Aledia

WHITE PAPER

FLEXINOVA



Enabling Scalable and Cost-Efficient MicroLED Adoption with a Flexible Platform

The Display Market at a Turning Point: MicroLED vs. OLED and LCD

The display industry is undergoing a fundamental shift. While OLED and LCD technologies continue to dominate the market today, emerging demands for higher performance, enhanced durability, and greater energy efficiency are creating strong momentum for microLED displays.

Market Drivers

In consumer electronics, automotive, augmented reality (AR), and wearable devices, the demand for next-generation displays is growing rapidly. Manufacturers and end-users alike are seeking technologies that can deliver:

- **Higher brightness** for better outdoor readability and visual impact
- **Superior energy efficiency** to extend battery life in portable devices and contribute to global energy savings
- **Increased pixel density** to enable ultra-high resolution screens
- **Enhanced durability and lifetime** to reduce environmental impact and improve product resilience

At the same time, sustainability requirements are becoming key decision factors. Reducing the energy consumption and improving the recyclability of displays is no longer optional, it is now essential for market competitiveness and regulatory compliance.

Challenges for MicroLED Adoption

Despite its unmatched potential, the widespread adoption of microLED technology still faces several hurdles:



- **Manufacturing costs** remain high, especially for devices requiring chips smaller than 10 µm.
- **Mass transfer yield and throughput** need significant improvements to support industrial-scale production.
- **Integration with existing TFT backplanes** and diverse system architectures adds another layer of complexity.

These barriers have slowed microLED deployment, despite its clear performance advantages.



Opportunity for Disruption

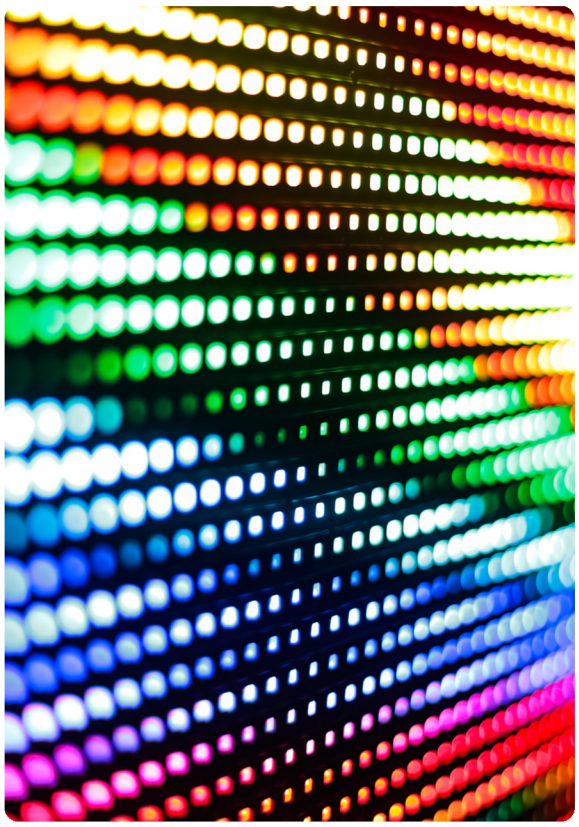
In both automotive and consumer markets, a significant opportunity is opening for microLED technologies that can meet stringent requirements:

- **Automotive displays** demand extreme reliability, high brightness, wide operating temperature ranges, and support for a broad range of applications such as functionalized knobs, transparent displays, and flexible form factors.
- **Consumer devices** — from wearables such as smartwatches to smartphones, tablets and laptops — seek small form factors, lightweight designs, and low power consumption without compromising on visual quality.

The Gap in the Market

Today, there is a clear gap for a scalable, cost-effective microLED platform that can deliver ultra-small chips with high efficiency, compatibility with existing manufacturing ecosystems, and flexibility to serve diverse applications.

This is where FlexiNova comes in.

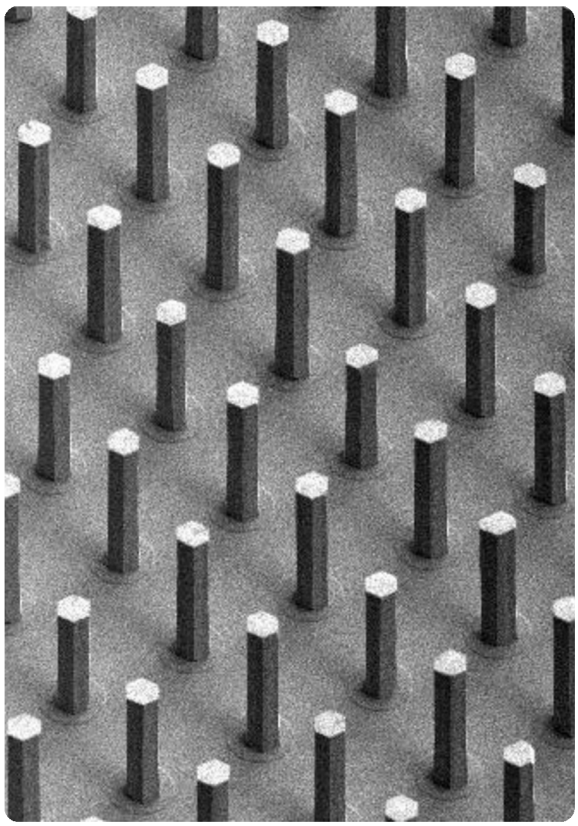


Platform 1 Technology: High-Performance MicroLEDs on Large Silicon Wafers

To deliver microLED technology at scale, performance alone isn't enough — industrial viability is key. Aledia's Platform 1 (PT1) addresses both. Based on 3D GaN nanowire structures grown on standard 8" and 12" silicon wafers, PT1 forms the technological foundation that enables Aledia's microLED vision to become a reality.

A Unique 3D Nanowire Architecture

Unlike planar LEDs, Aledia's nanowire growth creates self-contained, vertical LEDs where each nanowire acts as a complete light-emitting device. These structures are grown without etching through quantum wells (QWs) and require no passivation, reducing defect formation and surface recombination losses. Grown on stress-free silicon substrates, this architecture ensures excellent crystalline quality and a low defect density, even at very small sizes. The result is a breakthrough in scalable, uniform, and high-efficiency microLED production.

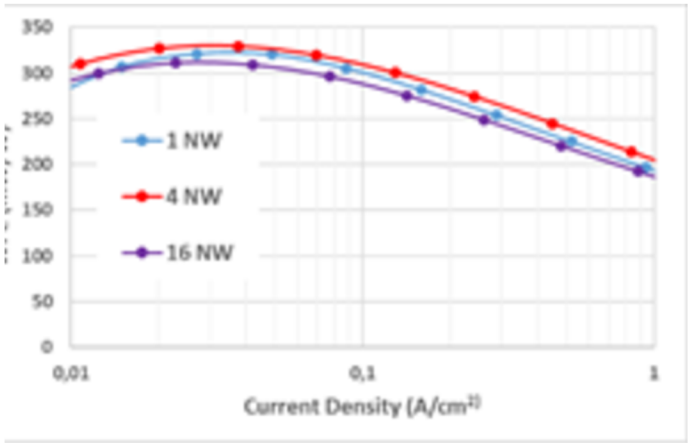


Core-shell nanowire growth on 200mm 5µm tall wires, 5µm pitch

World-Class Performance at All Scales

PT1's performance metrics place it at the forefront of the microLED industry:

- EQE ≥ 37% @ 1.5 µm chip size — with dome extraction — a world record at wafer level.
- Size-independent efficiency, maintaining top-tier performance across all chip dimensions, from below 5 µm to above 100 µm.
- Exceptional uniformity, with <2 nm wavelength deviation across full 8" wafers.
- No EQE degradation after mass transfer, validating the robustness of the architecture and its compatibility with high-throughput assembly techniques.

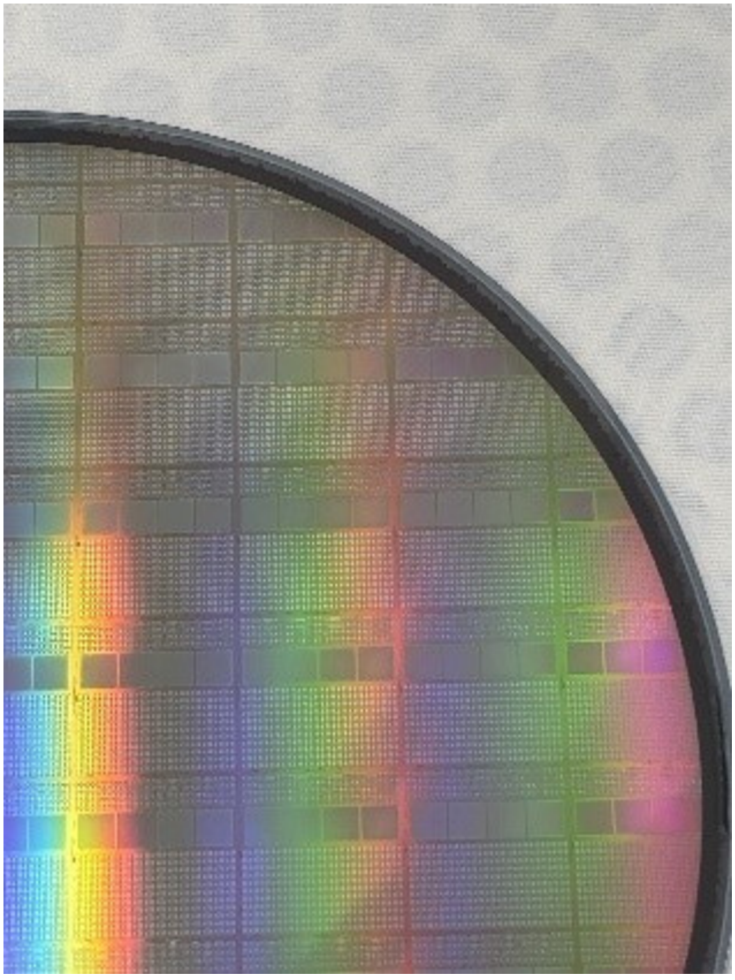


Consistent High Performance Across All Chip Sizes and Several Wires Counts.

Designed for Industrialization

Platform 1 isn't just a research breakthrough, it's built for industrial deployment:

- **Fast epitaxy**: A full nanowire LED stack is grown in under 3.5 hours, compared to 6–8 hours for conventional 2D LEDs, reducing time and cost.
- **Wafer-level compatibility:** PT1 uses SEMI-standard 8" and 12" silicon wafers, paving the way for integration with existing CMOS infrastructure and mass production environments.
- **Manufacturing readiness:** Aledia's Manufacturing line at SDM (Saut Du Moine), near Grenoble is already operational, supporting the transition to volume production.



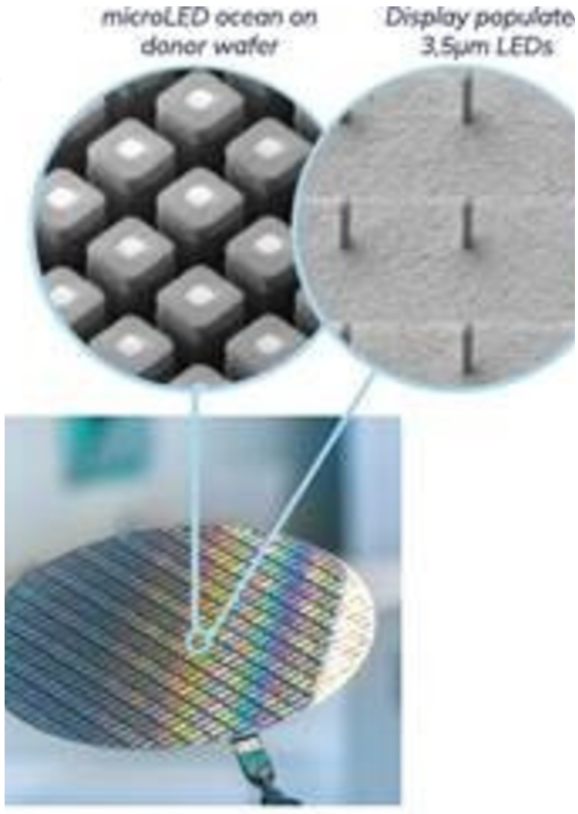
FlexiNova: A Scalable Platform Built for Integration, Efficiency, and Custom Design

While Platform 1 delivers unmatched nanowire microLED performance, FlexiNova transforms that core technology into a product-ready platform, designed to meet the real-world needs of display makers. Its name reflects its core strengths: Flexibility in Size, Design, and Voltage, all delivered with industrial scalability and proven transfer performance.

Flexi Size: Tailored Dimensions for Optimal Design

FlexiNova supports a broad range of chip sizes, from ultra-compact 15×30 µm² formats down to below 5 x5 µm². This size flexibility enables:

- :Seamless adaptation to customer-specific backplanes, transfer methods, and system architectures.
- Optimization at system level, whether for maximizing active area, improving pixel aperture ratio, or reducing assembly complexity.
- Greater freedom in mechanical and electrical design, supporting thin, compact, or curved form factors in next-generation displays



Flexi Design: Chip Architectures Optimized for Integration

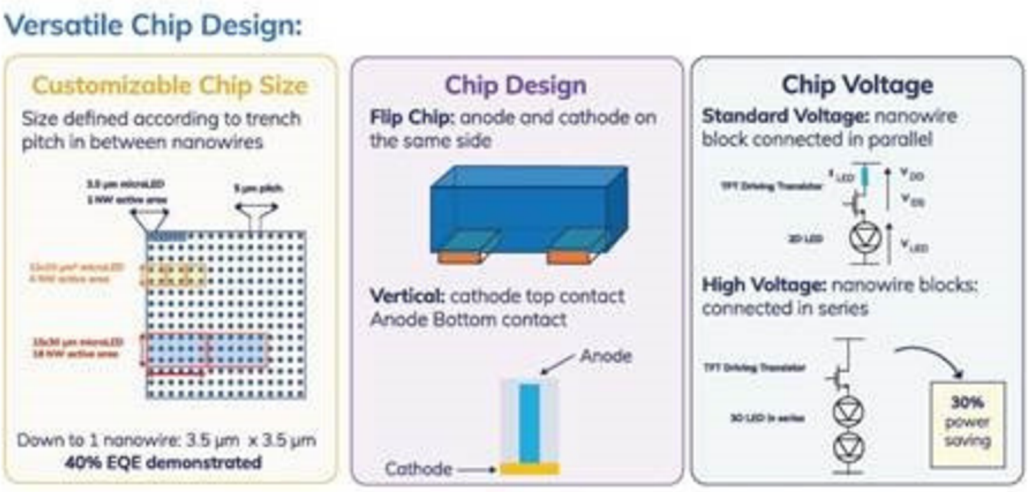
FlexiNova supports parallel and serial nanowire configurations within a single die, enabling customized electrical behavior and system performance. Its unique features include:

- **Built-in redundancy:** multi-wire chips maintain performance even in the presence of local defects.
- **Optimized layouts** for pixel-level integration, allowing for denser arrays and better current spreading.
- **Compact footprints** ideal for high-resolution displays and automotive HUDs, where space and reliability are critical, as well as for transparent displays, where the LED must occupy the smallest possible portion of the pixel area.

Flexi Voltage: Smarter Power Distribution, Longer Life

One of the most powerful differentiators of FlexiNova is its support for high-voltage operation:

- Nanowires can be connected in series, increasing the forward voltage (depending on the number of wires per chip) while reducing driving current at TFT level.
- This lowers the electrical losses on TFT backplanes, improving durability and enabling more efficient power management.
- Especially suited for automotive and battery-powered devices, where thermal management and long-term operation are essential.



FlexiNova: The Gateway to Consumer-Scale MicroLED Adoption

For years, microLED technology has promised a revolution in display performance, but has remained largely confined to lab demos and low-volume prototypes. FlexiNova combines high efficiency, industrial manufacturability, and system-level adaptability in a single platform, unlocking the path to mass-market deployment.

The Missing Link Between Innovation and Adoption

FlexiNova addresses the three key barriers that have long delayed microLED commercialization:

- **Performance**: unmatched EQE and visual quality, even at ultra-small chip sizes.
- **Scalability**: production-ready on 8” and 12” silicon wafers, with proven mass transfer compatibility.
- **Adaptability**: flexible chip sizes, voltages, and architectures for seamless system integration.

This unique combination enables display makers to shift from technology evaluation to product innovation.

Unlocking Next-Generation Products

FlexiNova's versatility empowers a new generation of display applications, across consumer, automotive, and industrial segments, where traditional OLED and LCD technologies are reaching their limits:



Wearables devices

- Ultra-small chips enable ultra-sharp resolution
- Low energy consumption extends battery life
- Superior readability even in bright daylight



TV Walls and indoor professional displays

- High peak brightness and perfect contrast
- Custom chip sizes for pixel-perfect scaling
- Cost-effectiveness through standard silicon processing

Automotive

- Transparent microLED displays as instrument clusters or integrated into windshields or windows
- Freeform and stretchable formats adapted to any cockpit surface
- High-reliability chips for HUDs and instrument clusters with extreme brightness (>10,000 nits) and temperature stability



Emerging use cases

- Smart mirrors, industrial visualization panels, infotainment systems

A Scalable Platform for a Fragmented Market

The flexibility of FlexiNova means OEMs no longer need to compromise between innovation and industrial feasibility. Whether the priority is form factor, lifetime, cost, or resolution, FlexiNova adapts, not only to current needs, but to future product evolutions.

Facing the Remaining Challenges

MicroLED technology has made tremendous strides in performance, manufacturability, and scalability. Yet no company can unlock its full potential alone: collaboration across the entire ecosystem is essential.



What's Left to Solve?

Despite the breakthroughs enabled by Aledia's nanowire-based Platform 1 and FlexiNova, several industry-wide challenges remain:

- **Efficient color conversion :** Further Develop quantum dots and nano-phosphors technologies to meet the resolution, lifetime stability, and panel integration requirements of high perfromance full-color microLED displays.
- **Scalable mass transfer solutions** : Standardize high-yield, low-cost transfer of millions of microLEDs per hour is essential for consumer-scale production, like direct transfer from Chip on Wafer demonstrated at R&D scale.
- **System-level optimization** : From TFT backplane compatibility and interconnect design to driving schemes, power distribution, and optical design optimization, successful integration demands end-to-end collaboration.

These challenges go beyond any single technology, and must be addressed in a collaborative approach at system level to achieve sustainable industrialization.

Collaboration is the Key

To accelerate microLED adoption, we need strong partnerships across the entire value chain:

- **TFT backplane suppliers:** to ensure seamless chip-to-panel integration with maximum efficiency.
- **Display manufacturers & end-users:** to align on real-world use cases and product specs.
- **Color conversion experts & equipment vendors:** to co-develop and standardize scalable solutions for mass production.

Aledia is committed to an open ecosystem approach, working through:
Strategic co-development programs
Early-stage design collaborations
Transparent dialogue on technology roadmaps and requirements

Today, the technology is mature and the platform is scalable. The next step is ecosystem alignment. With FlexiNova, Aledia is ready to support the most ambitious microLED programs, and we believe that long-term success will be collective.

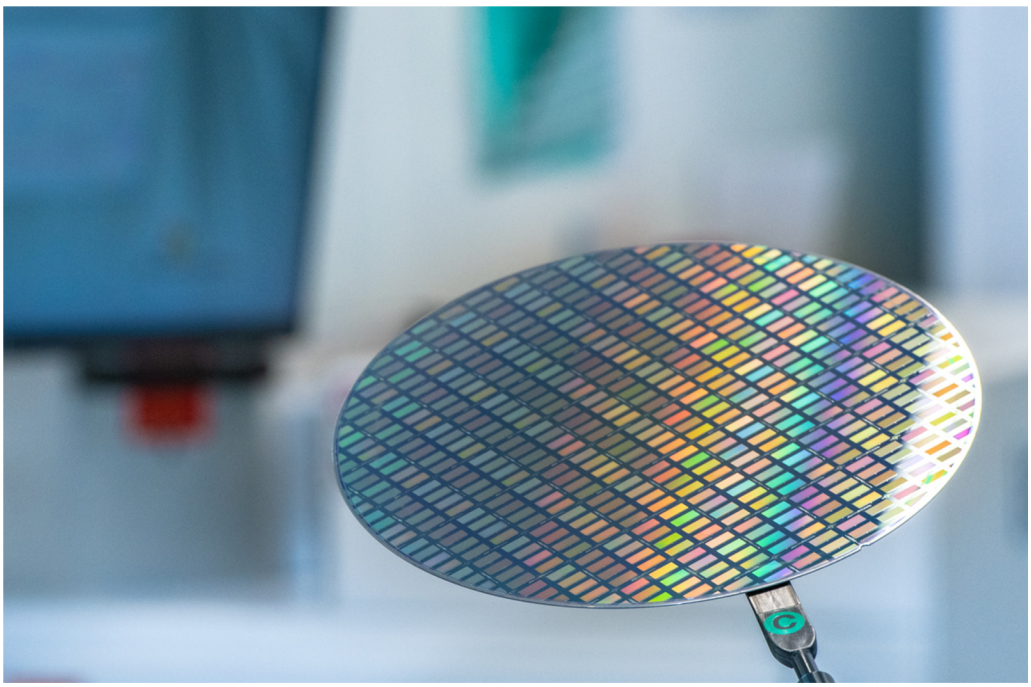
Let’s Build the Future of MicroLED Displays – Together

The microLED revolution is not a distant vision, it’s happening now. If you’re a display maker, system integrator, or OEM seeking the next leap in performance, energy efficiency, and integration flexibility, FlexiNova is ready.
Are you: Looking to integrate direct-view microLEDs into your product roadmap?
Evaluating microLED-based solutions for next-gen consumer or automotive displays?
In search of cost-effective, ultra-small, high-efficiency chips ready for industrial ramp-up? Looking for a microLED solution that is ahead of current display industry capabilities?

What Aledia Offers

Whether you're early in your evaluation or scaling up to production, our team is here to support your goals. Let’s explore how we can:

- Evaluate our technology in your systems: Understand how our chips perform in your architecture.
- Provide FlexiNova samples for prototyping: Test and validate with your display stack.
- Co-develop microLED solutions tailored to your needs: From opto-electrical specs to chip format and integration constraints.
- Grow together within an open innovation ecosystem: Join industry leaders shaping the future of displays.



Let’s Start the Conversation

To discuss your project or request samples, contact our team today:

- Eric Butaud – Senior Director of Product Marketing: eric.butaud@aledia.com
- Frédéric Moutiers – Senior Director of Business Development: frederic.moutiers@aledia.com

The future of microLED displays is collaborative.
Let’s build it — together.



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