



# IT OLED Technology and Industry Trend Analysis Report

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Senior Analyst  
Chang Wook HAN  
Chang Ho NOH

Analyst  
Dae Jeong YOON

<b>1. Key summary</b> .....	<b>5</b>
<b>2. LTPO TFT Backplane</b> .....	<b>7</b>
2.1 LTPS TFT, Oxide TFT and LTPO TFT Comparison	
2.2 Comparing LTPS TFT Panel and LTPO TFT Panel Performance	
2.3 How LTPO TFT Panels Have Low Power Consumption	
2.4 Products with LTPO TFT	
2.5 LTPO TFT Producer Status	
2.6 LTPO TFT Pixel Circuit Performance by Vendor	
2.7 LTPO TFT Manufacturing Cost Issues	
2.8 Low-cost LTPO TFT Technology	
<b>3. TFT Backplane for 8G Substrates</b> .....	<b>20</b>
3.1 LTPO TFT Fabrication	
3.2 Oxide TFT Development Status	
3.3 8G Ready IGZO Target Suppliers	
3.4 Need for High Mobility Oxide TFTs	
3.5 Performance Requirements for 8G Compatible Oxide TFTs	
3.6 Oxide TFT Internal Compensation Circuit for IT Products	

<b>4. RGB Tandem OLED</b> .....	<b>30</b>
4.1 Single OLED vs. Tandem OLED	
4.2 Tandem OLED Device Characteristics	
4.3 Single OLED and Tandem OLED Device Structures	
4.4 Issues with Tandem OLED	
<b>5. Color Filter on Encapsulation</b> .....	<b>36</b>
5.1 The Need for COE Technology	
5.2 Compare the Characteristics of Polarizer-applied and COE Panels	
5.3 COE Process	
5.4 COE Development by Panel Makers	
<b>6. Hybrid OLED</b> .....	<b>45</b>
6.1 Advantages of Hybrid OLED	
<b>7. Photolitho OLED</b> .....	<b>47</b>
7.1 Photolitho OLED Technology Announcement Example	
7.2 Photolitho OLED Development Status by Panel Company	
7.3 What Do Photolitho OLED Technologies Have in Common?	
7.4 Photolitho OLED Key Patents	

<b>8. OLED Panel Makers Mass Production Capacity Analysis and Forecast .....</b>	<b>64</b>
8.1 Samsung Display	
8.2 LG Display	
8.3 BOE	
8.4 TCL CSOT	
8.5 Visionox	
8.6 IT OLED Line Capacity by Panel Makers	
8.7 Annual Substrate Area Forecast	
<b>9. OLED Shipment Forecast .....</b>	<b>74</b>
9.1 Total	
9.2 By Applications	
9.3 By Panel Makers	

# 3. TFT Backplane for 8G Substrates

## 3.5 Performance Requirements for 8G Compatible Oxide TFTs

- OLED TVs use an external compensation circuit to compensate for the mobility and threshold voltage ( $V_{th}$ ) of the oxide TFT.
- External compensation circuits require additional logic circuits and memory, so they are not suitable for small and medium-sized IT products.
- In addition, external compensation circuits require the compensation factors to be extracted while the device is turned off, making them unsuitable for frequently used IT products.
- Internal compensation circuits are generally easy to compensate for changes in threshold voltage. However, IT products use more glass substrate area than TVs with glass substrate utilization efficiency of over 90%, so the  $V_{th}$  uniformity of oxide TFTs in 8G boards needs to be improved beyond the level required for TV panels.
- Variation in mobility is also a factor that reduces the amount of current, so an internal compensation circuit that compensates for both  $V_{th}$  and mobility must be developed.

Internal vs. external compensation

		Internal compensation circuit	External compensation circuit
Pixel	Layout	Complex	Simple
	Aperture ratio	Low	High
Process	Process variances	High	Low
	Yield	Low	High
Driving	D-IC	Required	Not required
	Large size and high refresh rate	Not suitable	Suitable
Compensation Performance	TFT	High	Low
	OLED	High	Low
	VDD&VSS	High	Low
	Initial Mura	High	Low

Source: LG Display KIDS Display School 2016

# 4. RGB Tandem OLED

## 4.1 Single OLED vs. Tandem OLED

- Tandem OLED was first applied by LG Display to secure the lifespan of automotive displays that are exposed to high temperature environments.
- Smartphones have a replacement cycle of about 3 years, but IT products such as tablet PCs and notebooks have a replacement cycle of about 5 years, and there are many screens with white backgrounds and fixed icons, so tandem OLEDs with a longer lifespan than single OLEDs should be applied.
- Tandem OLED requires 30% more organic material deposition chamber and 70% more organic material cost, but it has the advantage of increasing the lifespan by 4 times compared to single OLED.

Single OLED vs. Tandem OLED



	Single OLED	Tandem OLED
Current efficiency	High	High
Lifetime	Low	High
Power consumption	High	High
Color gamut	High	High
Organic material cost	Low	High
Deposition chamber cost	Low	High

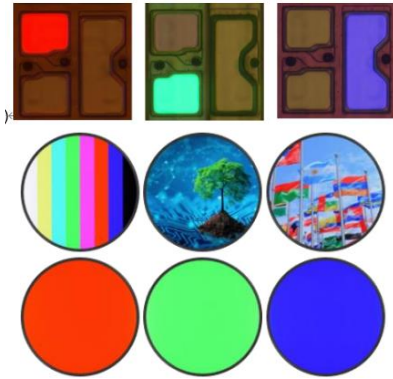

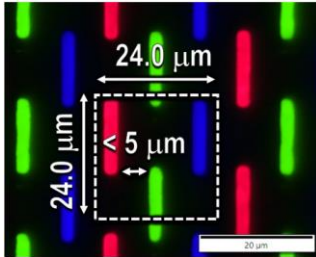
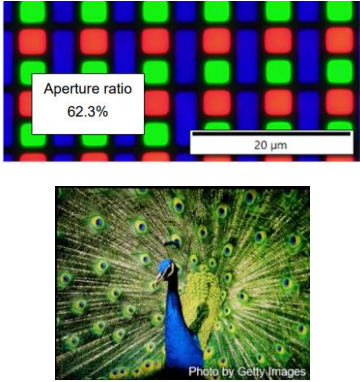
Source: UBI Research DB

# 7. Photolitho OLED

## 7.1 Photolitho OLED Technology Announcement Example

- SID 2023 featured presentations and sample demonstrations of high aperture RGB photopatterning technology from Japan Display's eLEAP, Visionox's Visionox intelligent pixelation (ViP), and Semiconductor Energy Laboratory's mask-less lithography (MML).

How RGB photopatterning technology was announced at SID 2023

	eLEAP	ViP	MML	
<b>Company</b>	JDI	Visionox	SEL	
<b>Active area size</b>	1.4" full round	7.9"	8.3"	1.5"
<b>Resolution</b>	454 x 454	-	7680 X 4320	3840 x 2880
<b>Pixel per inch</b>	326	381	1058	3207
<b>Aperture ratio</b>	54.1%	22.59 %	22%	62.3%
<b>PDL Gap</b>	10 $\mu\text{m}$	22/24 $\mu\text{m}$	< 5 $\mu\text{m}$	< 1 $\mu\text{m}$
<b>Brightness</b>	1200 nits	700 nits	400 ~ 700 nits	> 5,000 nits
<b>Picture</b>				

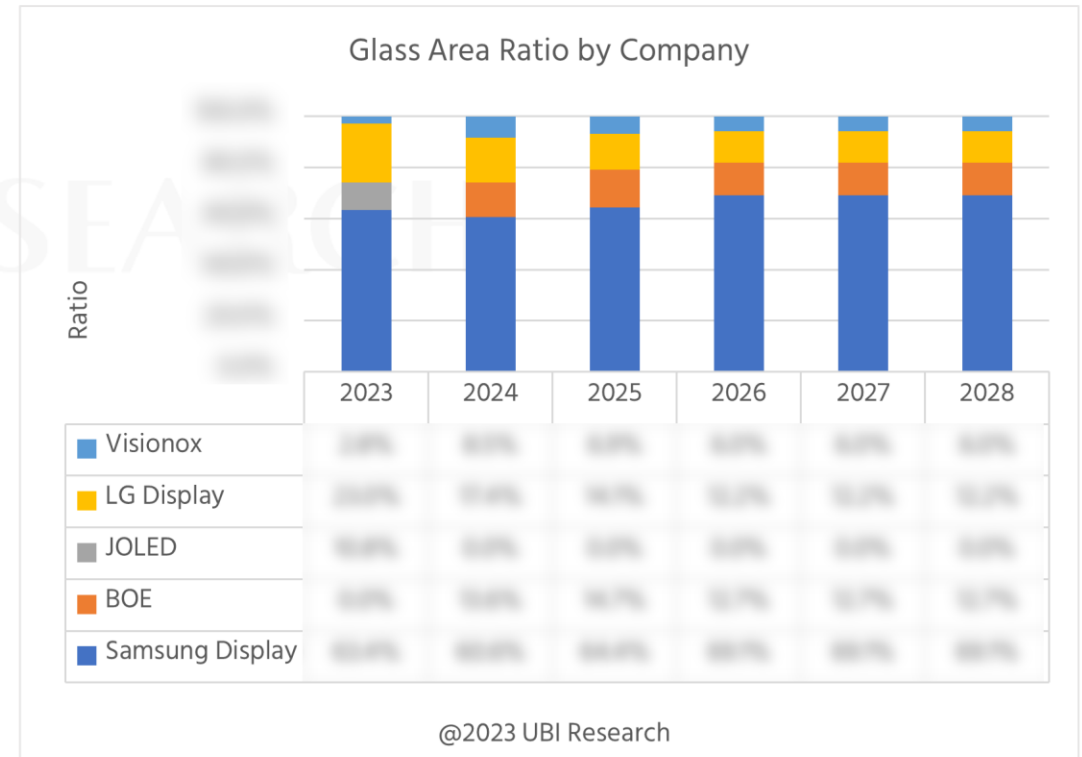
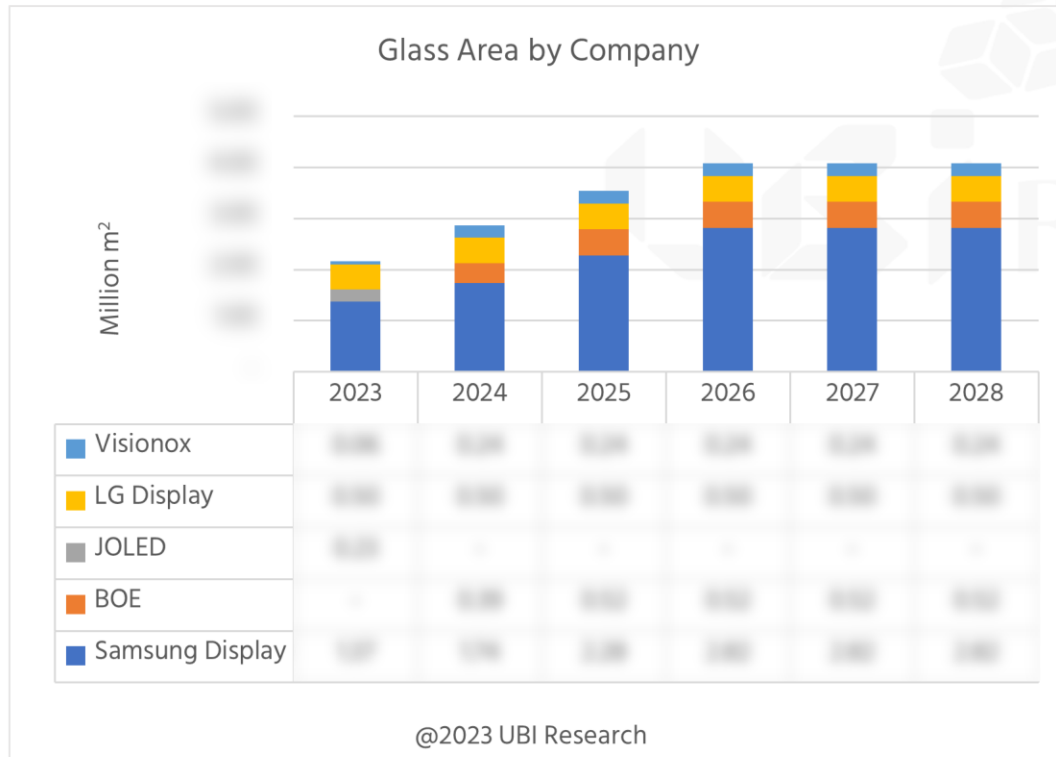
Source: UBI Research DB

# 8. OLED Panel Makers Mass Production Capacity Analysis and Forecast

## 8.7 Annual Substrate Area Forecast

### By Panel Makers

- Samsung Display's IT OLED line capacity is expected to reach \*\*\*M m<sup>2</sup> in 2028 due to A5 investment.
- The IT line capacity of LG Display, BOE, and Visionox is reflected only in the 6G line, and is expected to increase further in the future with investment in the 8.6G line.

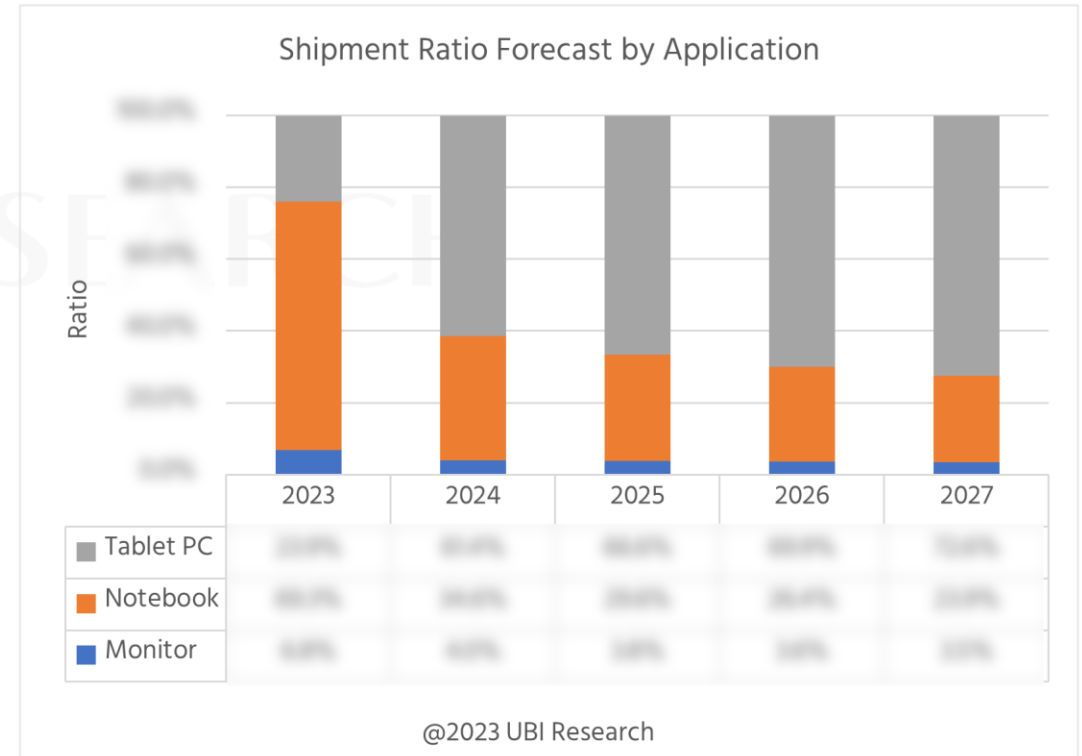
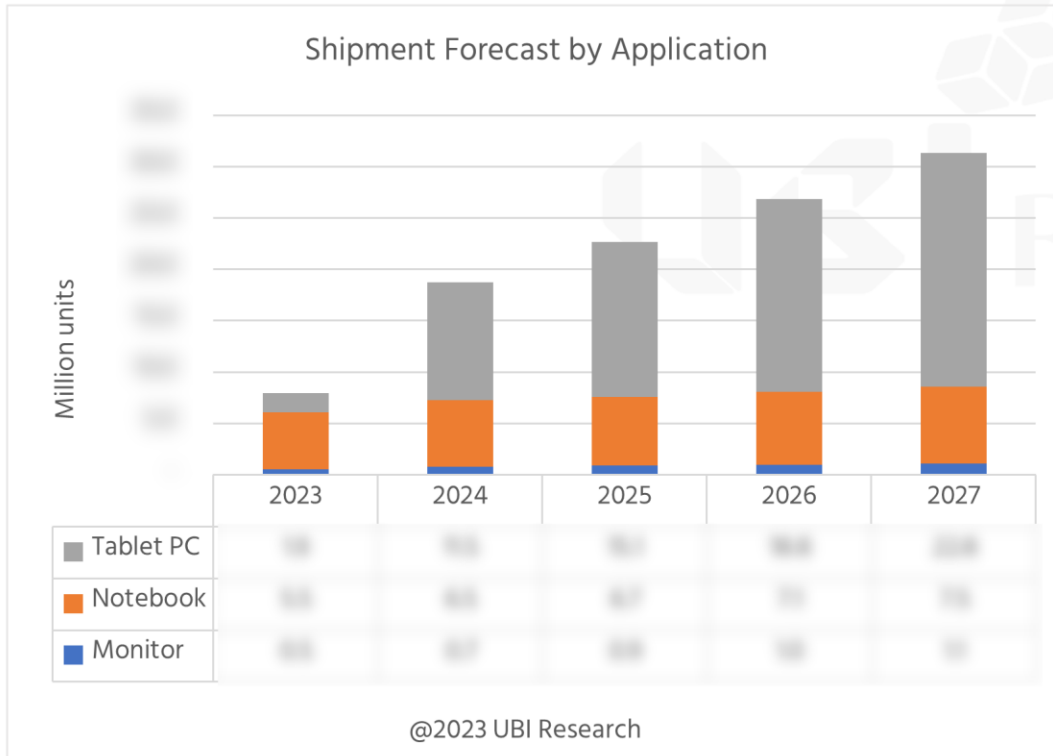




# 9. OLED Shipment Forecast

## 9.2 By Applications

- OLED shipments for Tablet PCs are expected to grow from \*\*\* million units in 2023 to \*\*\*million units in 2027, at an average annual growth rate of \*\*\*%.
- OLED shipments for notebooks are forecasted to reach \*\*\* million units in 2027 with an average annual growth rate of \*\*\*%.
- OLED shipments for monitors are expected to be \*\*\* million units in 2027.



# 9. OLED Shipment Forecast

## 9.3 By Panel Makers

- Samsung Display's OLED shipments for notebooks are expected to increase from \*\*\* million units in 2023 to \*\*\* million units in 2027, and OLED shipments for tablet PCs are expected to increase from \*\*\* million units in 2023 to \*\*\* million units in 2027.
- LG Display's OLED for tablet PCs are expected to maintain \*\*\* million units from 2024 unless there is additional investment.
- BOE and Visionox are expected to mass produce \*\*\* million and \*\*\* tablet PCs in 2024 and \*\*\* million and \*\*\* million units in 2027, respectively, from their 6G lines.

IT OLED shipment forecast by panel makers

(Million units)

Company	Application	2023	2024	2025	2026	2027
Samsung Display	Notebook	150	150	150	150	150
	Tablet PC	150	150	150	150	150
	Monitor	150	150	150	150	150
LG Display	Tablet PC	-	150	150	150	150
BOE	Tablet PC	-	150	150	150	150
Visionox	Tablet PC	-	150	150	150	150
Total		150	450	450	450	450

Source: UBI Research DB

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Senior Analyst  
**Chang Wook HAN**  
**Chang Ho NOH**

Analyst  
**Dae Jeong YOON**