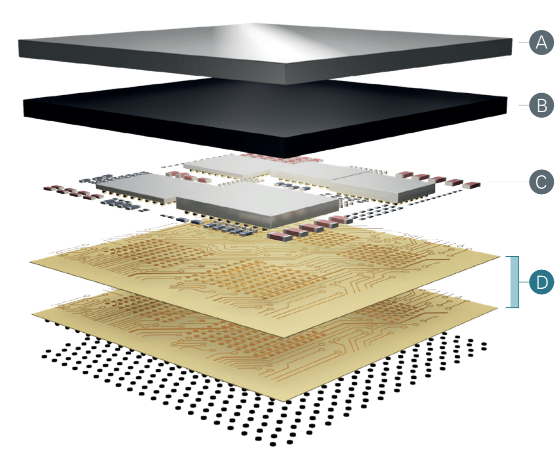


Panel-Level Packaging RDL Production Solutions

1. Ultrasonic Cleaner	6. Trace Electroplator
2. Sputter	7. Stud Electroplator
3. Pre-Treatment Micro Etcher	8. Heat Sink Electroplator
4. Exposure	9. Stripper & Cu Etcher
5. Developer	10. Solder Mask

The integrated RDL process is a critical success factor of FOPLP

Through RDL technologies, the monolithic chip is to connect different functions of the system to one encapsulated package. These techniques integrate multiple silicon dies with high density, small footprint and excellent product performance.



Ⓐ Electromagnetic Shielding layer

Reduce the effect of electromagnetic interference and ensure functional steady of electronic components.

Ⓑ Encapsulated layer

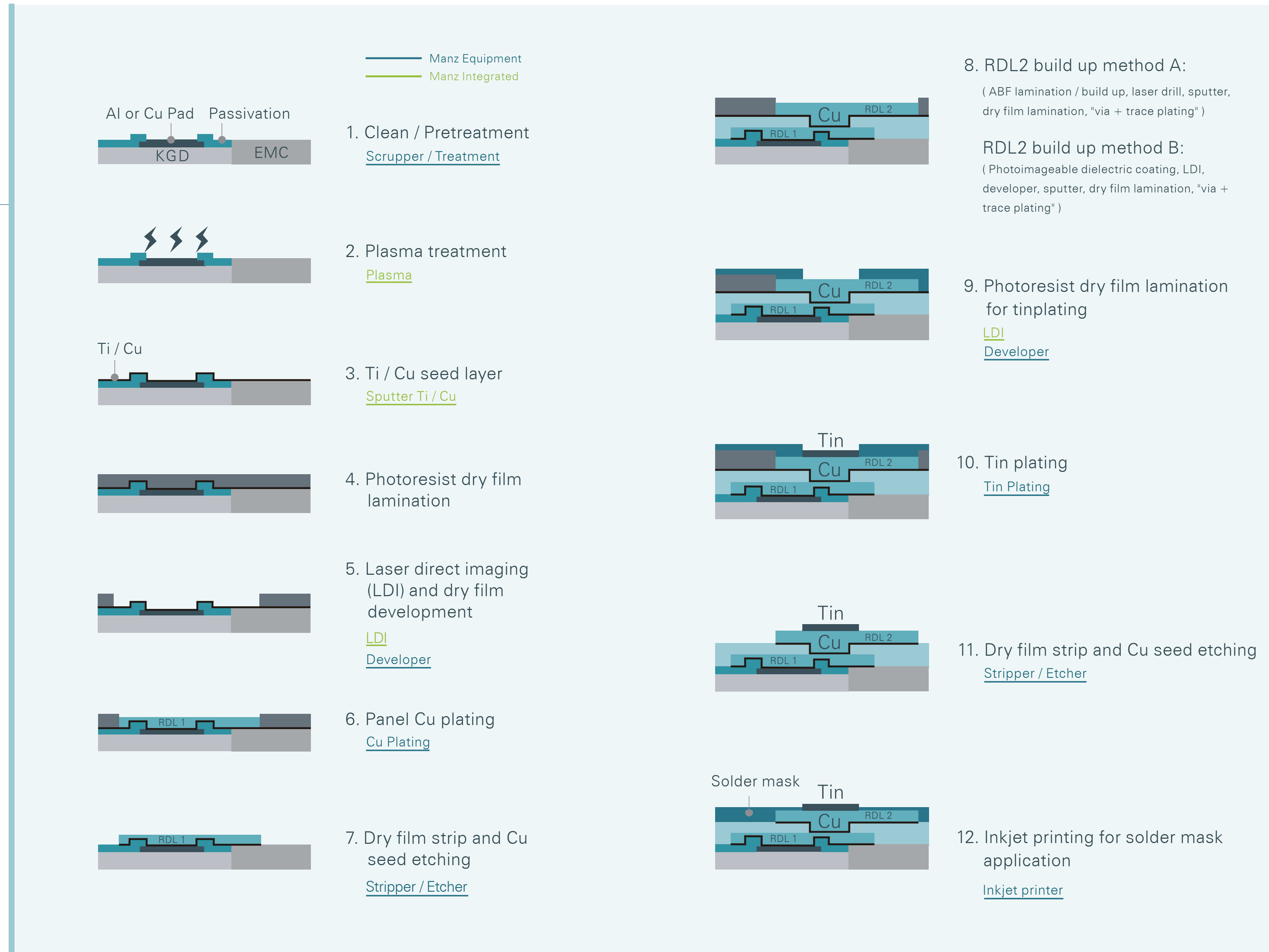
Provide physical and electrical protection of components by strengthening mechanical structure and environmental adaptation.

Ⓒ Components

Play different active roles in electronics circuit design including performing multiple sophisticated electronic functionality.

Ⓓ Redistribution layer

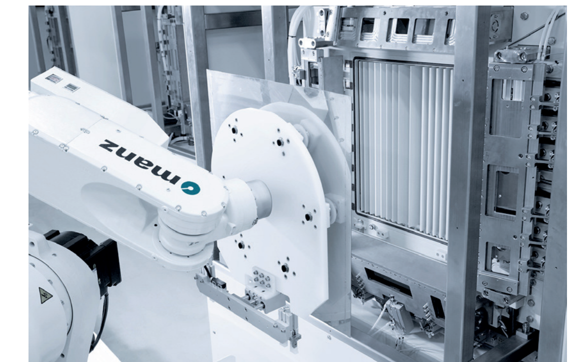
Attach different dies to a monolithic package by applying thinner line width and spacing process to gain functionality and reliability of sophisticated IC design.



The Key Technology to Achieve RDL Process

Manz Novel Vertical Plating

The new vertical electroplating without using a jig, which can save the purchase cost of the jig, as well as the consumption of electroplating solution and the cost of cleaning solution during the process. Meanwhile, the multiple section multi-anode system design could increase plating uniformity up to 95 % and the line width and spacing reaching to maximized $5\,\mu m$ / $5\,\mu m$.



Furthermore, the electroplating equipment adopts a modular design, which can be flexibly configured according to the customer's production capacity and plant area. The components can be quickly operated and disassembled, easy to maintain and can help customers to carry out efficient production.

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