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Power Platform Uses Silicon Wafer As The Package Enabling High Integration

[onsemi](#)'s Embedded Power Platform (EPP) is an architecture that uses the silicon wafer itself as the foundation of the package, enabling a highly integrated approach to power system design. Designed as a scalable platform, EPP brings electrical, mechanical and thermal design together from the outset to help customers achieve higher power density, improve system performance and accelerate development in AI, electrification and autonomous applications (Fig. 1).

EPP reimagines the package, transforming it from passive housing into an active contributor to system performance. By using the silicon wafer itself as the package, EPP enables the seamless integration and interconnection of silicon, silicon carbide (SiC) and gallium nitride (GaN) technologies within a highly integrated wafer-level architecture. Multiple devices, including FETs, drivers and controllers, can be embedded together in a single package and co-optimized for electrical, thermal and mechanical performance (Fig. 2).

EPP leverages onsemi's standard 12-inch silicon wafer manufacturing capabilities, bringing key integration processes into the precision and control of the semiconductor fab. This applies mature semiconductor design tools, wafer-level manufacturing and advanced simulation capabilities to power-system integration, helping improve performance while accelerating innovation. As Allyson Fairchild, EPP strategic project lead at onsemi observes, wafer level redistribution (interconnects) produce shorter, more precisely controlled electrical paths and parasitics.

Furthermore, this manufacturing process enables complete power-system co-design, allowing electrical, thermal and mechanical characteristics to be evaluated and optimized together from day one. The result is higher power density, improved system performance, reduced development complexity and faster time-to-market, says the vendor. Fairchild adds that the company is developing a full multiphysics digital twin for EPP, which will aid in product development as well as the customer's design work using EPP products and other activities.

Subaru Corporation is one of the first early engagement partners for EPP, working with onsemi to evaluate how the platform could support future electrified vehicle architectures. Through the collaboration, Subaru will gain early access to engineering samples, simulation models and technical expertise as the companies explore opportunities to improve vehicle performance, streamline development and accelerate innovation.

AI infrastructure, electrified transportation, industrial automation are all competing for the same critical resource: power. Customers need to move and manage more electricity within increasingly compact systems while controlling heat, efficiency, cost and development time.

Yet many of today's power systems are still developed using traditional design approaches that treat power electronics, mechanical design and thermal design as separate engineering challenges, with each layer optimized independently and sequentially. Decisions made at one stage can create compromises in another, leading to additional engineering iterations, costly late-stage changes and longer development cycles.

EPP replaces that sequential model with a common platform that can be co-designed, co-simulated and co-optimized. According to onsemi, this approach is designed to help customers:

- Achieve 3x to 5x higher power density, depending on the application
- Accelerate development cycles to as little as four months
- Improve thermal performance and heat dissipation
- Reduce electrical losses through lower parasitic inductance
- Enable greater device control and higher switching frequencies
- Identify design tradeoffs earlier and reduce costly late-stage changes
- Scale a common architecture across power levels, device types, applications and semiconductor technologies

The company offers examples of EPP's performance benefits in AI infrastructure and EV applications. For instance, for AI rack applications, in an early EPP-based solid-state circuit-breaker design, the EPP solution was approximately 50% smaller and 20% cooler than existing designs. By reducing packaging overhead and using the full EPP footprint to conduct heat, EPP can support more compact power systems, improve thermal management and enable greater power density in AI infrastructure, says the vendor.

EV traction inverters also stand to benefit. These inverters are often constrained by efficiency losses, thermal limitations, development complexity and system size. EPP addresses these challenges with up to 4x higher power density and 15% lower power losses compared to conventional approaches, according to the company, enabling smaller, lighter and more efficient designs.

EPP's scalable architecture supports a single inverter platform spanning low-end to high-end vehicle applications, allowing automakers to reuse a common design across multiple vehicle models and power classes. As onsemi explains, this approach can reduce R&D and manufacturing costs, accelerate qualification and development cycles, improve vehicle range or lower system costs, and help bring new vehicle programs to market faster.

EPP is expected to begin sampling in 2026 with strategic customers and ecosystem participants across automotive and AI applications. For more information, contact the [company](#).

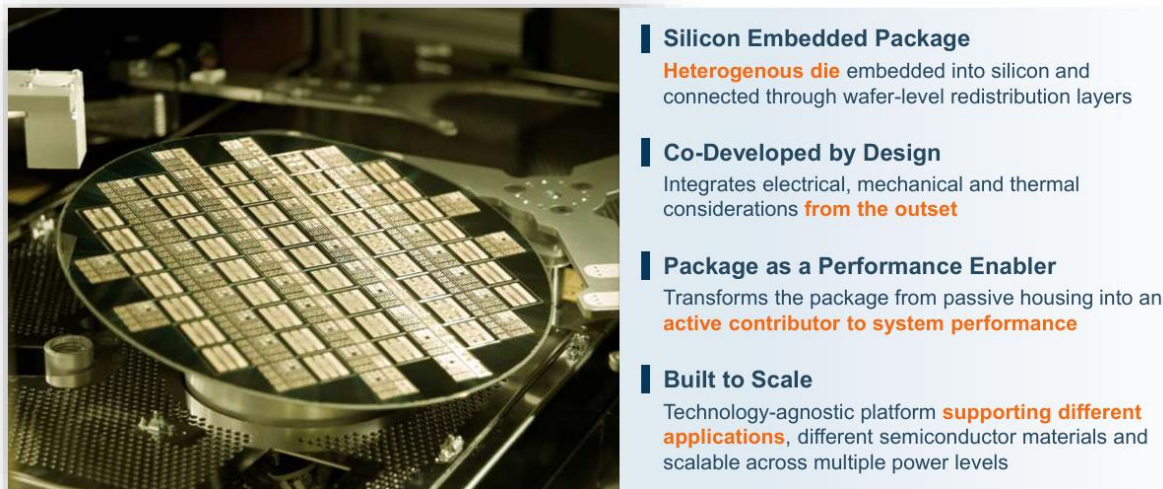


Fig. 1. onsemi's Embedded Power Platform (EPP) integrates multiple dies into a single silicon device. By jointly optimizing electrical, mechanical and thermal performance within a single architecture, EPP is said to enable 3x to 5x higher power density compared with current solutions with a highly integrated approach to power system design. This technology targets AI infrastructure and EV applications.

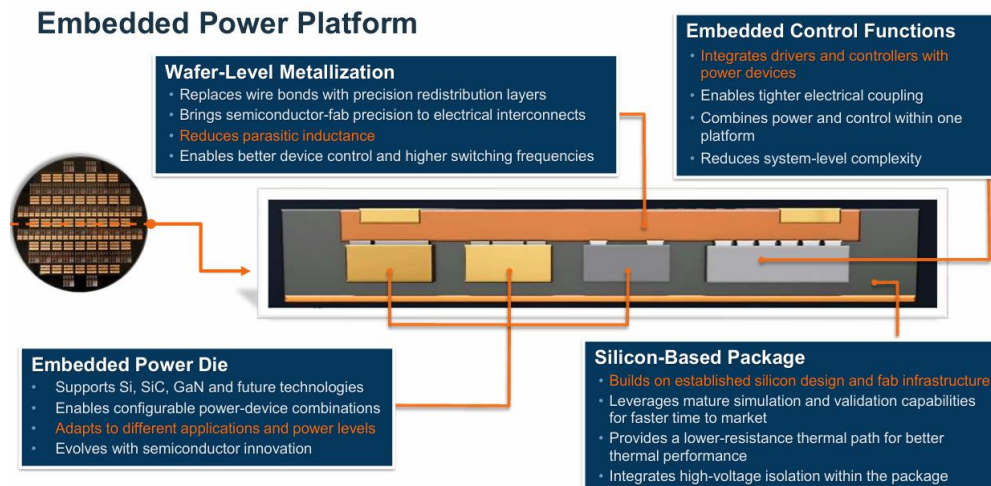


Fig. 2. Embedding different die types within a silicon wafer offers a variety of benefits as noted in this drawing. In particular, the ability to reduce parasitic inductance through shorter interconnects and achieve high isolation without compromising thermal performance are key enablers of high-power performance. As Allyson Fairchild explains, traditionally the material optimized for electrical isolation is not thermally conductive. But within silicon wafers, glass-like materials can be used for isolation, which are more thermally conductive. In turn, this allows the entire surface area of the silicon structure to conduct heat. "We're getting 2X the thermal performance in simulation," says Fairchild.