

The Global Market for MiniLED and MicroLED Displays 2023-2033

https://marketpublishers.com/r/GA866834863AEN.html

Date: October 2022 Pages: 225 Price: US\$ 1,250.00 (Single User License) ID: GA866834863AEN

Abstracts

This report analyses the market for Mini-LEDs and Micro-LEDs, covering technology and market developments. The displays market is constantly advancing, with new technologies allowing for greatly improved brightness, HDR, and colour reproducibility. Recently, mini-LED and micro-LED have attracted major attention in the displays market and are being implemented in products by consumer electronics giants such as Samsung and Apple.

The market is projected to explode in the next few years, taking a significant chunk of the displays market and pushing into wearables, transparent display, flexible display, stretchable display for skin-integrated devices, AR/VR, smartphones automotive lighting such as active headlights, and projector applications. MiniLED backlights are utilized in large-screen TVs, monitors, automotive and industrial applications. Improvements MiniLED offer over incumbent display technologies include:

High brightness.

High contrast ratio.

Low power consumption.

Higher efficiency.

MicroLED started to gain market traction in 2022. MicroLEDs are targeted at direct view displays. Improvements they offer include:



high efficiency

high brightness-readable under sunshine (>10,000 nits)

high colour saturation

ultra-high resolution (>2000 dpi with Si backplane)

ultra-low power consumption

flexibility

quick response rate (on/off switching within nano-seconds).

long lifetime (>80,000 hours).

These properties make them attractive for application in very large TVs, AR/VR and automotive applications. Other applications include wearable/implantable optoelectronic devices, light communication/light interconnection, medical treatment, spatial imaging etc.

Report contents include:

Latest technology and supply chain information.

Industry trends and growth drivers.

Assessment of technology challenges.

Industry developments in the past 18 months.

Current and planned mini-LED and micro-LED products.

Analysis of markets and applications for mini-LED and micro-LEDs. Markets covered include

65" TVs and video walls

AR/VR projectors



Heads-up displays (HUD)

Smartphones,

Automotive displays

Wearables and smartwatches

Laptops, monitors and tablets

Medical displays

Flexible, stretchable and foldable displays

Transparent displays.

Analysis of non-display markets including lighting and LiFi communications.

Latest information on novel LED growth, transfer techniques, manufacturing and scale up.

Ten year forecasts for mini-LED and micro-LED market, by revenues, units and applications to 2033.

Assessment of competitive landscape.

Profiles of 84 companies in the mini-LED and micro-LED market. Companies profiled include Aledia, ALLOS Semiconductors GmbH, AU Optronics Corporation, Foxconn Electronics, GI?, iBeam Materials, Inc., Innolux Corporation , Industrial Technology Research Institute (ITRI), Japan Display Inc. (JDI), Royole Corporation, Konka Group, LG Display Co., Ltd., MICLEDI Microdisplays, Mikro Mesa Technology Co., Ltd., Nichia Corporation, PlayNitride, Inc., Rohinni LLC, Samsung, San'an Optoelectronics Co., Ltd., Seoul Semiconductor/Seoul Viosys Co., Ltd., Sony, Vuzix Corporation. TCL Electronics, Tianma Microelectronics Co., Ltd., VueReal and more.



Contents

1 REPORT AIMS AND OBJECTIVES

2 EXECUTIVE SUMMARY

- 2.1 The Mini-LED market
- 2.2 The MicroLED market
- 2.2.1 Market in 2021
- 2.2.2 Market in 2022
- 2.3 The global display market
- 2.3.1 Display technologies assessment
- 2.4 Motivation for use of MiniLEDs and MicroLEDs
- 2.5 MiniLED and MicroLEDs applications
- 2.6 Market and technology challenges
- 2.7 Industry developments 2020-2022
- 2.8 CES 2021 display innovations
- 2.9 CES 2022 and Display Week 2022 displays innovations
- 2.10 Market activity in China
- 2.11 Global shipment forecasts for Mini-LEDs and Micro-LEDs to 2027
 - 2.11.1 Mini-LEDs
 - 2.11.1.1 Units
 - 2.11.2 Micro-LEDs
 - 2.11.2.1 Units

3 TECHNOLOGY BACKGROUND

- 3.1 MiniLED (mLED) vs MicroLED (µLED)
 - 3.1.1 Display configurations
- 3.2 MiniLED displays
 - 3.2.1 Comparison to LCD and OLED
 - 3.2.2 Advantages and disadvantages
 - 3.2.3 Backplane types
 - 3.2.4 Costs
 - 3.2.5 High dynamic range miniLED displays
 - 3.2.6 Quantum dot films for miniLED displays
 - 3.2.7 Perovskite colour enhancement film in MiniLEDs

3.3 MicroLED

3.3.1 Development



- 3.3.1.1 Sony
- 3.3.2 Types
- 3.3.3 Production
- 3.3.3.1 Integration
- 3.3.3.2 Transfer technologies
- 3.3.4 Comparison to LCD and OLED
- 3.3.5 MicroLED display specifications
- 3.3.6 Advantages
 - 3.3.6.1 Transparency
 - 3.3.6.2 Borderless
 - 3.3.6.3 Flexibility
- 3.3.7 Costs
- 3.3.8 Manufacturing
 - 3.3.8.1 Epitaxy and Chip Processing
 - 3.3.8.1.1 Uniformity
 - 3.3.8.2 Assembly Technologies
 - 3.3.8.2.1 Monolithic fabrication of micro displays
 - 3.3.8.2.2 Mass transfer
 - 3.3.8.2.3 Mass Transfer Processes
 - 3.3.8.2.3.1 Elastomer Stamp Transfer
 - 3.3.8.2.3.2 Roll-to-Roll or Roll-to-Panel Imprinting
 - 3.3.8.2.3.3 Laser-induced forward transfer (LIFT)
 - 3.3.8.2.3.4 Electrostatic Transfer
 - 3.3.8.2.3.5 Micro vacuum-based transfer
 - 3.3.8.2.3.6 Adhesive Stamp
 - 3.3.8.2.3.7 Fluidically Self-Assembled Transfer
 - 3.3.8.3 Full colour conversion
 - 3.3.8.3.1 Phosphor Colour Conversion LEDs
 - 3.3.8.3.2 Quantum dots colour conversion

4 DISPLAY BACKLIGHTS

- 4.1 TVs
 - 4.1.1 The market in 2021
 - 4.1.2 The market in 2022
 - 4.1.3 MiniLED Quantum Dot TV
 - 4.1.4 Products
- 4.2 Smartwatches and wearables
- 4.3 Smartphones



4.4 Samsung
4.4.1 Wall display
4.4.2 Neo QLED TV range
4.5 LG
4.5.1 LG mini QNED range
4.5.2 MAGNIT MicroLED TV
4.6 TCL
4.6.1 8 Series and 6 Series

5 LAPTOPS, MONITORS AND TABLETS

5.1 MiniLED

5.2 MiniLED and MicroLED laptop, monitor and tablet products and prototypes

6 FLEXIBLE, STRETCHABLE AND FOLDABLE MICROLED

- 6.1 Foldable microLED displays
- 6.2 Product developers

7 BIOTECHNOLOGY AND MEDICAL DISPLAYS

- 7.1 MicroLEDS
- 7.1.1 MicroLEDs for medical applications
- 7.2 Product developers

8 AUTOMOTIVE

8.1 MiniLED
8.2 MicroLED
8.2.1 Head-up display (HUD)
8.2.2 Headlamps
8.3 Product developers

9 VIRTUAL (VR) AND AUGMENTED REALITY (AR)

9.1 MiniLED9.2 MicroLED9.2.1 AR/VR Smart glasses and head-mounted displays (HMDs)9.2.2 MicroLED contact lenses



9.2.3 Products and prototypes

10 TRANSPARENT DISPLAYS

10.1 Applications10.2 MicroLEDs10.3 Product developers

11 SUPPLY CHAIN

11.1 miniLEDs

11.2 microLEDs

12 COMPANY PROFILES 120 (84 COMPANY PROFILES)

13 REFERENCES





List Of Tables

LIST OF TABLES

- Table 1. Announced microLED fabs.
- Table 2. Summary of display technologies.
- Table 3. MiniLED applications.
- Table 4. MicroLED applications.
- Table 5. Market and technology challenges for miniLED and microLED.
- Table 6. Micro and MicroLED industry developments 2020-2022.
- Table 7. MiniLED and microLED product announcements at CES 2021.
- Table 8. MiniLED and microLED product announcements at CES 2022 and Display Week 2022.
- Table 9. Mini/microLED activity in China.
- Table 10. Mini-LEDs backlights global market 2020-2033, by market (Million units).
- Table 11. Global Micro-LED display market (thousands of units) 2020-2033.
- Table 12. Comparison between miniLED and microLED.
- Table 13. Comparison between miniLED displays and other display types.
- Table 14. Advantages and disadvantages of MiniLEDs.
- Table 15. Comparison of AM and PM driving.
- Table 16. MicroLED backlight costs.
- Table 17. Comparison to conventional LEDs.
- Table 18. Types of microLED.

Table 19. Summary of monolithic integration, monolithic hybrid integration (flip-

chip/wafer bonding), and mass transfer technologies.

- Table 20. Summary of different mass transfer technologies.
- Table 21. Comparison to LCD and OLED.
- Table 22. Schematic comparison to LCD and OLED.
- Table 23. Commercially available microLED products and specifications.
- Table 24. microLED-based display advantages and disadvantages.
- Table 25. Mass transfer methods, by company.
- Table 26. Comparison of various mass transfer technologies.
- Table 27. Comparison of LED TV technologies.
- Table 28. MiniLED and MicroLED TVs launched in 2022.
- Table 29. MiniLED and microLED TV products.
- Table 30. Samsung Neo QLED TV range.
- Table 31. LG mini QNED range
- Table 32.TCL range of miniLED TVs.
- Table 33. MiniLED laptop, monitor and tablet products and prototypes.



- Table 34. Flexible, stretchable and foldable miniLED and MicroLED products.
- Table 35. Medical display miniLED and MicroLED products.
- Table 36. Automotive display & backlight architectures
- Table 37. Applications of microLED in automotive.
- Table 38. Automotive display miniLED and MicroLED products.
- Table 39. Comparison of AR Display Light Engines.
- Table 40. MicroLED based smart glass products.
- Table 41. tooz technologies smart glasses.
- Table 43. Applications of miniLED and microLED transparent displays.
- Table 44. Companies developing MicroLED transparent displays.
- Table 45. microLED supply chain.
- Table 46. LG mini QNED range
- Table 47. Samsung Neo QLED TV range.
- Table 48. San'an Mini and Micro LED Production annual target.
- Table 49. NPQDTM vs Traditional QD based Micro-LEDs.
- Table 50. TCL miniLED product range.



List Of Figures

LIST OF FIGURES

Figure 1. Blue GaN microLED arrays with 3um pixel pitch use polychromatic quantum dot integration to achieve full colour AR displays.

- Figure 2. The progress of display technology, from LCD to MicroLED.
- Figure 3. Mini-LEDs backlights global market 2020-2033, by market (Million units).
- Figure 4. Global Micro-LED display market (thousands of units) 2020-2033.
- Figure 5. Display system configurations.
- Figure 6. Schematic of LCD with MicroLED backlight.
- Figure 7. Schematic for configuration of full colour microLED display
- Figure 8. BOE glass-based backplane process.
- Figure 9. MSI curved quantum dot miniLED display.
- Figure 10. MicroLED schematic.
- Figure 11. Pixels per inch roadmap of µ-LED displays from 2007 to 2019.
- Figure 12. Mass transfer for µLED chips.
- Figure 13. Schematic diagram of mass transfer technologies.
- Figure 14. Comparison of microLED with other display technologies.
- Figure 15. Lextar 10.6 inch transparent microLED display.
- Figure 16. Transition to borderless design.
- Figure 17. Schematics of a elastomer stamping, b electrostatic/electromagnetic transfer,
- c laser-assisted transfer and d fluid self-assembly.
- Figure 18. Schematics of Roll-based mass transfer.
- Figure 19. Schematic of laser-induced forward transfer technology.
- Figure 20. Schematic of fluid self-assembly technology.
- Figure 21. Schematic of colour conversion technology.
- Figure 22. Process flow of a full-colour microdisplay.
- Figure 23. LG QNED miniLED TV.
- Figure 24. microLED wearable display prototype.
- Figure 25. APHAEA Watch.
- Figure 26. Samsung Wall display system.
- Figure 27. Samsung Neo QLED 8K.
- Figure 28. MAGNIT MicroLED TV.
- Figure 29. AUO AmLED.
- Figure 30. laptop ROG Zephyrus Duo 16.
- Figure 31. Acer Predator X32 Mini-LED Gaming Monitor.
- Figure 32. Acer EI491CRG9 curved miniLED display.
- Figure 33. AOC 27-inch Mini LED-backlit gaming monitor AG2740GM.



- Figure 34. 12.9-inch iPad Pro.
- Figure 35. Apple Pro Display XDR.
- Figure 36. Asus ProArt PA32UCX.
- Figure 37. ROG Swift PG32UQXE.
- Figure 38. Lenovo ThinkVision Creator Extreme P27.
- Figure 39. Creator 17 gaming laptop.
- Figure 40. Samsung Odyssey G9 Neo gaming monitor.
- Figure 41. AU Optonics Flexible MicroLED Display.
- Figure 42. Schematic of the TALT technique for wafer-level microLED transferring.
- Figure 43. Foldable 4K C SEED M1.
- Figure 44. MicroLEDs for medical applications
- Figure 45. 2023 Cadillac Lyriq EV incorporating mini-LED display.
- Figure 46. MicroLED automotive display.
- Figure 47. Issues in current commercial automotive HUD.
- Figure 48. Rear lamp utilizing flexible MicroLEDs.
- Figure 55. Mojo Vision smart contact lens with an embedded MicroLED display.
- Figure 49. Cellid AR glasses, Exploded version.
- Figure 50. Air Glass.
- Figure 51. Panasonic MeganeX.
- Figure 52. Thunderbird Smart Glasses Pioneer Edition.
- Figure 53. Vuzix microLED microdisplay Smart Glasses.
- Figure 54. Leopard demo glasses by WaveOptics.
- Figure 56. Different transparent displays and transmittance limitations.
- Figure 57. 7.56' high transparency & frameless MicroLED display.
- Figure 58. Supply Chain of miniLED Backlight.
- Figure 59. WireLED in 12" Silicon Wafer.
- Figure 60. Typical GaN-on-Si LED structure.
- Figure 61. 300 mm GaN-on-silicon epiwafer.
- Figure 62. MicroLED chiplet architecture.
- Figure 63. Concept Apple Vr Ar Mixed Reality Headset.
- Figure 64. 1.39-inch full-circle microLED display
- Figure 65. 9.4' flexible MicroLED display.
- Figure 66. BOE MiniLED display TV.
- Figure 67. BOE miniLED automotive display.

Figure 68. Image obtained on a blue active-matrix WVGA (wide video graphics array) microdisplay.

Figure 69. Fabrication of the 10-µm pixel pitch LED array on sapphire.

Figure 70. A 200-mm wafer with CMOS active matrices for GaN 873 ? 500-pixel microdisplay at 10- μ m pitch.



- Figure 71. IntelliPix[™] design for 0.26? 1080p microLED display.
- Figure 72. C Seed 165-inch M1 microLED TV.
- Figure 73. N1 folding MicroLED TV.
- Figure 74. C Seed outdoor TV.
- Figure 75. Focally Universe AR glasses.
- Figure 76. Flexible microLED.
- Figure 77. Jade Bird Display microdisplays.
- Figure 78. JBD's 0.13-inch panel.

Figure 79. 0.22" Monolithic full colour microLED panel and inset shows a conceptual

- monolithic polychrome projector with a waveguide.
- Figure 80. Prototype microLED display.
- Figure 81. APHAEA MicroLED watch.
- Figure 82. Lextar 2021 micro LED and mini LED products.
- Figure 83. LSAB009 microLED display.
- Figure 84. LG MAGNIT 4K 136-inch TV.
- Figure 85. Schematic of Micro Nitride chip architecture.
- Figure 86. Nationstar Mini LED IMD Package P0.5mm.
- Figure 87. 55" flexible AM panel
- Figure 88. 9.4' flexible MicroLED display.
- Figure 89. 7.56-inch transparent Micro LED display.
- Figure 90. PixeLED Matrix Modular MicroLED Display in 132-inch.
- Figure 91. Dashboard 11.6-inch 24:9 Automotive MicroLED Display.
- Figure 92. Center Console 9.38-inch Transparent MicroLED Display.
- Figure 93. 48 x 36 Passive Matrix microLED display.
- Figure 94. microLED microdisplay based on a native red InGaN LED.
- Figure 95. Micro-LED stretchable display.
- Figure 96. The Wall.
- Figure 97. Samsung Neo QLED 8K.
- Figure 98. NPQD[™] Technology for MicroLEDs.
- Figure 99. Wicop technology.
- Figure 100. B-Series and C-Series displays.

Figure 101. A micro-display with a stacked-RGB pixel array, where each pixel is an RGB-emitting stacked microLED device (left). The micro-display showing a video of fireworks at night, demonstrating the full-colour capability (right). N.B. Areas around the display

- Figure 102. TCL MiniLED TV schematic.
- Figure 103. TCL 8K Mini-LED TV.
- Figure 104. The Cinema Wall MicroLED display.
- Figure 105. Photo-polymer mass transfer process.



- Figure 106. 7.56" Transparent Display.
- Figure 107. UMini0.9 4K.
- Figure 108. VueReal Flipchip microLED (30x15 um2).
- Figure 109. Vuzix uLED display engine.
- Figure 110. Mi TV Master series.



I would like to order

Product name: The Global Market for MiniLED and MicroLED Displays 2023-2033 Product link: <u>https://marketpublishers.com/r/GA866834863AEN.html</u> Price: US\$ 1,250.00 (Single User License / Electronic Delivery)

> If you want to order Corporate License or Hard Copy, please, contact our Customer Service: info@marketpublishers.com

Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <u>https://marketpublishers.com/r/GA866834863AEN.html</u>

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name: Last name: Email: Company: Address: City: Zip code: Country: Tel: Fax: Your message:

**All fields are required

Custumer signature _____

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <u>https://marketpublishers.com/docs/terms.html</u>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970