IMAPS Symposium 2026

Scaling the Future: Panel Level Packaging Market Trends Uncovered

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PANEL LEVEL PACKAGING ADOPTION DRIVERS

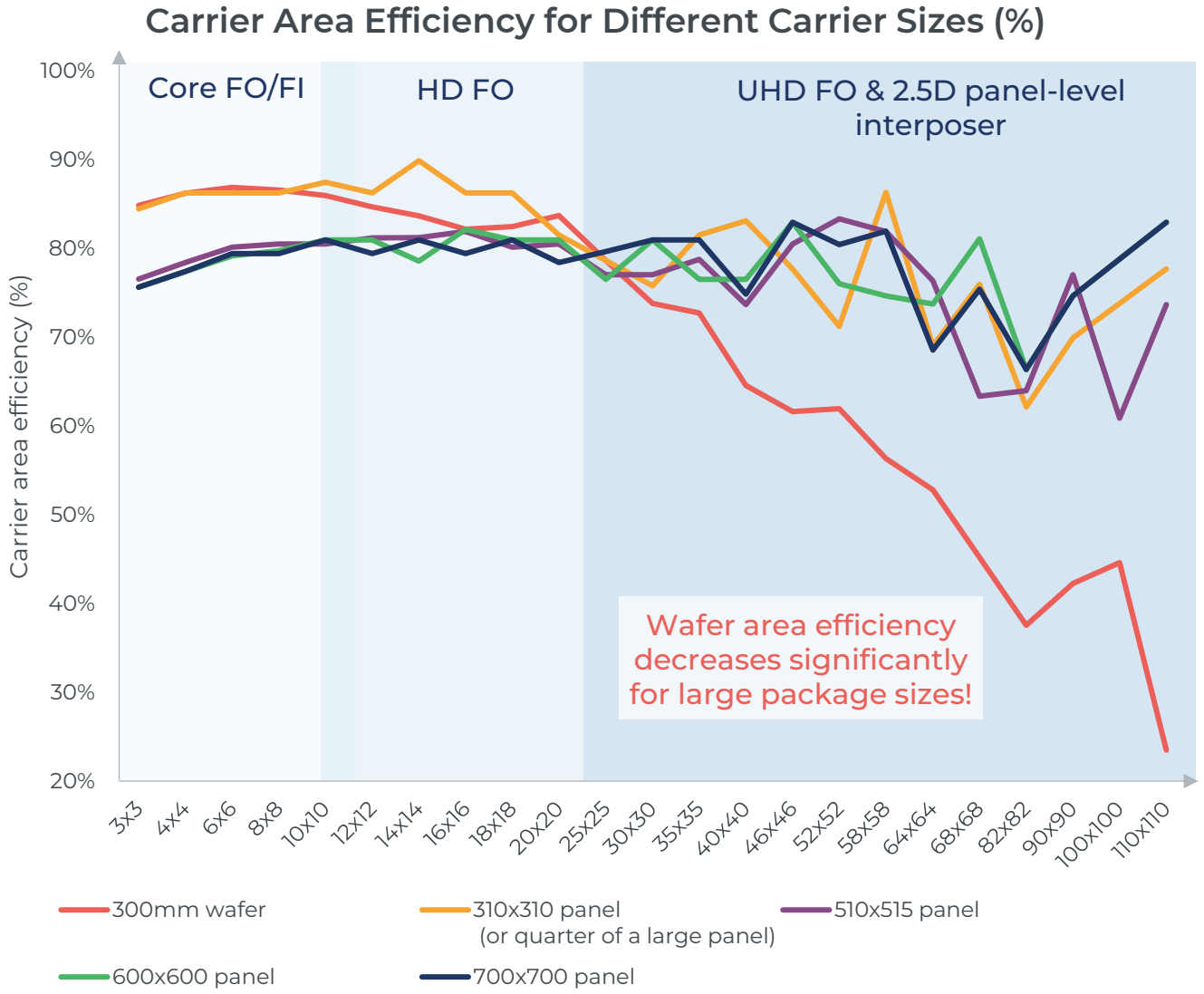
Two main drivers for panel adoption:

High-Volume Manufacturing for cost reduction
Low to Mid-End PLP

Replacing FOWLP and QFN
RF, Power IC, Power Module, APU, MCU

Large Package Size for HPC/AI
High-end PLP

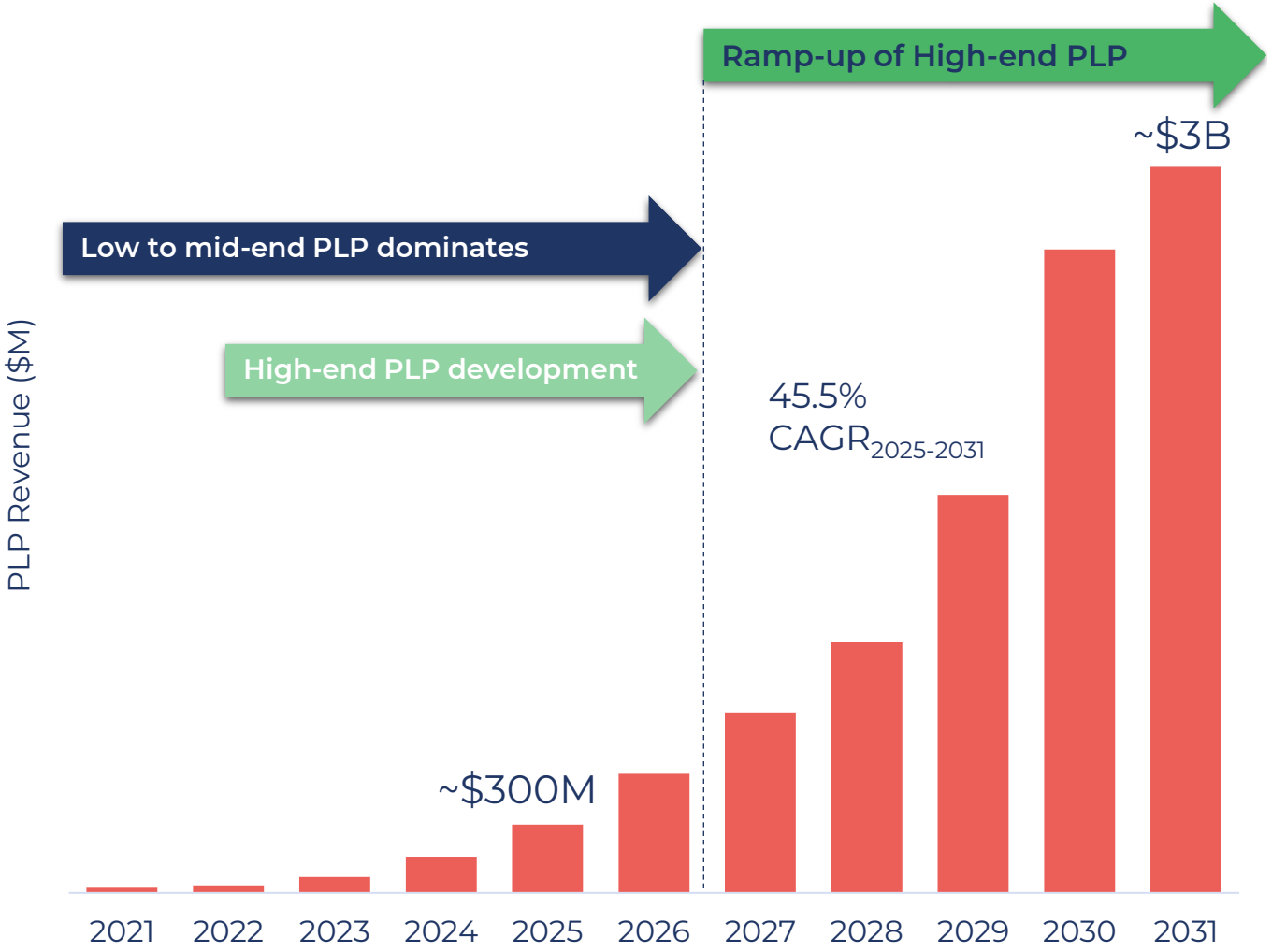
Replacing CoW 2.5D interposers
xPU/ASIC + HBM, Chiplets
Co-Packaged Optics: Optical Engine + Assembly

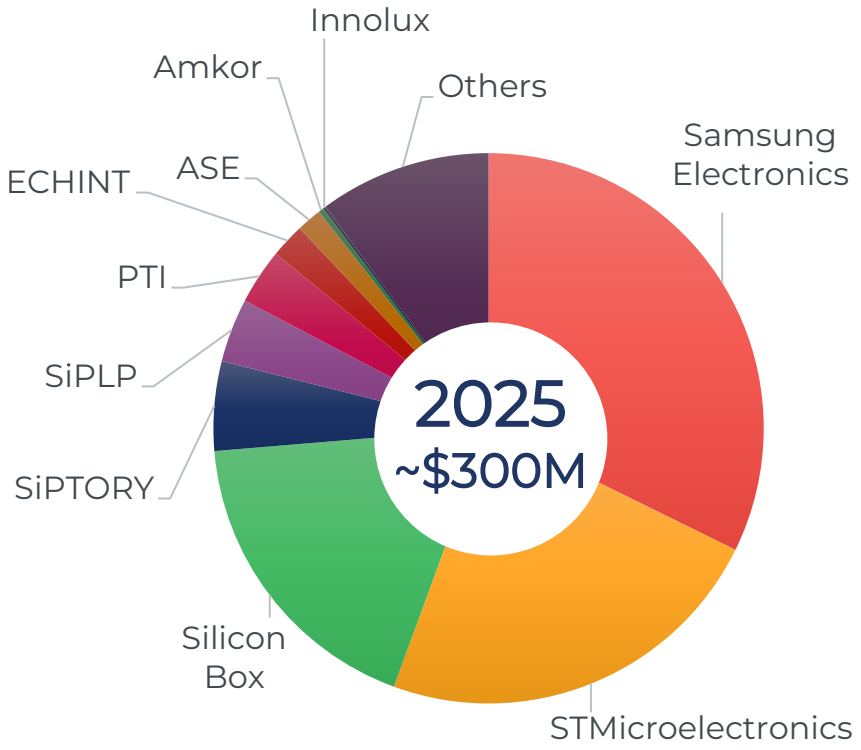


Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING MARKET EVOLUTION AND MARKET DRIVERS

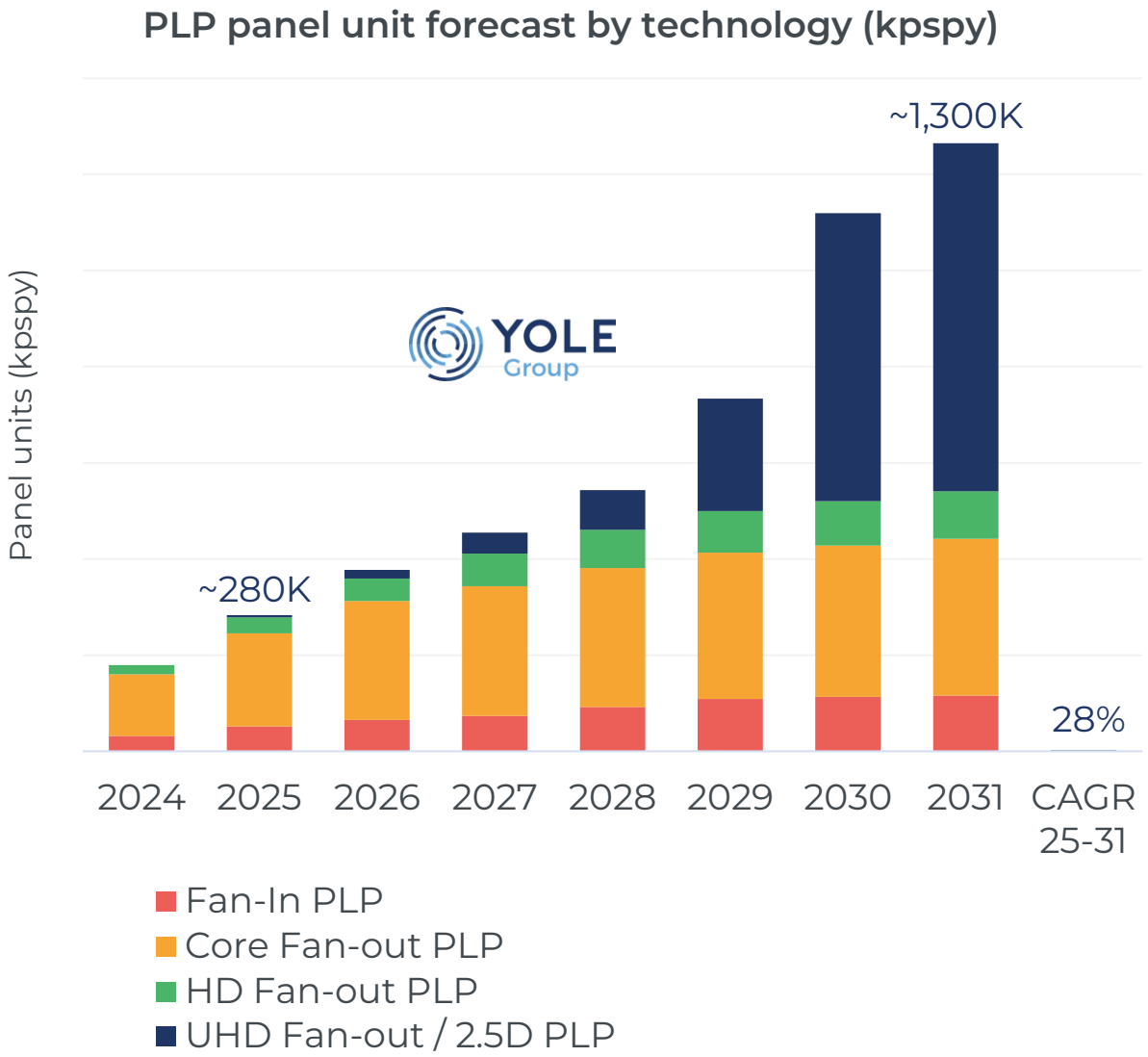
PLP market revenue forecast 2025-2031 ($M)





Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING PANEL UNIT FORECAST BY TECHNOLOGY



UHD FO / 2.5D panel-level interposer:

- Highest CAGR 2025-2031
- Silicon Box, ASE and PTI introducing the technology
- TSMC CoPoS to ramp in 2029 for AI GPU

HD FO

- Samsung PLP for its smartwatch APU with FO-PoP
- Silicon Box, ASE, PTI, ECHINT as potential entrants
- Potential for CPO optical engine for EIC + PIC stacking

Core FO and Fan-In

- PMIC, Power IC/module, RF, MCU
- Small package size and low-density RDL
- SiPTORY, SiPLP, STMicroelectronics, PTI, Silicon Box, ECHINT, Innolux and more

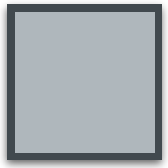
Source: Yole, Panel Level Packaging 2026

WHY THERE IS NOT A STANDARD PANEL SIZE?

Smaller panels attractive for high-end while large panels enable HVM efficiency

Small panel size

≥ 300x300 mm² – < 400x400 mm²

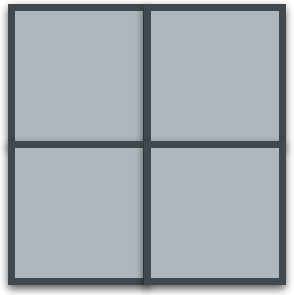


ASE, tsmc, AOI, OIP TECHNOLOGY, SMAT

- ✓ Easier warpage management
- ✓ Better layer uniformity
- ✓ Lower initial investment
- ✓ Lower tool footprint
- ✓ Easier adaptation from wafer tooling
- ✓ Ideal for pilot lines and high-end
- ✗ Cost efficiency drops in large volume

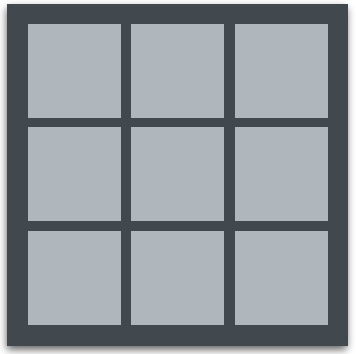
Large panel size

> 400x400 mm² – < 700x700 mm²



SAMSUNG, ECHINT, ASE, Powertech Technology Inc., SILICON BOX, SiPLP, Rapidus, nepes, EMCT, Unimicron, SHINKO, Amkor Technology

≥ 700x700 mm²



INNOLUX CORPORATION, SPACEX

- ✓ Easy adaptation from PCB/substrate/LCD tooling
- ✓ Levering process know-how from other industries
- ✓ High-cost efficiency for high-volumes
- ✓ Efficient for less complex package configurations
- ✓ High equipment footprint and large investment, but efficient for HVM
- ✗ Challenging for fine L/S, high-end PLP due to warpage and less uniformity

Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING AS A REPLACEMENT FOR QFN

Conventional assembly strips used in wirebond or flip chip QFN processing

75 x 250 mm

90 x 270 mm

100 x 300 mm

Rectangular-shaped panels Panel Level Packaging processing

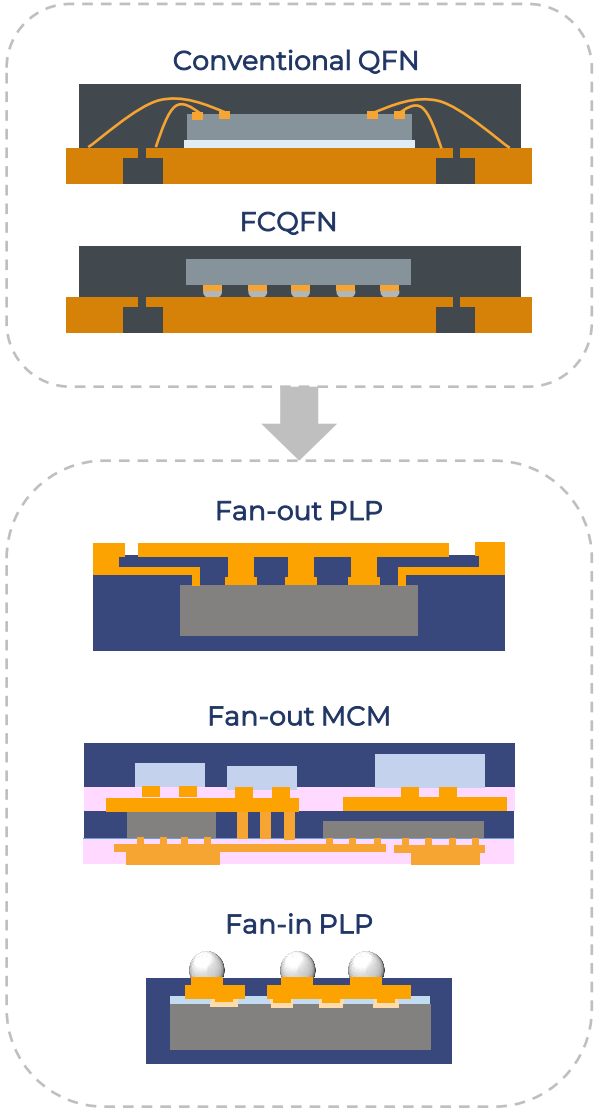
Mainly large panel processing:

600x600mm²

700x700mm²

Other sizes available across the industry

Volume driven demand



PMIC / Power IC
(Mobile / Consumer / Robotics / Drone / EV)

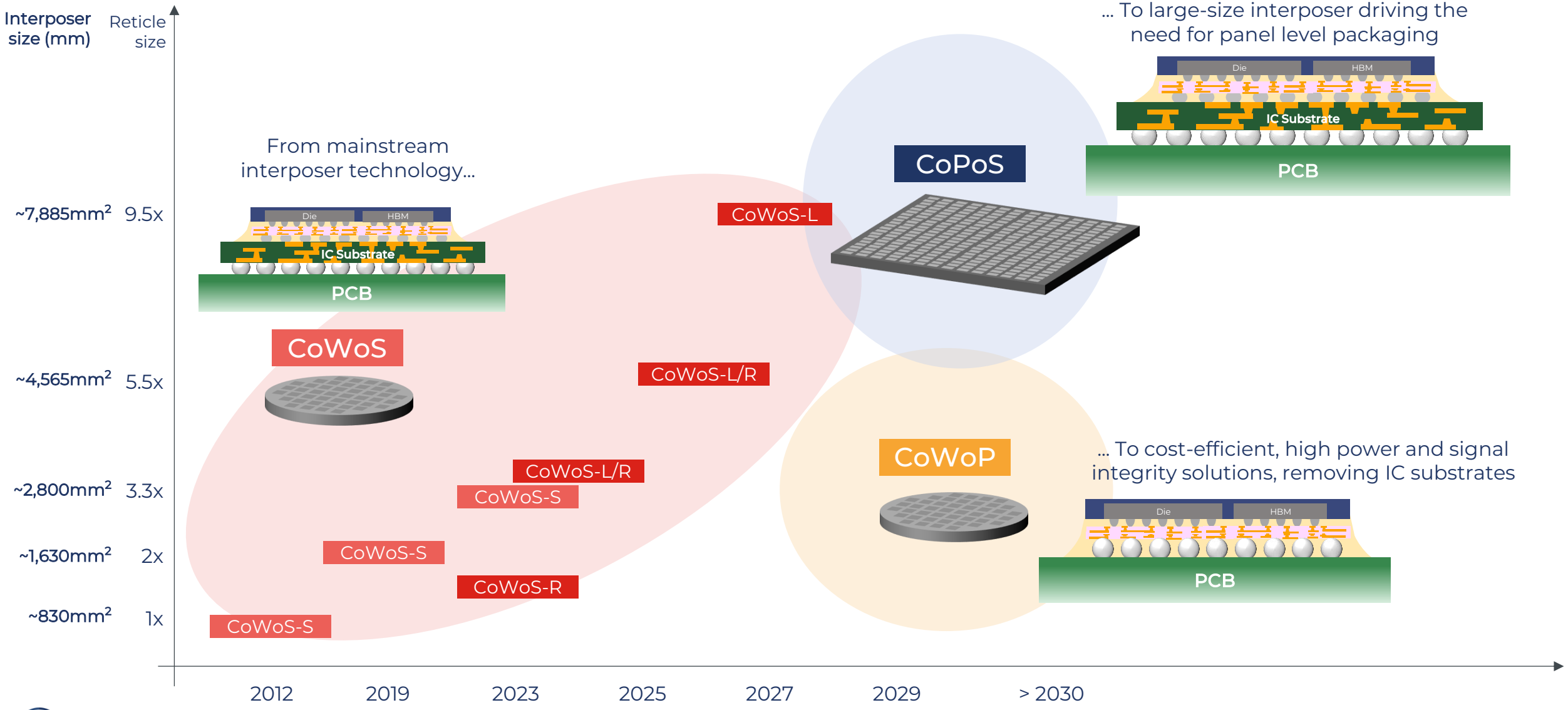
Power Module
(automotive / server / other)

RF & analog ICs
(Consumer / Auto / Telecom / defense)

MCU
(EV / other)

Source: Yole, Panel Level Packaging 2026

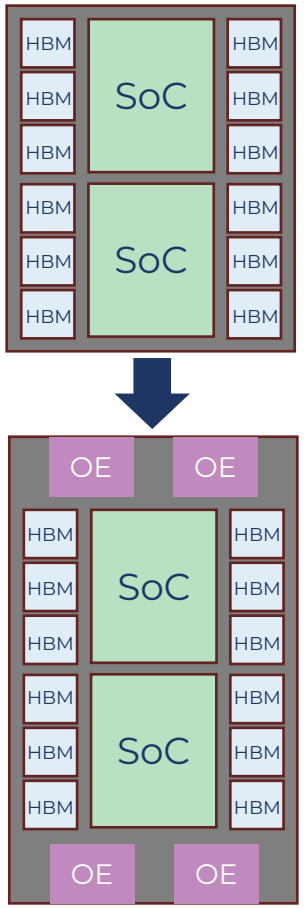
LARGE DIMENSION PACKAGE TREND – COWOS VS. COWOP VS. COPOS



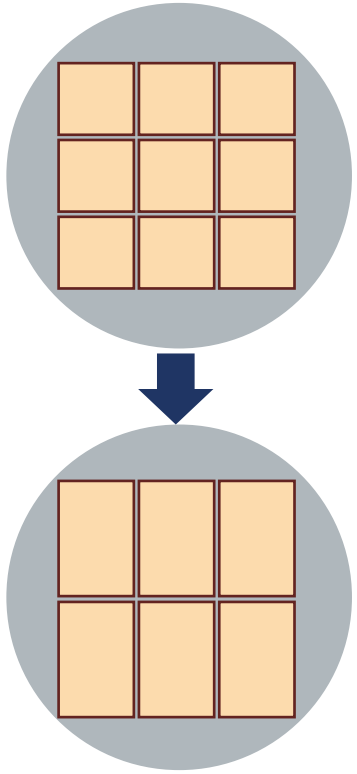
Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING POTENTIAL: CO-PACKAGED OPTICS

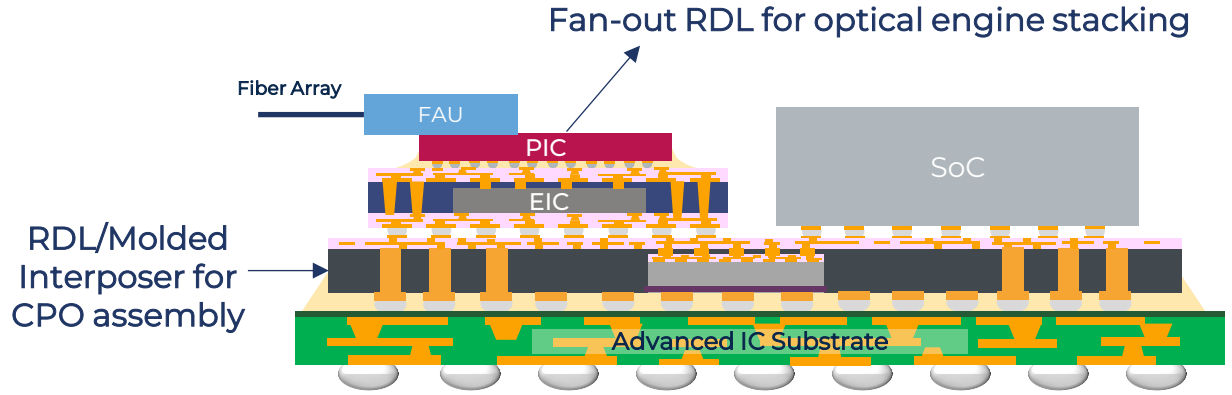
CPO 2.5D interposer; 3D stacking for optical engine

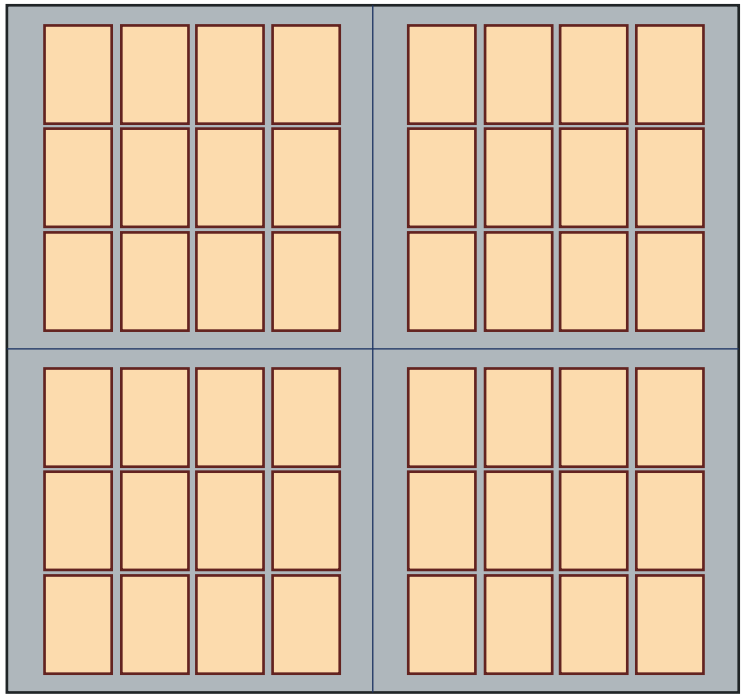


5.5x reticle interposer
No optical engine



>6x reticle interposer
With optical engine





PLP example with 600x600mm² area

Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING EQUIPMENT SUPPLIERS

Source: Yole, Panel Level Packaging 2026

Temporary Bonder & Debonder

DYNATECH, Shin-Etsu, AIMECHATEC, TAZMO, SUSS, ERS, tok, KOSTEK, LINTEC, TEL, SCIENTECH

Die Bonder

Besi, ASMPT, SHIBAURA, PYXIS CF PTE LTD, GMM 均華精密, ADA SEMI 阿达半导体, CAPCON, TORAY, Kulicke & Soffa

Plasma

ULVAC, NEMS tek GLOW THE FUTURE, evatec process systems, Skytech 天虹科技, Nordson, LINCOTEC, E&R Engineering Corp. 鈦昇科技

Coater/Developer Lithography

Canon, EVG, SCREEN, Veeco, schmoll maschinen, ORC, Lam RESEARCH, KLA, ADTEC ENGINEERING, TAZMO, USHIO, onto innovation, TORAY, MIKOPTIK 源卓微纳

Wet Process (Etch/Cleaning)

manz, SCIENTECH, YES, ACM RESEARCH, mks Atotech, SCHMID, KSDW, Lam RESEARCH, GPTC 弘塑科技

Sputtering

evatec process systems, LINCOTEC, Skytech 天虹科技, ULVAC, APPLIED MATERIALS, KLA, SCHMID

Plating (RDL)

EBARA CORPORATION, ASMPT, manz, ACM RESEARCH, Lam RESEARCH, Semsimetric, mks Atotech, RENA, TKC GLOBAL TECHNOLOGY

Molding

TOWA, YAMADA, YAMAHA ROBOTICS, GMM 均華精密, PYXIS CF PTE LTD, Besi

Thermal Processing

YES, C SUN 志聖, GP GROUP

Drill/Dicing/ Grind/Mark/CMP

DISCO Kiru-Kezuru-Migaku Technologies, LPKF Laser & Electronics, ACCRETECH, schmoll maschinen, SCHMID, EO TECHNICS, GPM 均豪精密

Metrology and Inspection

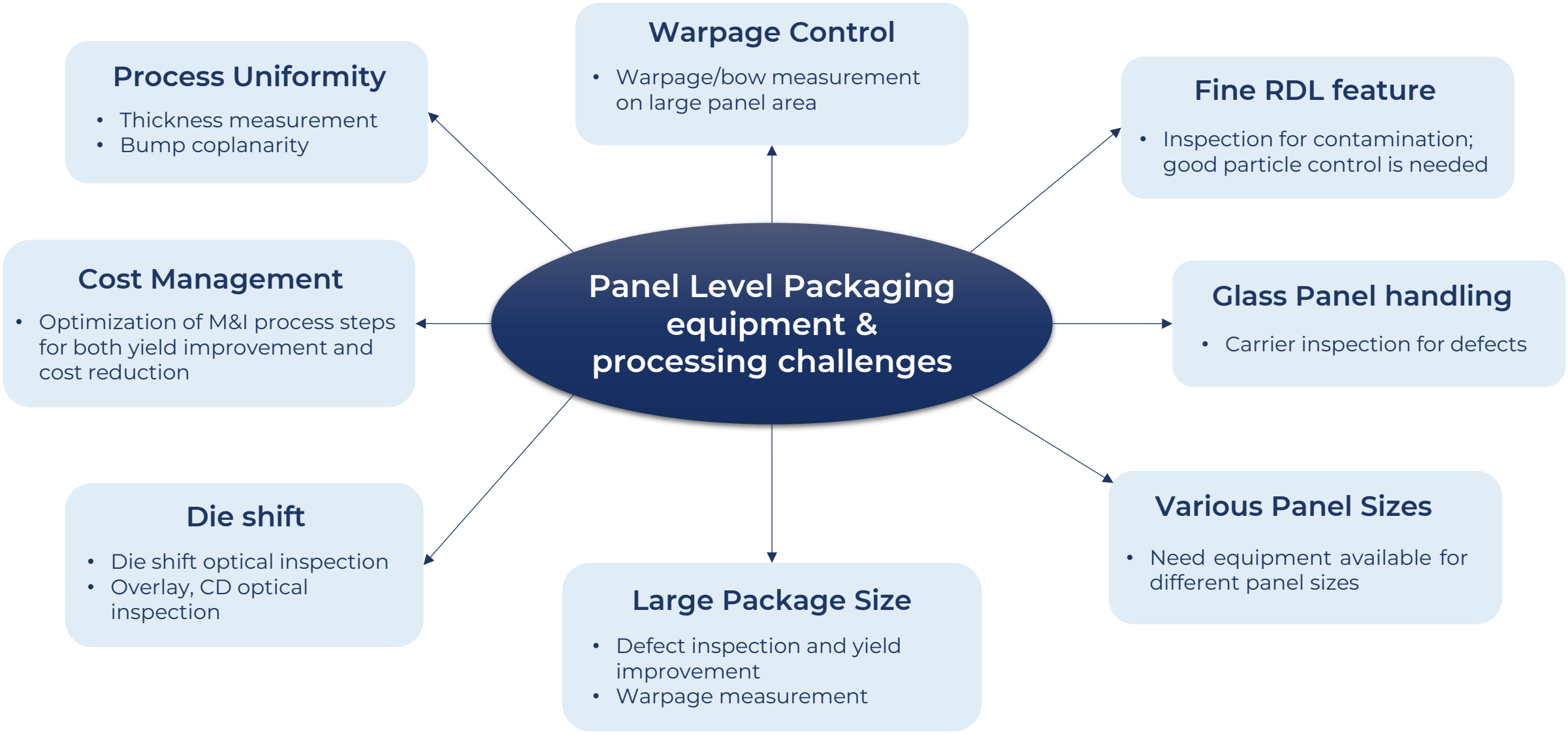
KLA, onto innovation, CIMS Creativity in Motion, Camtek See Beyond, FAVITE, VIEW, akrometrix Thermal Warpage & Strain Metrology, 大量科技 TALIANG TECHNOLOGY, cmit, VITrox, TORAY, Nordson, UT 由田新技 UTECHZONE, GPM 均豪精密

Others (handling, lamination, automation, sorter, etc.)

G2C+ Alliance, Tongtai, TAZMO, 德沪涂膜 PRECISION SYSTEMS, 家登精密 Gudeng Precision, LEETECH, 長廣精機 ETERNAL PRECISION MECHANICS, CKplas 中勤 CHUNG KING ENTERPRISE CO., LTD., MIRLE, RORZE, DYNACHEM, GPTC 弘塑科技

**Non-exhaustive list of players!*

EQUIPMENT CHALLENGES AND METROLOGY & INSPECTION NEEDS



Source: Yole, Panel Level Packaging 2026

PANEL LEVEL PACKAGING CHALLENGES

Panel level packaging allows...

- Cost reduction and area efficiency
- Scalability and flexibility
- Adaptability from other panel-based processes

But still comes with hurdles...

Economical & supply chain challenges

- Large investments are needed
- Demand to fulfill FOPLP capacity
- Lack of a standard panel size

Technical challenges

- Needed resolution at good yields
- New processes and materials
- High warpage
- Die placement accuracy and die shift
- Process uniformity
- Carrier delamination

Source: Yole, Panel Level Packaging 2026

KEY TAKEAWAYS

- **Panel level packaging is a fast-growing segment** – from ~$300M in 2025 to ~$3B in 2031, 45.5% CAGR
- **Two distinct segments** growing in different directions:
    - **Low- to mid-end PLP:** Core FO/FI, HD FO for consumer, industrial, automotive, telecom
    - **High-end PLP:** UHD FO, 2.5D PLP for datacenter AI and HPC
- **TSMC's CoPoS entry** as the pivotal catalyst for high-end validation, expected in 2029
- **Fragmented but still evolving supply chain:** Samsung, STMicroelectronics, ASE, SiPTORY, Silicon Box, PTI, ECHINT are scaling
- **No standard panel size:** small vs. large panel trade-offs
- **Co-packaged optics** as an emerging application?
- **Widespread list of PLP equipment entrants**
- **Technical & economic hurdles:** warpage, die shift, fine RDL, capex, demand uncertainty