PLAYNITRIDE -MicroLED Industry Pioneer

Mar. 20, 2024

Dr. Charles Li, Founder and Chairman of PlayNitride (6854 TT)

MicroLED has started changing the display industry landscape since 2023.
PlayNitride, **the world's first publicly-traded MicroLED company, will be driving a decade-long paradigm shift in the global display technology.**

OLED and LCD

BOE
SAMSUNG
LG
AUO
INNOLUX

US$411bn
market cap

* Total market value as as of March 11, 2024

Disclaimer

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Outline

I. What is MicroLED and Mass Transfer?

II. MicroLED – The Ultimate Display Technology

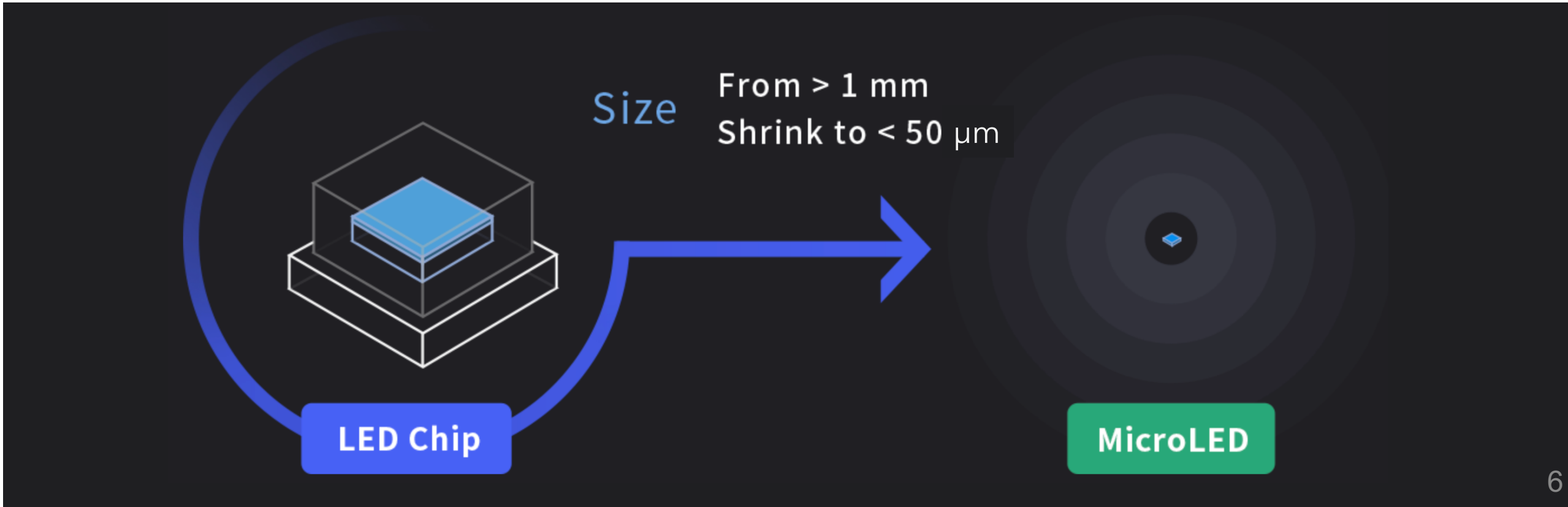
III. PlayNitride's MicroLED Leadership

IV. Appendix

I. What is MicroLED and Mass Transfer?

LED Structure Miniaturization

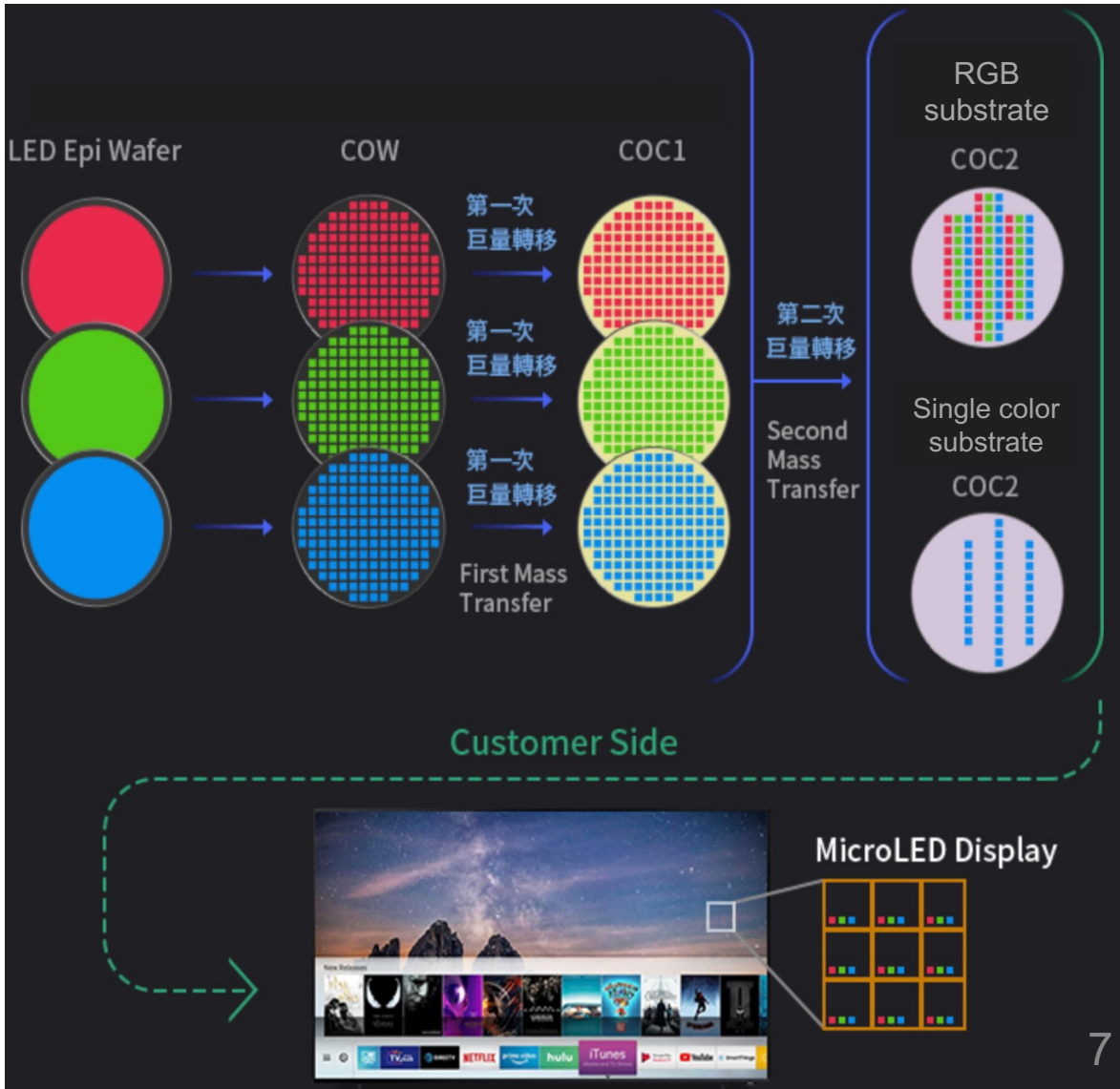
MicroLED, as the name suggests, is to miniaturize the structure of the LED by removing the LED package and substrate, so that the size of the LED device can be reduced to **less than 50μm**. A major feature of MicroLED is that the LED substrate is removed, leaving only the epitaxial film, which provides the MicroLED chip that is light, thin and short. It can be used for mass transfer production and meet the pixel size of various displays.



Mass Transfer and Chip on Carrier (COC)

During MicroLED display production, it is necessary to **mass transfer the three-color chips of R/G/B from their respective epi wafers to the temporary substrate and arrange the chips to the correct position** according to the pixel size of the display, so as to facilitate the subsequent mass transfer process.

PlayNitride invented such already arranged temporary substrate called Chip On Carrier (COC). COC has become the industry standard and a key process in MicroLED display production.

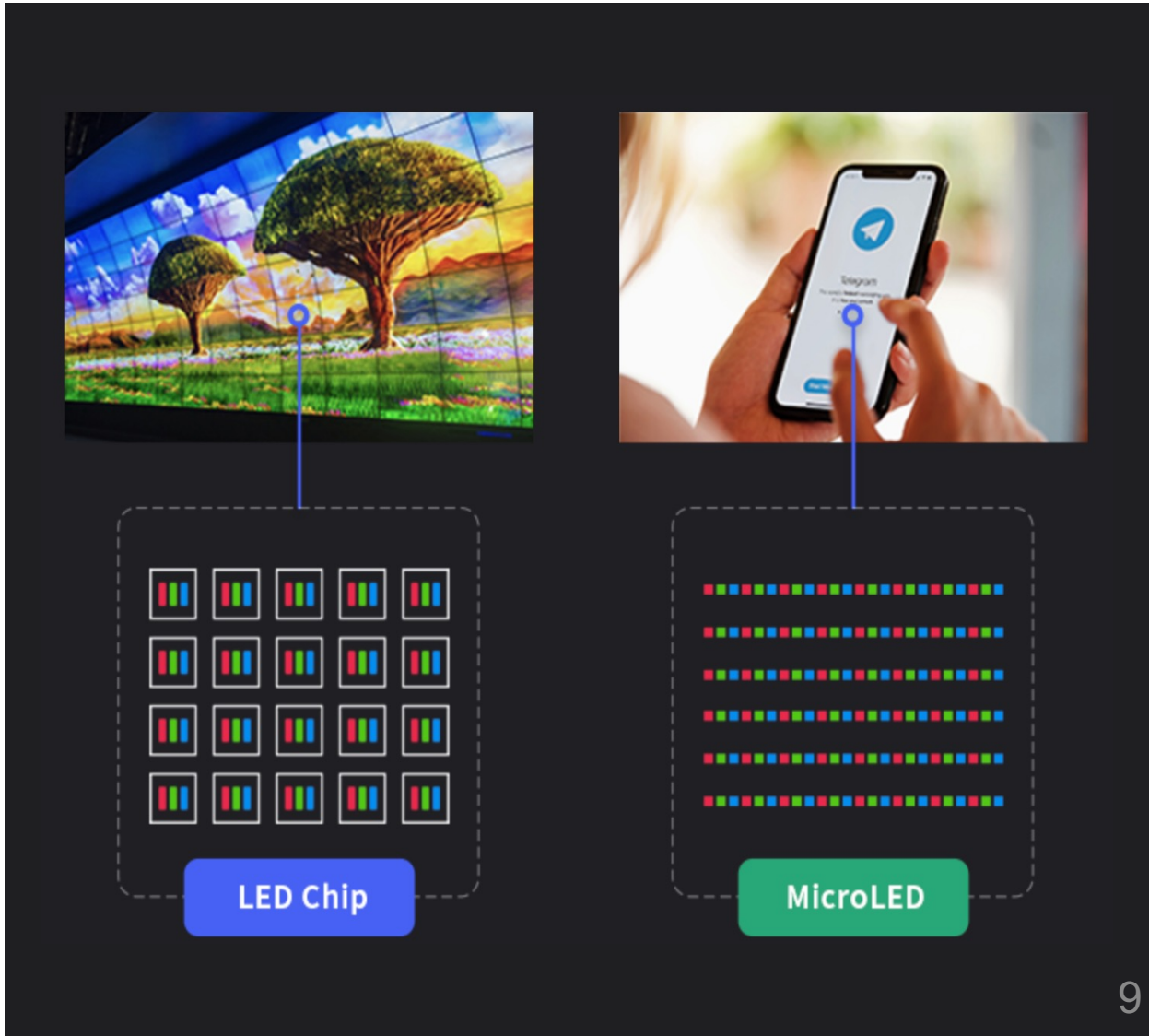


II. MicroLED – The Ultimate Display Technology

MicroLED Display

The MicroLED display combines the technologies of **LED miniaturization and arraying, and directly mass transfers and bonds the MicroLED chips to the driving backplane**, which has circuit structure design.

Ordinary LEDs can only be used in large video walls due to their large size, while **micron-scale MicroLED chips can be used in watches, mobile phones, cars, computer screens, TVs, AR/VR and other applications in various sizes and fields.**



We Are The Best Performer of MicroLED Display

Higher Efficiency & Lower Power Consumption

Longest Lifetime with Best Reliability

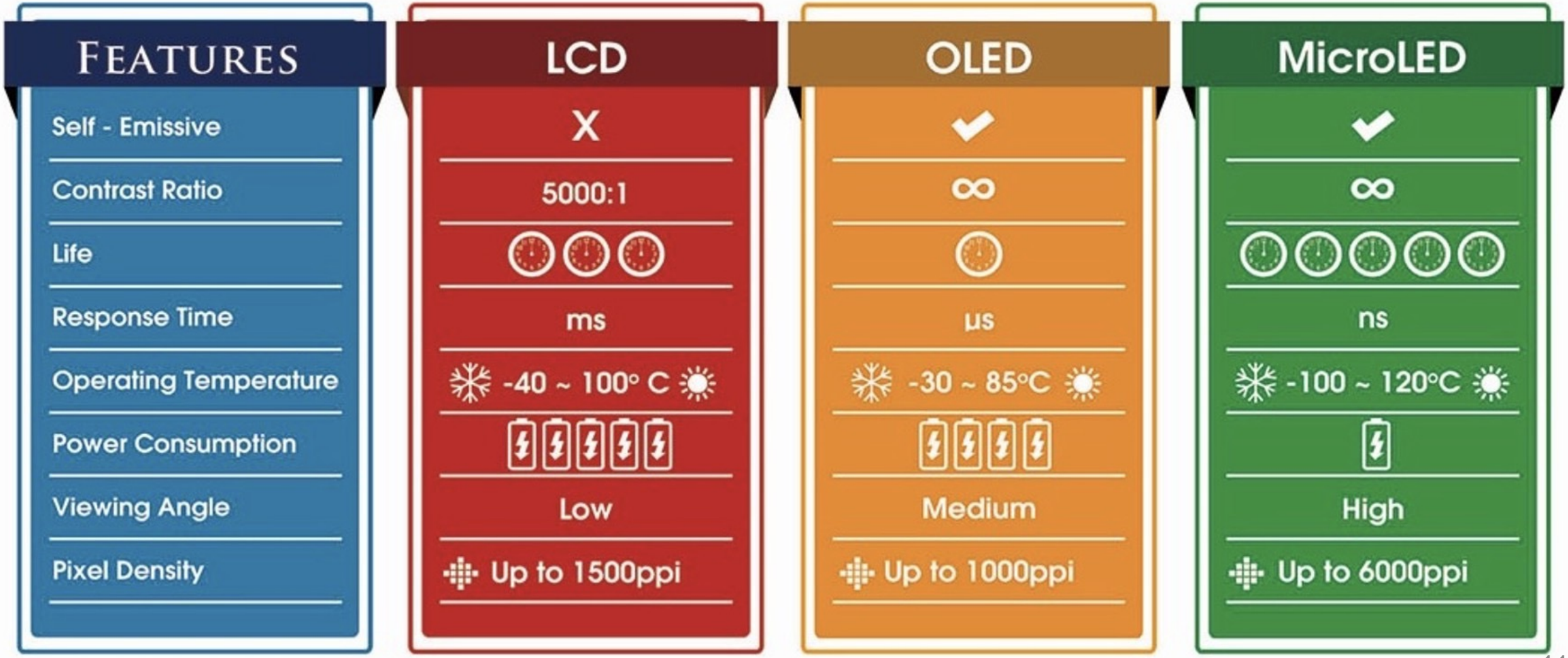
Highest Brightness & Contrast Ratio

Fastest Response Time

Highest Pixel Density

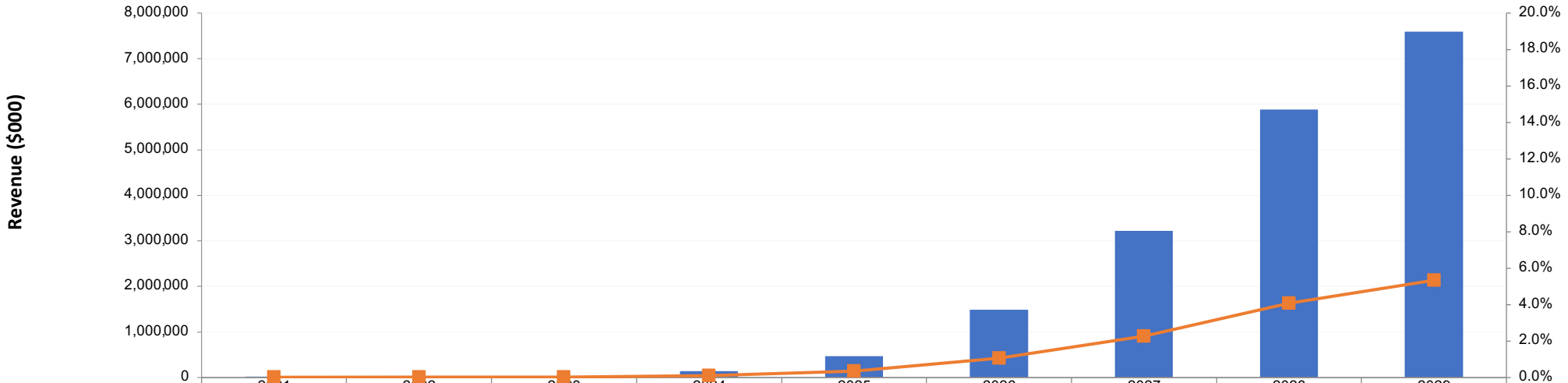
Flexible and Bendable

MicroLED Display Is The Ultimate Display Technology



MicroLED Display Market: US$7.6bn, 2029

MicroLED display revenue forecast (annual)



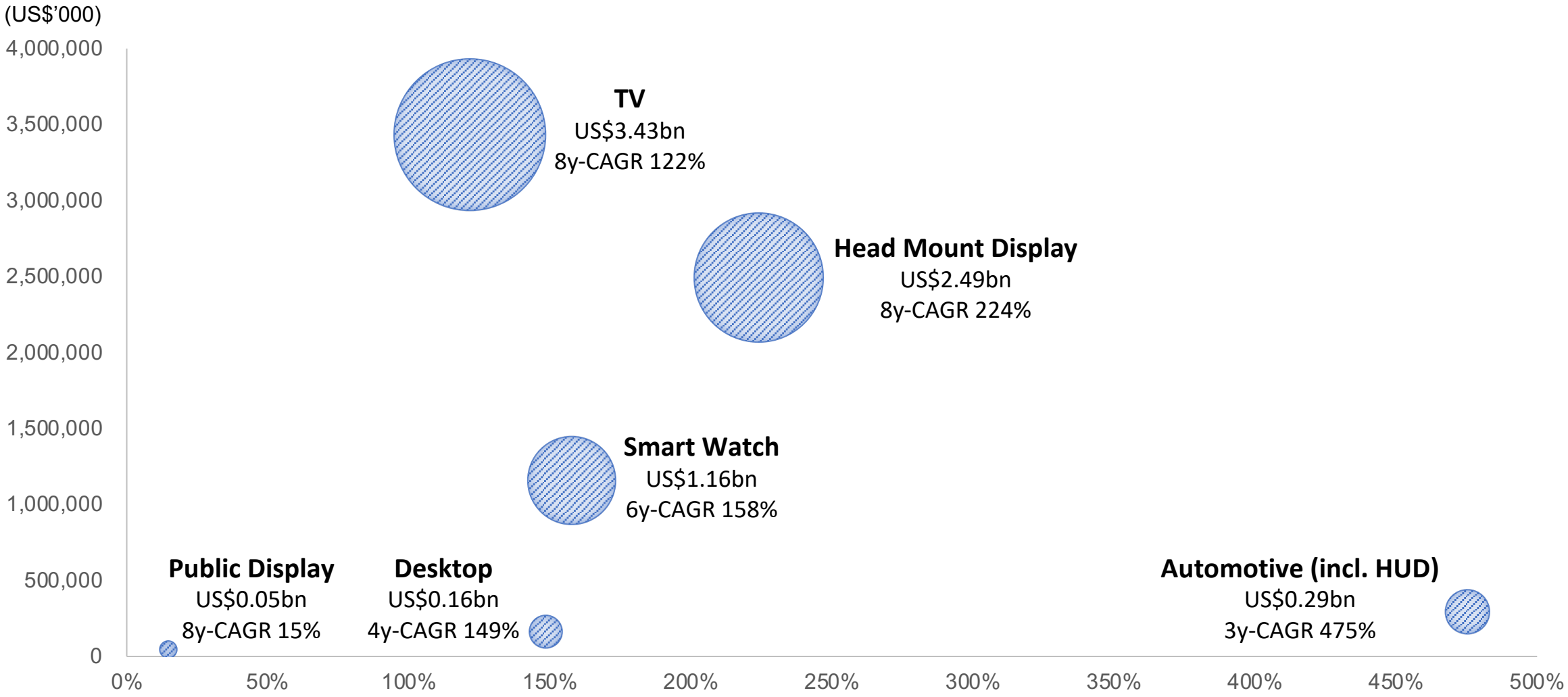
	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue ($000)	21,406	24,282	36,047	139,917	464,711	1,493,377	3,221,623	5,880,581	7,588,159
Share (%)	0.0%	0.0%	0.0%	0.1%	0.3%	1.1%	2.3%	4.1%	5.3%

Annual revenue for MicroLED displays is about $24.3mn in 2022 and is expected to reach $36.0mn in 2023. Revenue from MicroLED displays will increase to **$7.6bn in 2029** to account for **5.3%** of the total Flat Panel Display (FPD) revenue of $143.2bn, with a **127.2% CAGR** during 2022–29.

Annual shipments of MicroLED displays are about 31 thousand units in 2022 and are expected to reach 125 thousand units in 2023. Shipments of MicroLED displays will increase to **42.4mn units in 2029** to account for **1.1%** of total FPD shipments, with a **180.6% CAGR** during 2022–29.

(source: Omdia Report)

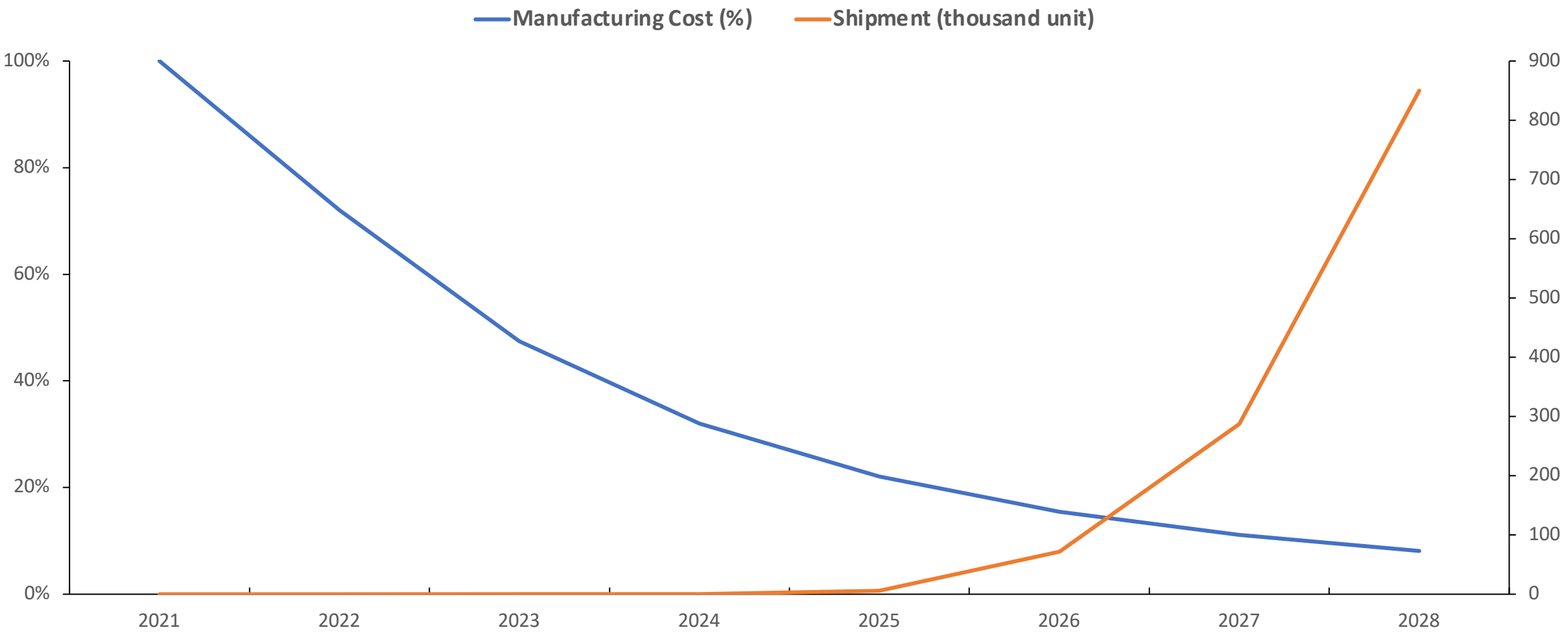
2029 MicroLED Application Market Size & CAGR



(source: Omdia Report)

Reduce MicroLED Cost For Market Penetration

The Cost of 75-inch 3840x2160 LTPS/RGB MicroLED Display Cost vs. MicroLED TV shipment

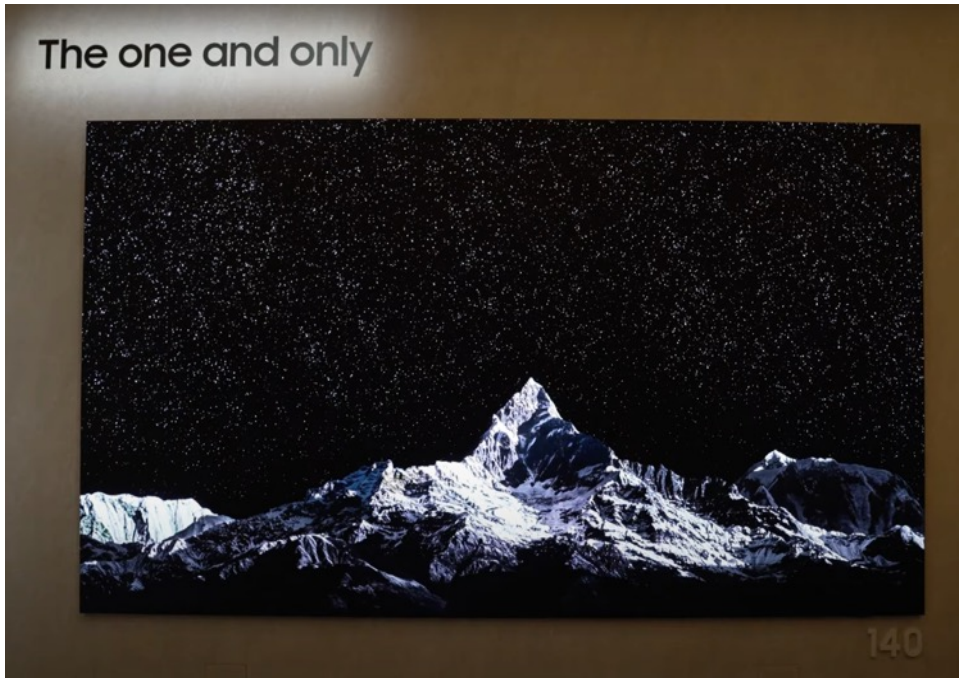


(source: Omdia Report)

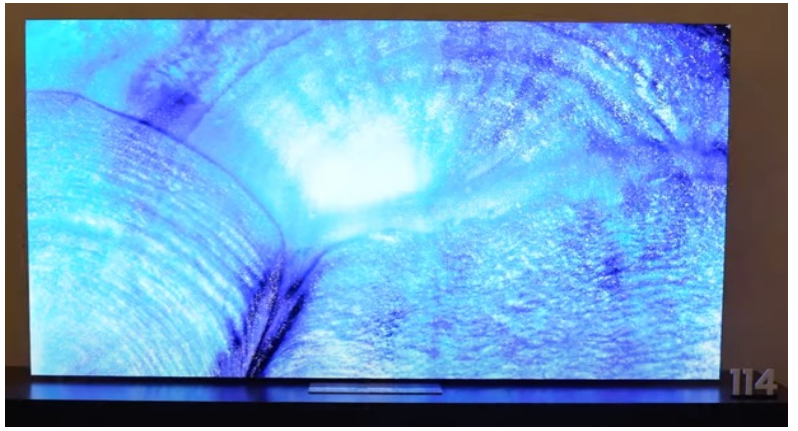
MicroLED Displays Can Be Everywhere

MicroLED TVs in CES 2024

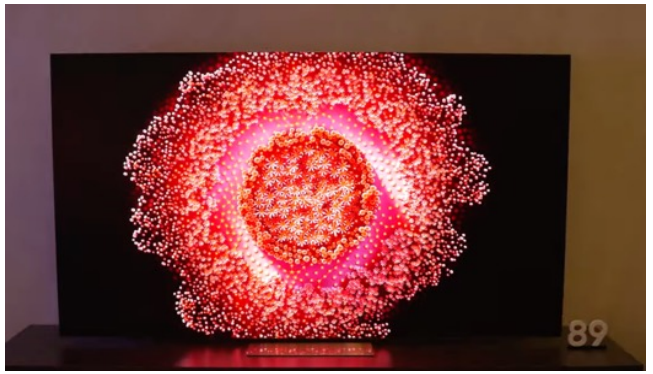
140"



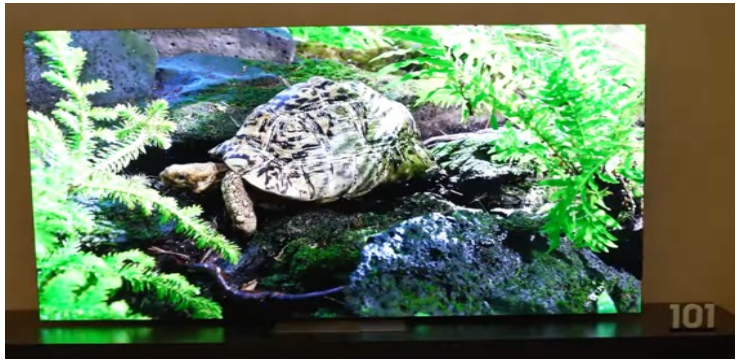
114"



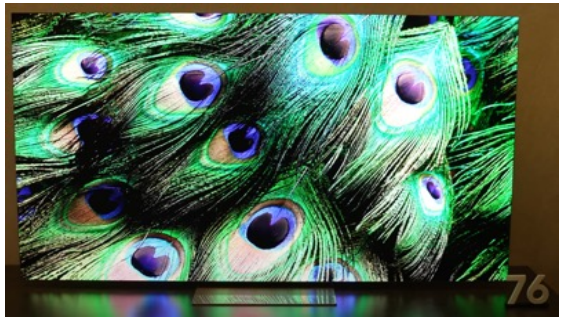
89"



101"



76"



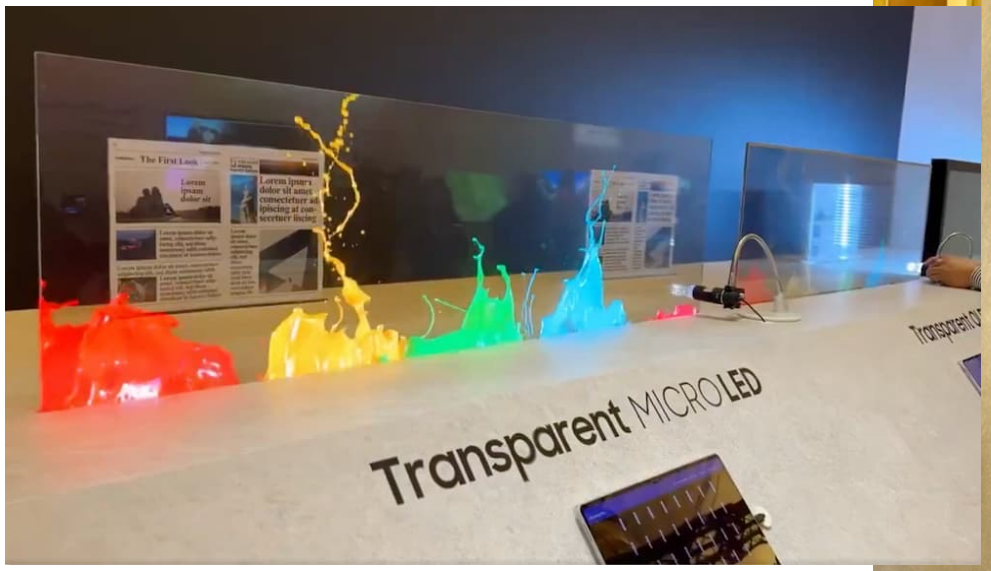
(source: SamMobile YouTube)

Samsung Electronics unveiled its newest MicroLED TV Lineup in CES 2024.

The 2024 MicroLED lineup offers new models ranging from 50 to 140-inches (50, 63, 76, 89, 101, 114 and 140-inches) to provide consumers with a breadth of options for unparalleled picture quality and screen experience. Thanks to its modular nature, MicroLED is not bound by shape, ratio and size, making it completely customizable to fit a consumer's desired set up. In addition, it comes without bezels, so regardless of configuration, the boundary between screen and real life is seamless.

MicroLED in CES 2024

Samsung Transparent MicroLED Display

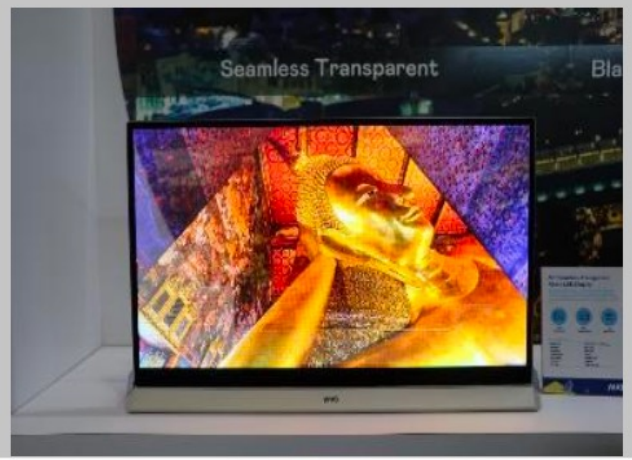


(source: TechNews website)

(source: Tom's Guide website)

MicroLED in CES 2024

AUO Transparent MicroLED Display



Size	30-inch
Tech	Micro LED
Resolution	960x540
Pixel pitch	0.69mm
Brightness	600cd/m^2
LED type	RGB/flip chip

Size	17.3-inch
Tech	Micro LED
Resolution	1280x720
Pixel pitch	0.3mm
Brightness	>1,200cd/m^2
Touch	TP cell = 0.5mm, 5 points

Size	13.5-inch
Tech	Micro LED
Resolution	1920x1080
Pixel pitch	<0.3um
Brightness	5,000cd/m^2
Pixel density	163 PPI

Source: Photos taken by Omdia at CES 2024

(source: Omdia Report)

MicroLED in CES 2024

AUO Automotive MicroLED Display

Interactive Transparent Window
(2024 CES Innovation Award)

Rollable Rear Seat Entertainment
(2024 CES Innovation Award)

(Source: AUO Website)

MicroLED in CES 2024

CarUX Automotive MicroLED Display

(source: TechNews website)

(source: CarUX Website)

MicroLED in CES 2024

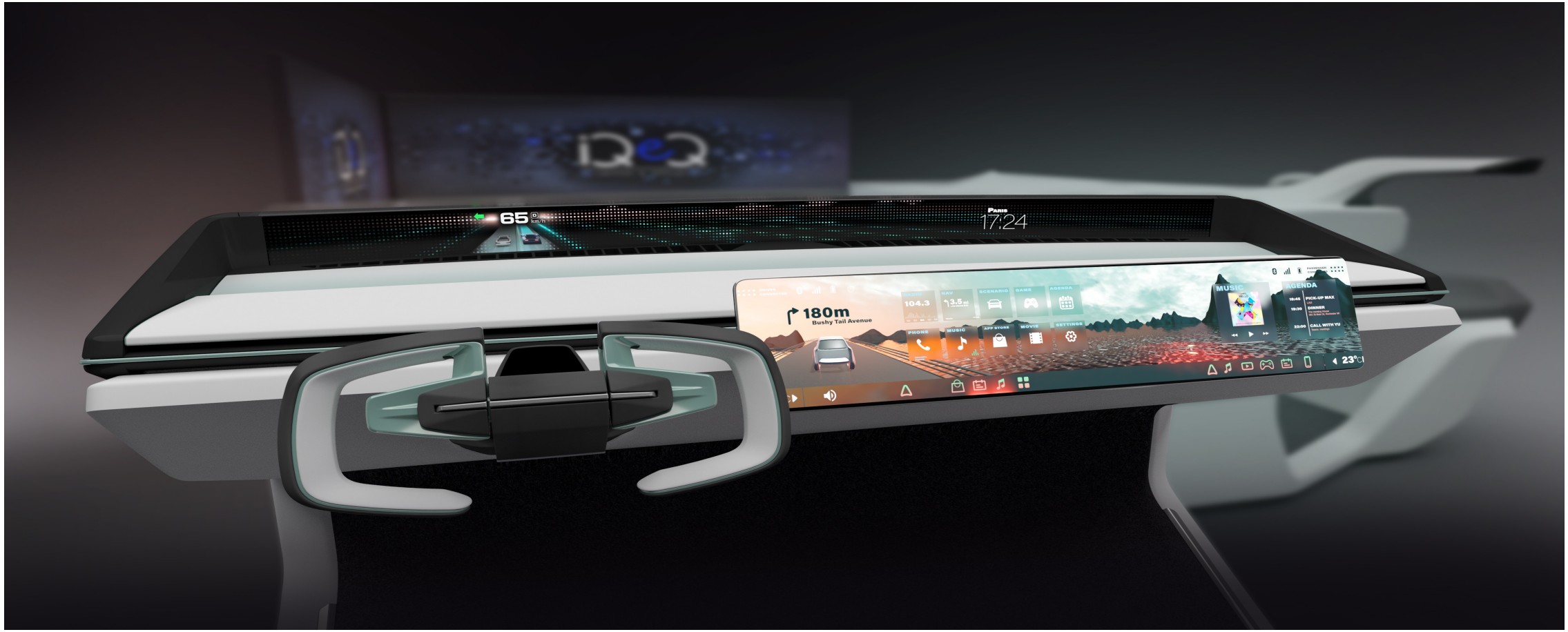
Continental creates world's first see-through car display in Swarovski crystal

2024 CES Innovation Award: “10-inch Crystal Center Display”, features an image-generated MicroLED panel embedded in a Swarovski crystal casing that creates the effect of floating on the screen by displaying the content in high brightness and high contrast.

(source: Continental Press Release)

MicroLED in CES 2024

FORVIA's Skyline Immersive Display



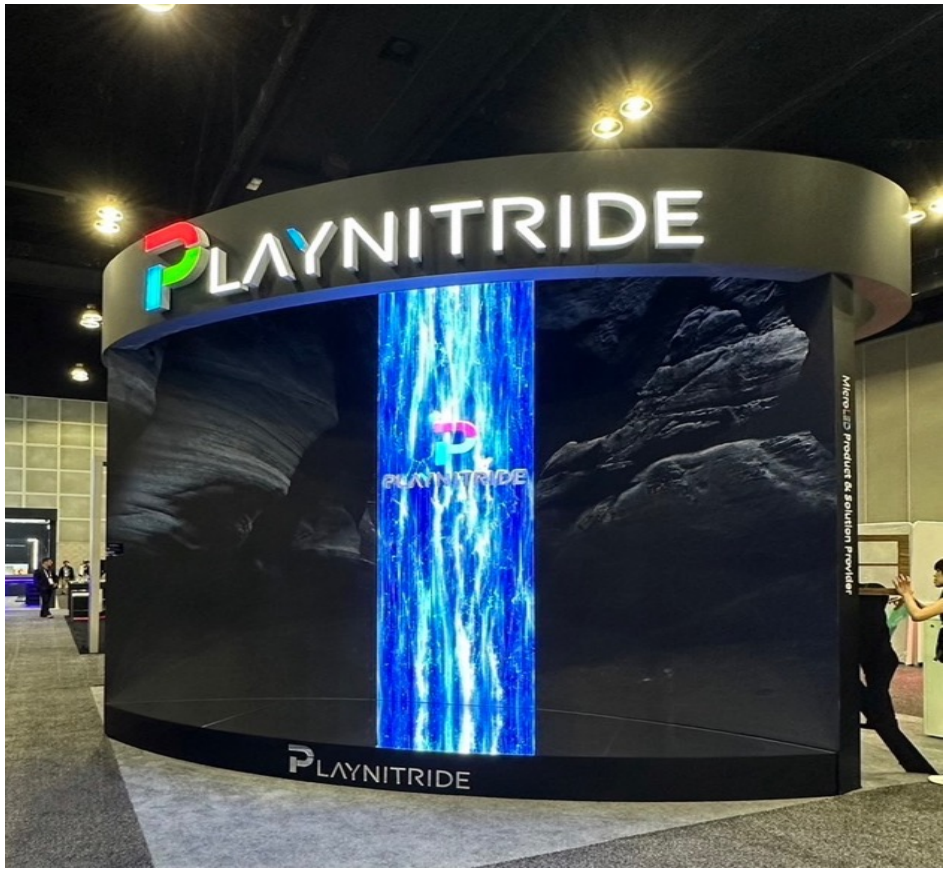
2024 CES Innovation Award "Skyline Immersive Display" : A continuous display that sits between the windshield and instrument panel reduces the amount of shift of the driver's gaze from the road to the display, creating a safer driving experience.

(source: FORVIA Newsroom)

Large-sized MicroLED Display (Modular PCB)

PIXELED MATRIX

89“ 5K 32:9 P0.43 Curved Monitor
(Seamless tiling by 168 modules)



166“ 5K P0.833 Waterfall Display
(Seamless tiling by 324 modules)
2023 SID Best MicroLED-based Technology Award

Interactive Installation Art

Designed 10 years ago by Random International Design Company, this contemporary artwork "To Light You Fade", originally adopting OLED organic light-emitting materials, was re-interpreted by PlayNitride in this October, spliced by 2688 panels with tens of millions of MircoLED, fully showing the beautiful mirror luster and dynamic gradient light and shadow, resurrecting this interactive installation art and injecting sustainable vitality into it.

MicroLED Displays for Automotive

- 14.6"
- 2560 x 1440 (202ppi)
- Rollable (Curvature radius 40mm)

- 3.5"
- 141ppi
- >100,000 dynamic lifting test
- With Touch function

(images from AUO website)

MicroLED Displays for Automotive

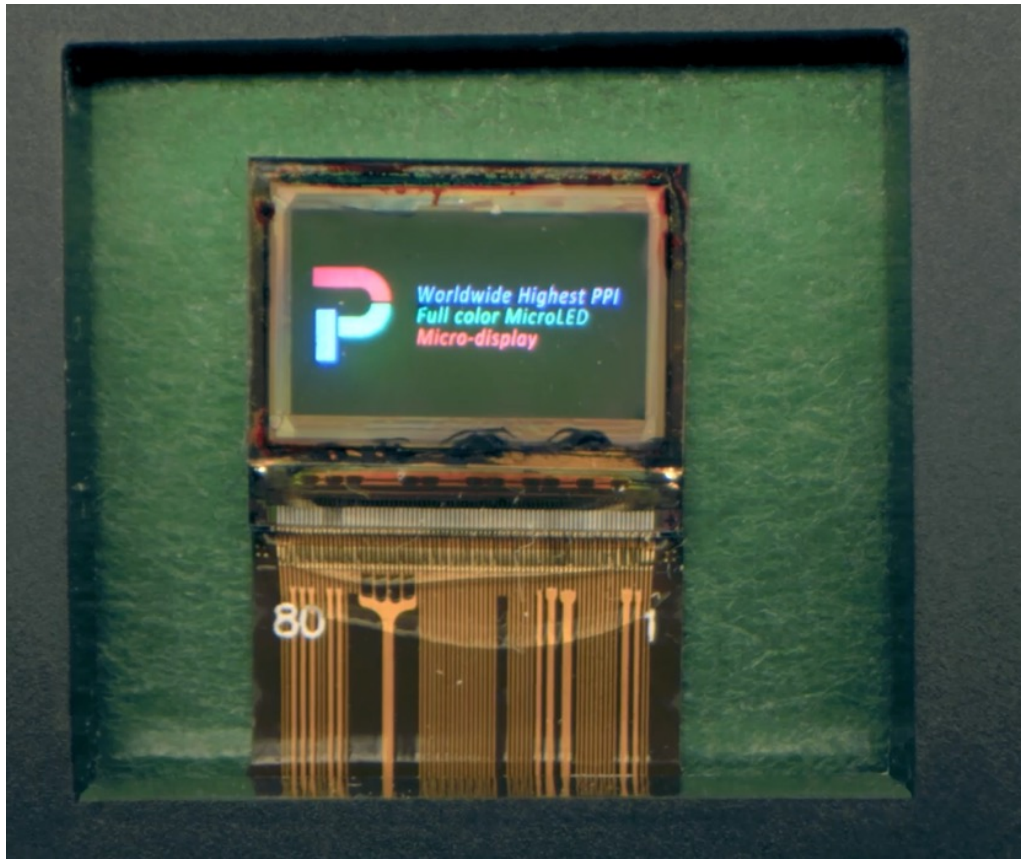
- more than 5.5 million MicroLED chips
- less than 30μm MicroLED chip
- LTPS plastic backplane
- 228 ppi

Wearable MicroLED Display

PIXELED Display

1.39" 338ppi MicroLED Circular Display

MicroLED Micro-Display Is the Key for AR Glasses

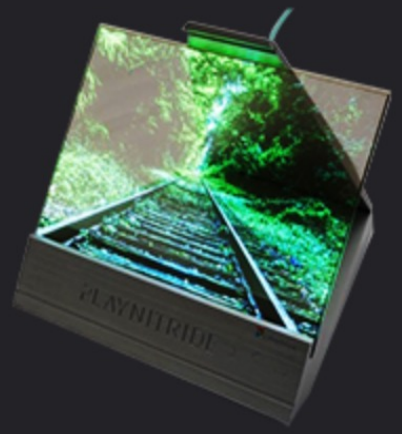


- 0.49-inch MicroLED μ-display
- 1920*1080 (FHD)
- 4536PPI
- Full Color
- >4,000,000 MicroLED 2.5μm chips

Driving Technologies Lead to Various Applications

MicroLED on TFT

PIXELED Display



Using TFT-driven PixeLED Display technology, transparent displays, curved PixeLED Films, and various common display applications can be made.

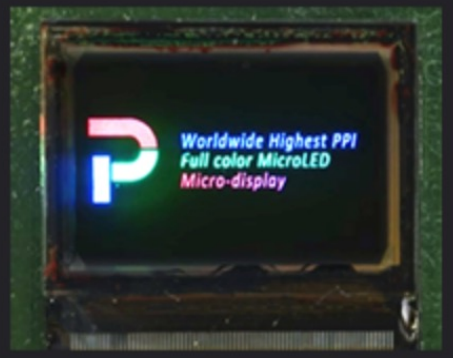
MicroLED on PCB

PIXELED MATRIX

Using PCB-driven PixeLED Matrix technology, it can be borderless tiling into PixeLED Tile displays of any size and aspect ratio

MicroLED on Silicon

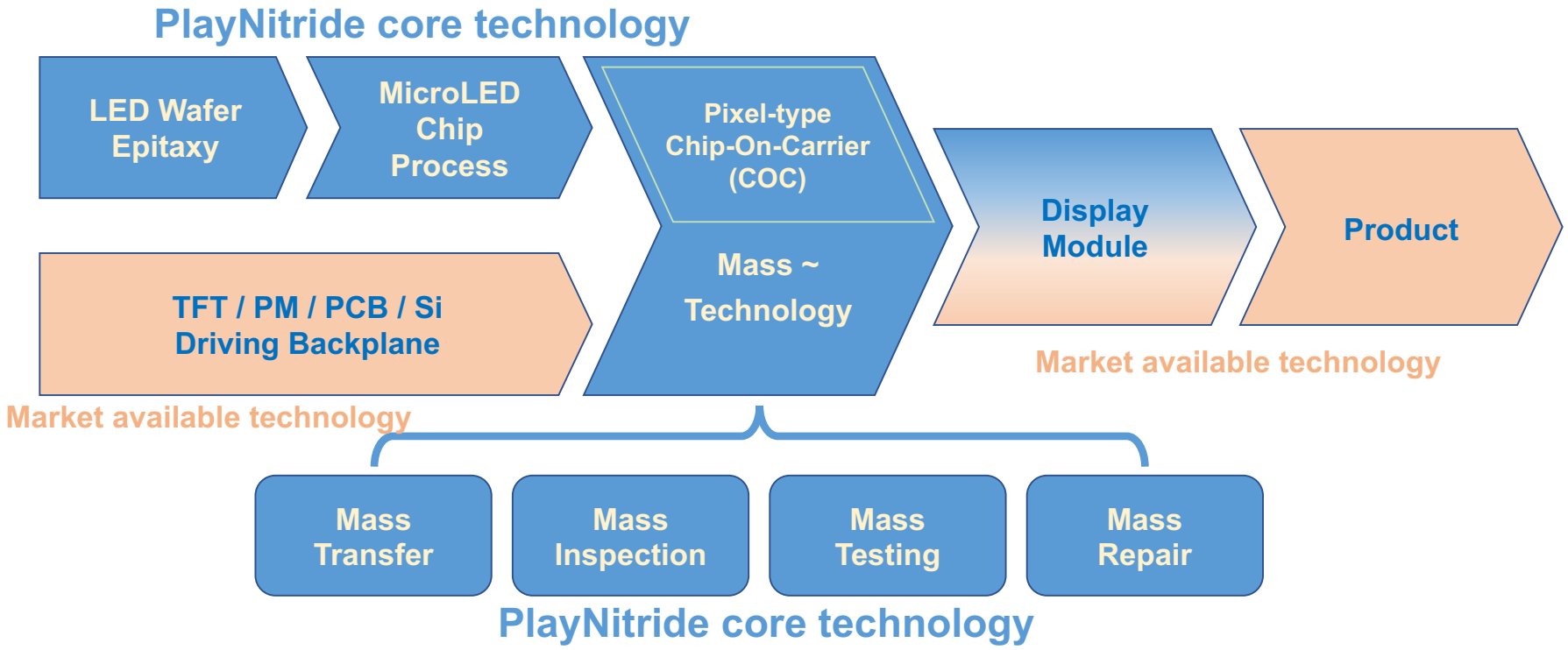
μ-PIXELED



Using μ-Pixel LED technology driven by silicon chip, with ultra-high brightness and ultra-fine picture quality, it can be used in AR glasses and projection HUD

III. PlayNitride's MicroLED Leadership

We Facilitate The MicroLED Ecosystem



- PlayNitride is one of the few companies that owns and integrates the key technologies of MicroLED displays. We've completed technical know-how to quickly optimize production and solve new technical challenges.
- In each technical link, PlayNitride has a strong team to innovate and develop our proprietary technology.
- PlayNitride is in a leading position in the market, and widely deploys patents and shortened learning curve.

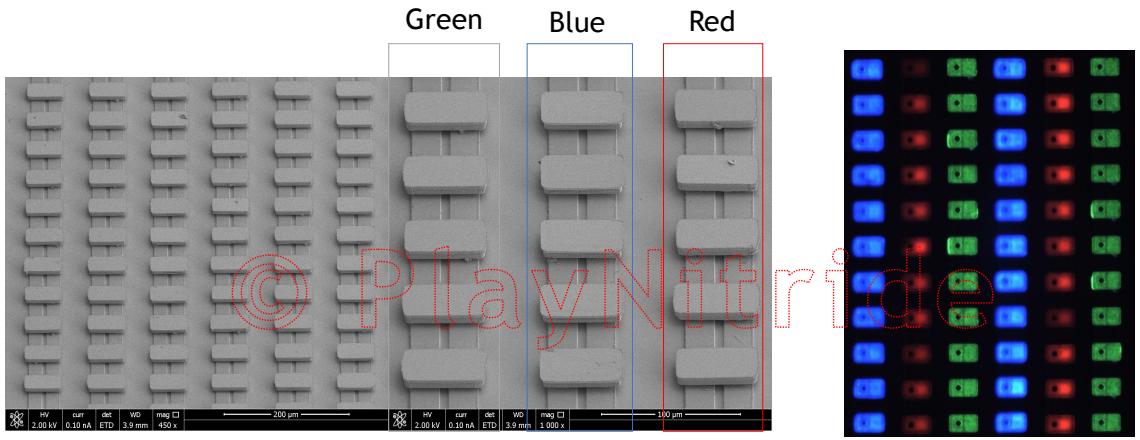
Core of R&D And Technical Advantages

High uniformity 6-inch R/G/B LED wafer

- Uniform brightness across wavelengths, no need for binning

High yield R/G/B MicroLED chips

- Chip on wafer yield > 99%
- LED wafer utilization > 80%



Industry-leading mass transfer, inspection and testing

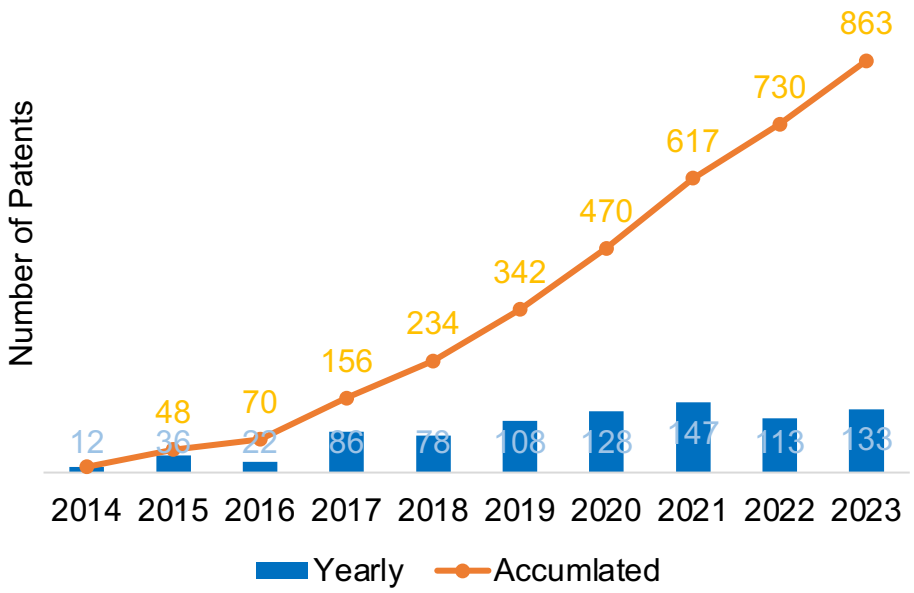
- Self-made automatic mass transfer equipment
- Massive addressing repair technology

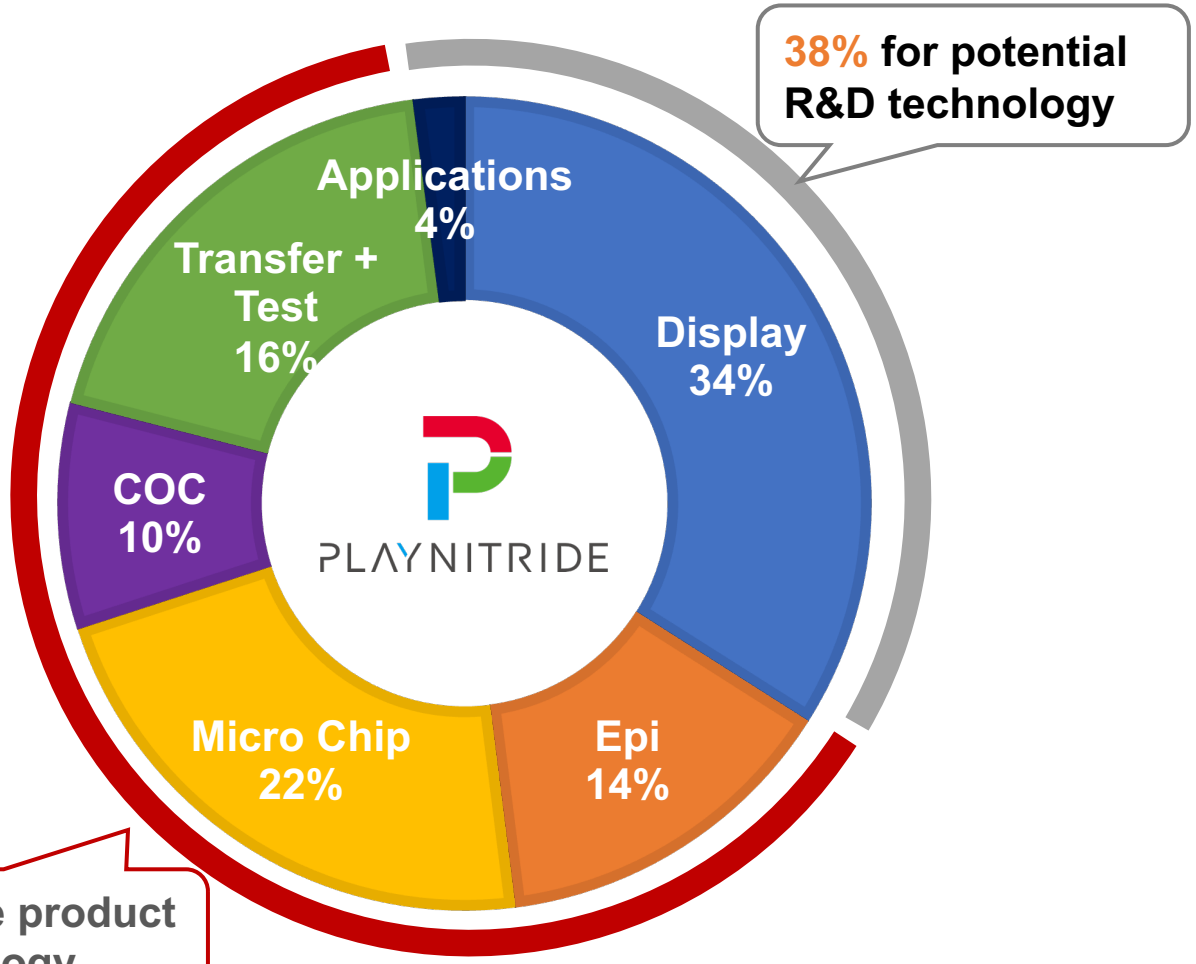
Self-developed MicroLED one-stop solutions

- Cooperating with industry-leading panel display manufacturers
- Providing various MicroLED chips for various displays including ultra-micro, tiling, highly transparent and flexible MicroLED displays.
- Supporting customers design needs for different applications

Patent Portfolio

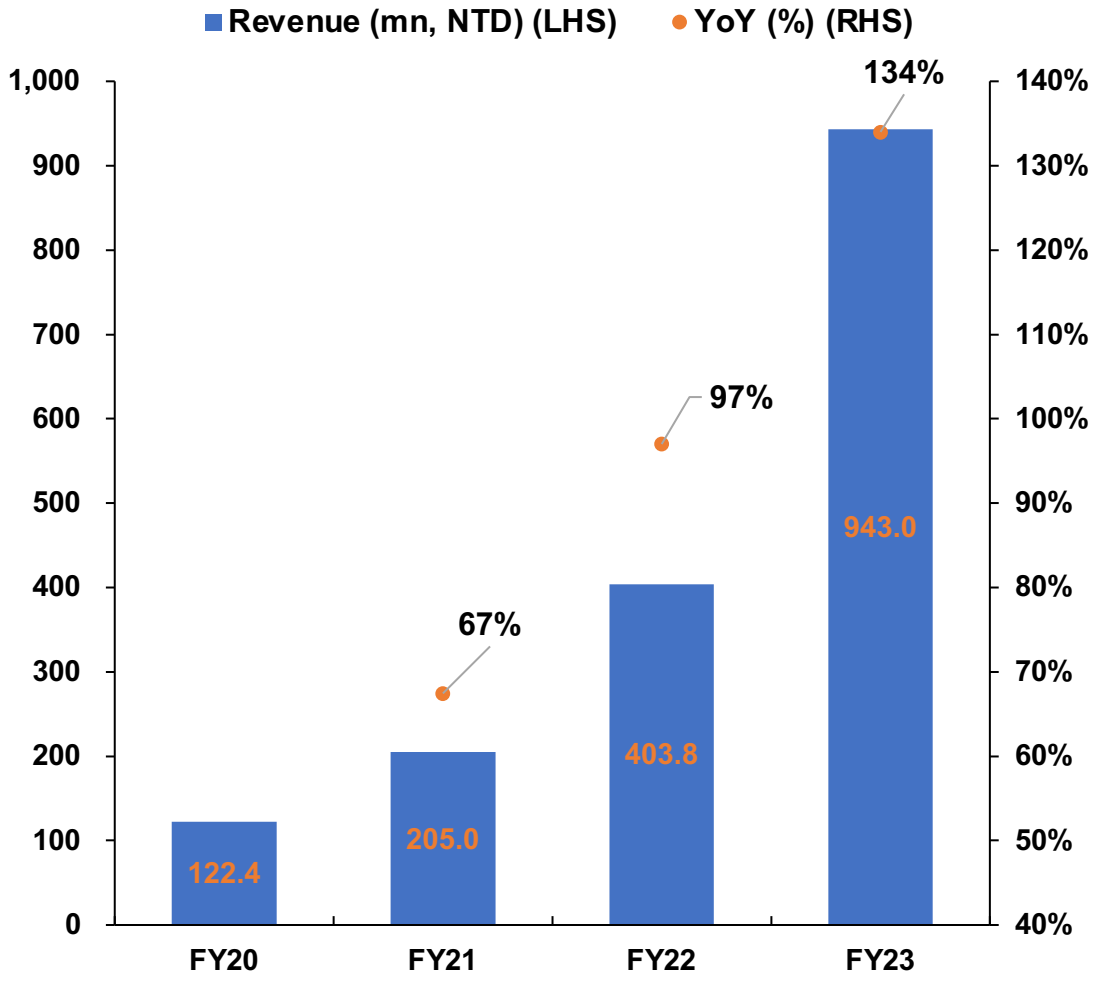
PlayNitride total patent applications reached 863.
Covering the entire MicroLED ecosystem.

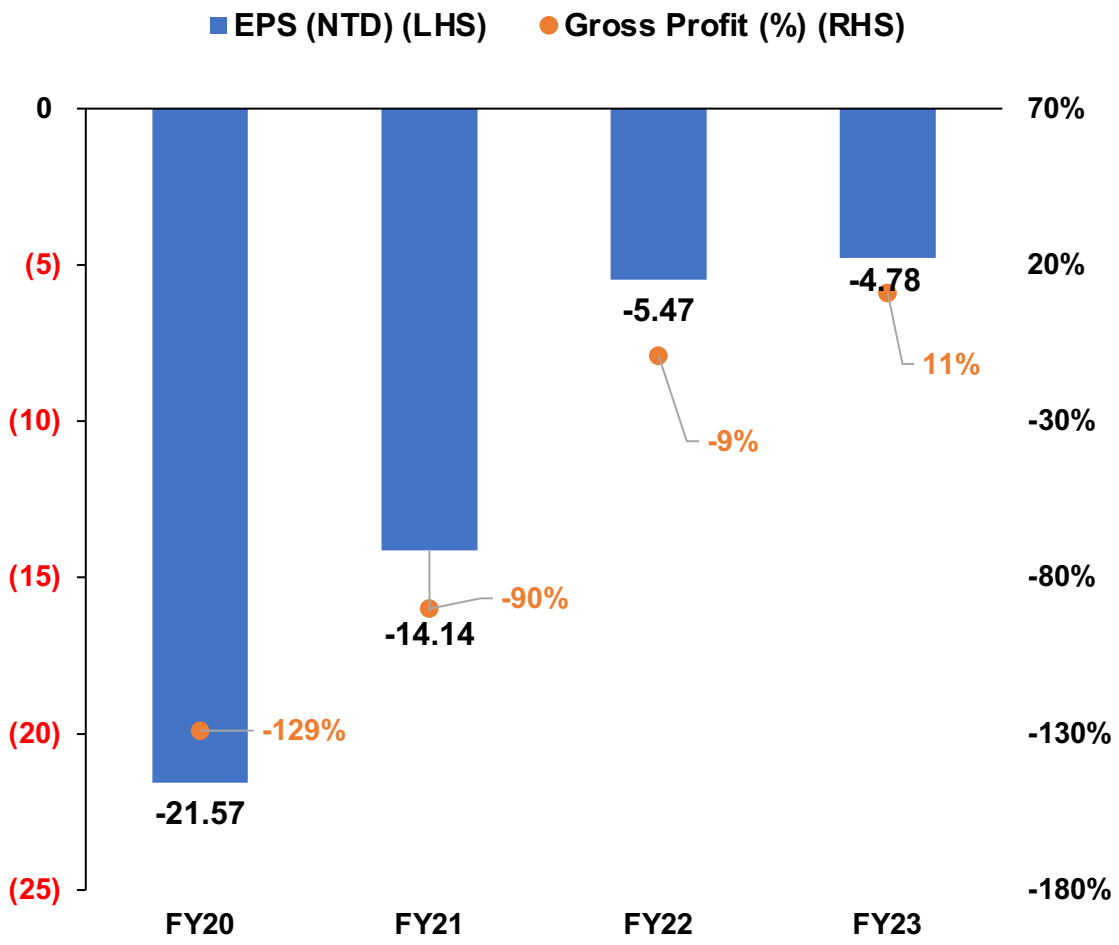




* Statistics as of December 2023

Financial Performance





[Note] FX Gain：2022 NTD 207million, 2023 (NTD 7.17 million)

Prospect & Planning

- **Add New Business Item:**
  - In addition to COC, Turnkey Solution, and NRE, the sales of transfer equipment is to be added.
- **Diversify Customer Contributions:**
  - Expanded sales team and U.S. subsidiary starts operation to develop and serve European/American/Asian markets.
- **Optimistic about Revenue Momentum:**
  - Maintain the 2020-2023 revenue growth trend, continue to narrow losses, and move towards the road of break-even.
- **Continuous Investment in R&Ds:**
  - Master the research and development of next-generation process technology and equipment, maintain a leading position, and accumulate future potentials.

PLAYNITRIDE

Q&A Session

Website