

Glass Substrates and Interposers: Wafer and Panel Scale Manufacturing Processes and Applications

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Advanced packaging and substrates, including interposers, play an increasingly pivotal role in achieving higher bandwidth, enhanced performance, efficient power delivery, larger package sizes, and cost optimization in semiconductor applications. Among these, glass packaging technology has emerged as a transformative solution, particularly at wafer and panel scales, offering unmatched cost efficiency, dimensional stability, and electrical performance for large-body designs.

Over the past 15 years, global investments exceeding \$1 billion have accelerated innovations in glass packaging to align with system-scaling roadmaps in the semiconductor industry. Glass substrates provide critical advantages over traditional organic laminates and silicon wafers, such as minimal warpage, the ability to support ultra-fine high-density redistribution layers (RDL), and scalability to large panel manufacturing for enhanced cost and size efficiencies. Significant progress has been made in addressing challenges like through-glass vias (TGVs) and glass singulation, enabling high-volume manufacturing with precision and reliability.

Glass packaging is uniquely positioned to drive advances in wafer- and panel-scale applications, particularly in areas such as 5G/6G mm-wave integration, AI-driven systems and high-performance computing, and photonics integration. The technology's scalability and compatibility with advanced manufacturing processes make it a key enabler for heterogeneous integration in 2.5D and 3D architectures. This progress is further supported by ongoing R&D, substantial global manufacturing investments, and government initiatives aimed at enhancing local semiconductor ecosystems.

This presentation will delve into the evolution of glass packaging technologies, highlighting their application at wafer and panel scales. It will explore their potential to revolutionize advanced display systems, heterogeneous integration, and other high-performance applications, while addressing remaining technical and business challenges.