



Makrolon® Makrofol®

“Nighthawk” IMSE® Demonstrator

Enabling smart surface design with high performance materials



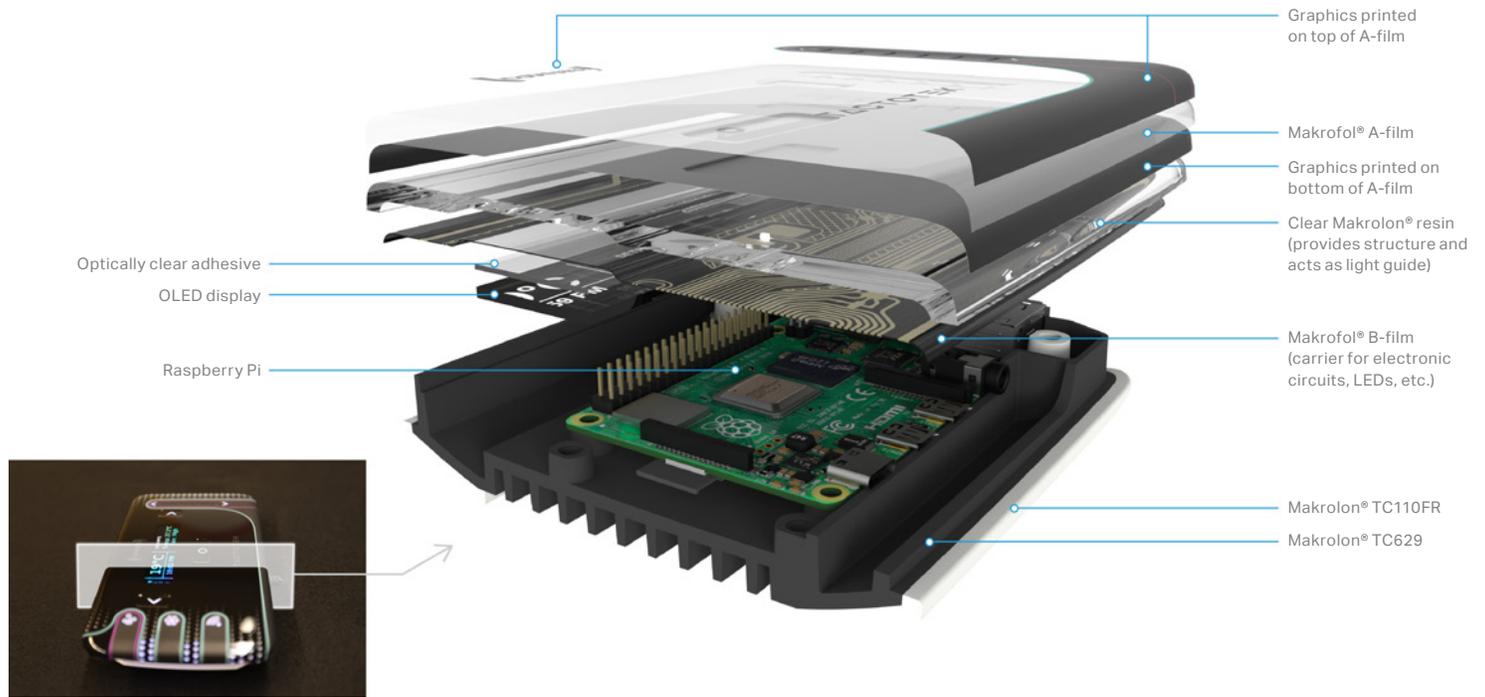
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COVESTRO

The Nighthawk Demonstrator is the result of collaboration between Covestro and TactoTek, leveraging IMSE (In-Mold Structural Electronics) technology and high performance materials. IMSE parts offer numerous advantages over traditional electro-mechanical assemblies. By achieving electronics functionality, cosmetics, and structure in a singular part, IMSE maximizes resource efficiency, design flexibility, and reliability.

Sandwich Structure of IMSE Part



The IMSE Manufacturing Process



1. **Film printing** – decoration applied to A film, silver ink applied to B film



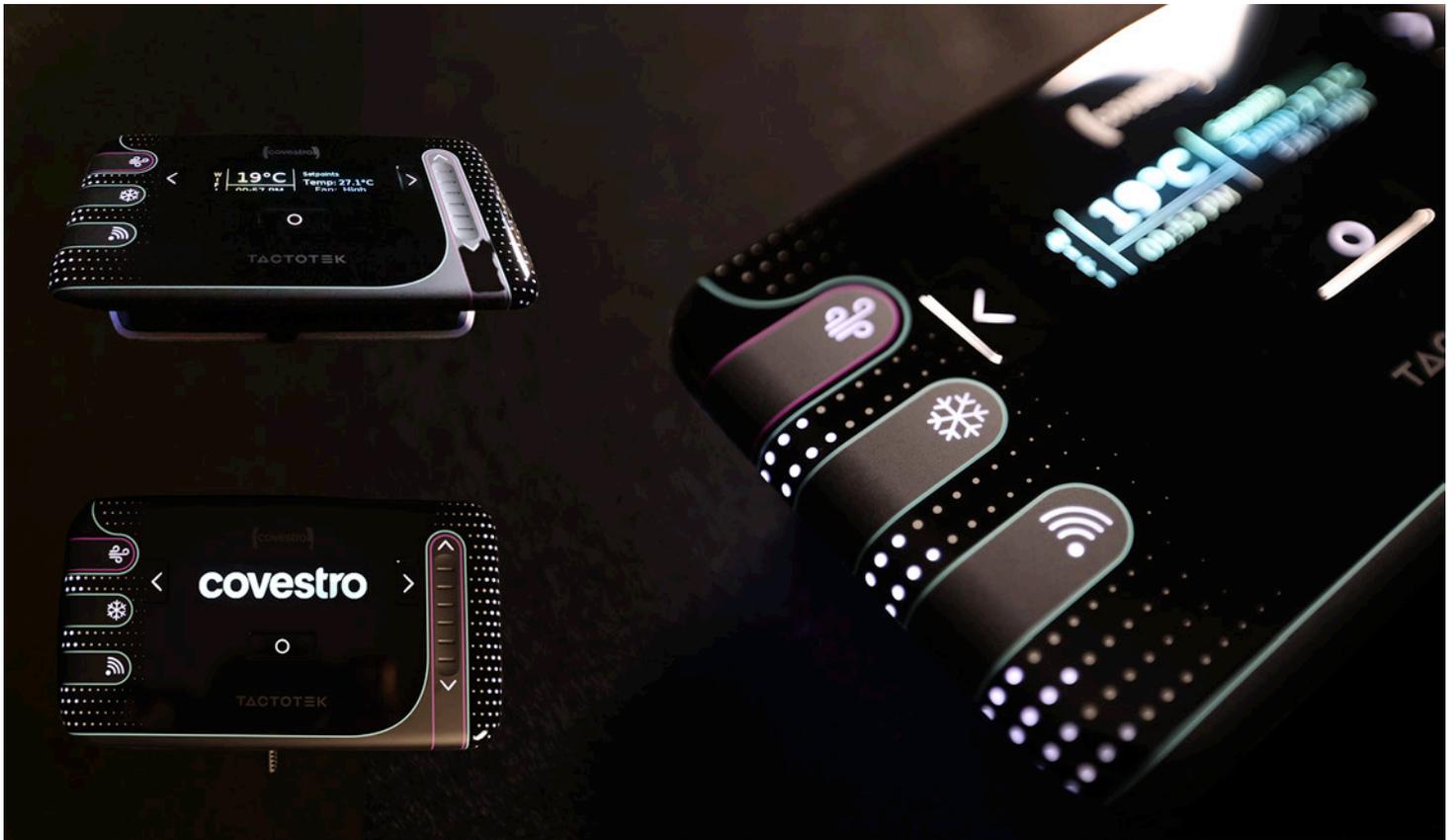
2. **Component Mounting** – LEDs and other components mounted to B film



3. **Film Forming** – films formed under heat and high pressure



4. **Injection molding** – specialty polycarbonate injected between films to build sandwich structure



Any surface becomes a smart surface

The Nighthawk Demonstrator illustrates next generation design of functionalized and seamless smart surfaces. Using state-of-the-art polycarbonate materials from Covestro, harmonized with TactoTek's advanced approach to electronics integration, the Nighthawk demonstrator highlights how any device can be:

Thinner & Lighter

- Electronics embedded in structure
- 90% space reduction
- 50% weight reduction
- Efficient use of plastics

Infinitely Customizable

- State of the art materials enable infinite surface functions
- Maximum geometric design freedom (e.g. color, finish, geometry)

Reliable & Sustainable

- Reduced modes of failure through component encapsulation
- Reduces CO₂ emissions by 60%, cradle to gate
- Easily upgraded through software updates

Cost Effective

- Reduced value chain complexity
- Cost effective versus traditional HMI manufacturing
- Reduces SKUs for multiple models

At Covestro, creating a brighter future means embracing full circularity to achieve 100% climate neutrality by 2035. Our circularity initiatives leverage alternative energy and raw material sources, and extend polymer life-cycles through advanced recycling initiatives. See more at <https://www.covestro.com/en/sustainability>

IMSE Technology unlocks the future of sustainable electronics by generating applications with

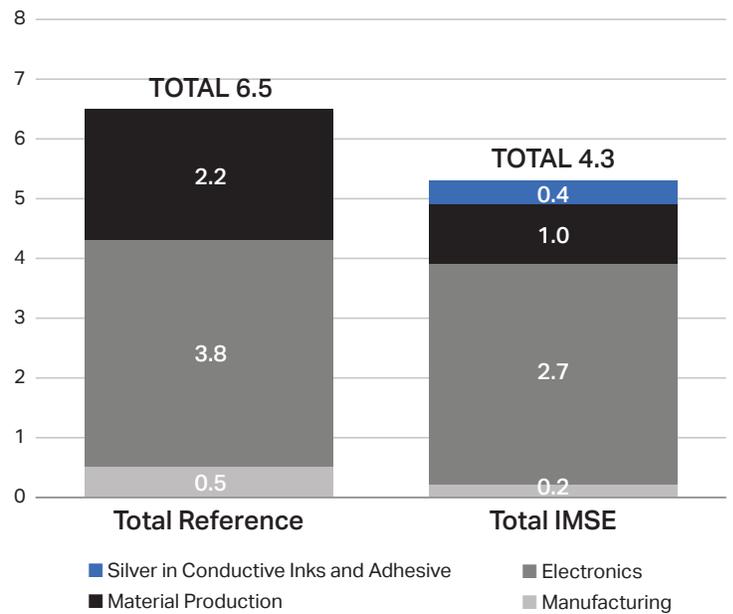
- **Greater material efficiency:** Reducing size and weight generates applications that require less material.
- **Longer lifespan:** IMSE applications are mono-material solutions, more reliable, and easy to upgrade and recycle.
- **Reduced production complexity:** IMSE simplifies traditional manufacturing tooling while also reducing waste.

At the forefront of innovation and sustainability, Covestro launched the world's first carbon neutral polycarbonate in 2021*. By replacing fossil-based materials with biomass materials, Makrolon® RE polycarbonate offers the same high quality performance with net zero carbon footprint. Makrofol® films made from partial biomass materials further contribute to reducing CO₂.

* [Covestro starts offering the first climate-neutral* polycarb](#)

IMSE and Reference global warming potentials, in kg CO₂eq.

Life cycle stages stacked. Functional unit: one piece of car control panel





“Covestro materials, Makrolon for the polycarbonate, Makrofol for the polycarbonate film, are instrumental to the structural integrity and performance of those parts in demanding industries like automotive and high end electronics.”

– Dave Rice, SVP, Marketing and Business Development TactoTek



IMSE parts demand materials with high optical purity, ideal flow, consistent formability, and excellent dimensional and thermal stability. Covestro provides process-compatible Makrolon polycarbonate resins and Makrofol films tuned for IMSE part manufacturing. All materials used in the Nighthawk demonstrator have passed the rigorous TactoTek T3 reliability standard.

Makrolon: 2207, 2207 RE*, Ai2217, and Ai2217 RE*

* RE: materials with 72% bio-circular content (mass attributed)

Makrofol: Makrofol AC*, Makrofol DE MB**

* AC: film made from partially bio-based materials

** DE MB: film with bio-circular content (mass attributed)



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TACTOTEK



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