2020 OLED Display Annual Report

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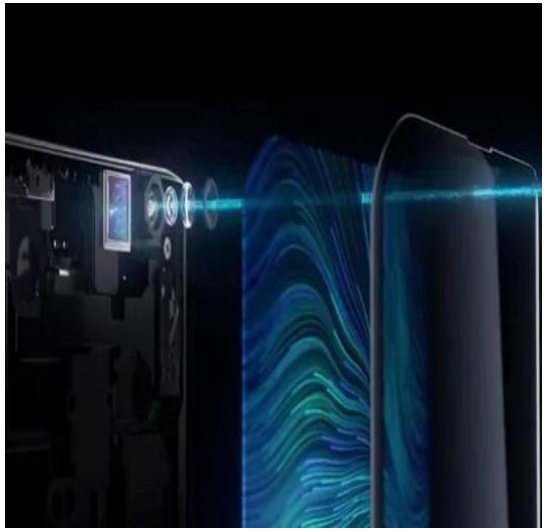
Contents

1. Key Summary ····· 5
2. OLED Industry Analysis for Smartphones····· 7
   - 2.1 OLED Smartphone Trend Analysis 8
   - 2.2 Foldable Phone Trend Analysis 18
   - 2.3 Smartphone and Foldable Phone Trend Prospect 19
   - 2.4 Rigid OLED, Flexible OLED, Foldable OLED Structure Analysis 23
   - 2.5 Analysis of OLED Exhibition Trends for Smartphones and Foldable Phones 27
   - 2.6 Business Status of OLED Companies for Smartphones and Foldable Phones 55
   - 2.7 Overall OLED Performance Analysis for Smartphone 63
   - 2.8 Quarterly OLED Performance Analysis for Smartphones and Foldable Phones 65
   - 2.9 OLED performance analysis by company 67
   - 2.10 OLED performance analysis by size 71
   - 2.11 OLED Performance Analysis by Substrate 80
   - 2.12 OLED Performance Analysis by Country 84
   - 2.13 OLED Demand Supply Analysis 86
   - 2.14 OLED Market Forecast for Smartphones and Foldable Phones 88
3. OLED Industry Analysis for TV····· 92
   - 3.1 OLED TV Trend Analysis 93
   - 3.2 OLED TV Exhibition Trend Analysis 95
   - 3.3 WRGB OLED and QD-OLED Structure Analysis 107
   - 3.4 Trend Analysis of OLED for TV 108
   - 3.5 Current Status of OLED business for TV 119
   - 3.6 Overall OLED Performance Analysis 121
   - 3.7 OLED Performance Analysis by Size 124
   - 3.8 OLED Demand and Supply Analysis 127
   - 3.9 OLED Market Forecast for TV 129
4. OLED Industry Analysis for Watches····· 130
   - 4.1 OLED Watch Trend Analysis 131
   - 4.2 Analysis of OLED Trend for Watches 134
   - 4.3 Business Status of OLED Companies for Watches 140
   - 4.4 Overall OLED Performance Analysis 142
   - 4.5 OLED performance analysis by company 144
   - 4.6 OLED Performance Analysis by Substrate 148
   - 4.7 OLED Performance Analysis by Country 152
   - 4.8 OLED Market Forecast for Watches 154
5. Monitor OLED Industry Analysis····· 155
   - 5.1 OLED Monitor Trend Analysis 156
   - 5.2 RGB OLED and Sol OLED structure analysis 157
   - 5.3 Monitor OLED Display Trend Analysis 158
   - 5.4 Business Status of OLED Companies for Monitor 164
   - 5.5 Monitor OLED Market Forecast 165
6. Automotive OLED Industry Analysis ····· 166
   - 6.1 Automotive Display Trend Analysis 167
   - 6.2 Automotive OLED Structure Analysis 186
   - 6.3 Automotive Display Exhibition Trend Analysis 188
   - 6.4 Business Status of OLED Companies for Automotive 204
   - 6.5 Automotive OLED Market Forecast 206
7. Solution Process OLED Industry Analysis····· 211
   - 7.1 Sol OLED structure and technology analysis 212
   - 7.2 Current Status of Sol OLED Companies 218
   - 7.3 Sol OLED Business Analysis and Forecast 224
   - 7.4 Sol OLED Exhibition Trend Analysis 232
8. OLED Mass Production Capa Analysis and Prospect· 240
   - 8.1 Investment timing and investment capa prospects 241
   - 8.2 Full Production Capa Analysis and Investment timing Analysis 242
   - 8.3 Prospect of mass production capacity 244
   - 8.4 Mass Production Capa Forecast by Company 247
   - 8.5 Mass Production Capa Forecast by Generation 250
   - 8..6 Mass Production Capa Forecast by Company for Mobile Device 253
   - 8.7 Mass Production Capa Forecast by Substrate for Mobile Device 256
   - 8.8 Prospect of OLED Mass Production Capa for TV 258
   - 8.9 Production Capa Forecast by Country 259
   - 8.10 Status of OLED Mass Production Line by Company for Smartphones 261
   - 8.11 Status of OLED OLED Production Line by Company 264
9. OLED Market Performance Analysis····· 265
   - 9.1 Overall Market Performance Analysis 266
   - 9.2 Market performance analysis by company 268
   - 9.3 Performance Analysis by Application 287
   - 9.4 Market Performance Analysis by Substrate 291
   - 9.5 Market performance analysis by country 309
   - 9.6 ASP 319
10. OLED Market Forecast····· 321
    - 10.1 Overall market outlook 322
    - 10.2 Market Forecast by Panel Company 323
    - 10.3 Market Forecast by Application 325
    - 10.4 Market Forecast by Country 327

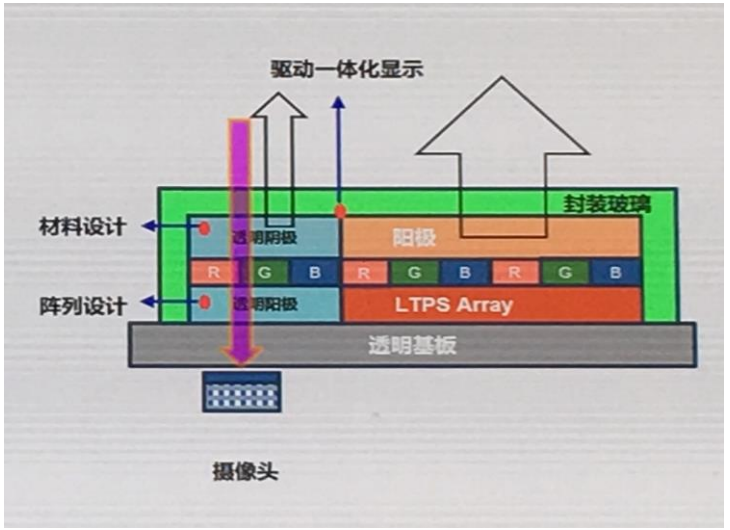
2.3 Smartphone and Foldable Phone Trend Prospect

- **UPC OLED Smartphone**
  - In 2020, it is expected that UPC (under panel camera) smartphones will be released without camera holes placed behind the screen.
  - At CIOC 2019, Visionox proposed a method of making a transparent display near the camera using transparent electrodes, and at 29th Finetech Japan, BOE announced the use of patterned electrodes and a method of implementing pixels at low resolution near the camera location.
  - The issues of UPC smartphones include low transmittance and color deviation. The solution to this problem is to use high-transparent PI substrate, patterned cathode electrode, pixel design to reduce color deviation, and to improve photo quality. Algorithm technology is being considered.

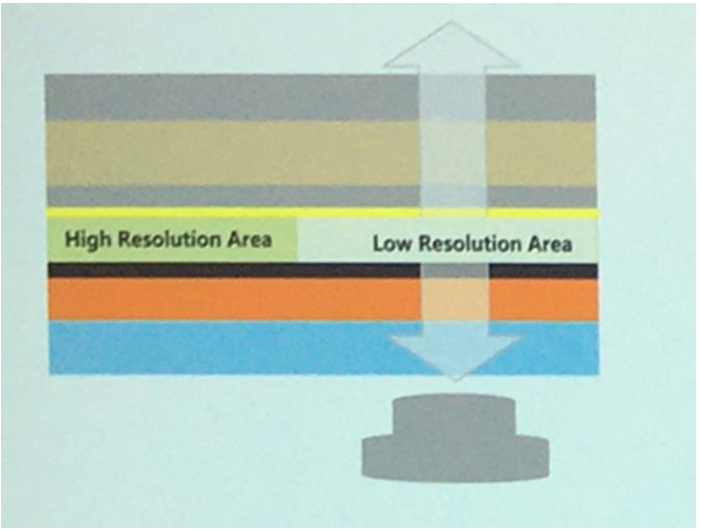
Oppo's Concept



Visionox's Concept



BOE's Concept



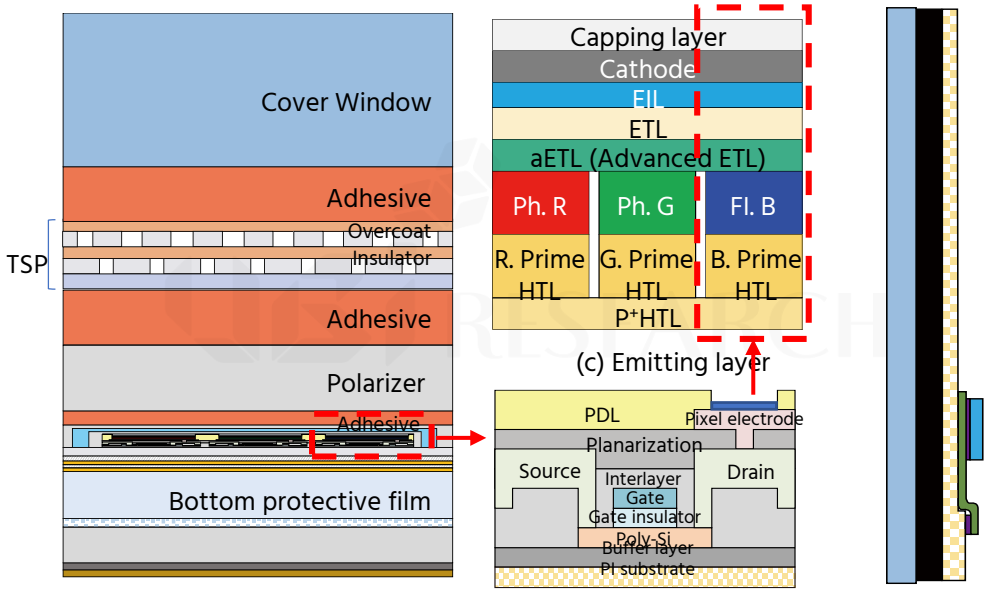
Source: twitter.com/oppomobileindia , Visionox, BOE, UBI Research DB

2.4 Rigid OLED, Flexible OLED, Foldable OLED Structure Analysis

Flexible OLED

- Like rigid OLED, LTPS TFT and OLED pixels are formed on the polyimide substrate, and PET protective film is attached to the bottom.
- Encapsulation is a thin film encapsulation (TFE) method in which inorganic and organic materials are laminated, and touch is divided into an on-cell method in which a touch electrode is directly formed on the TFE and an add-on method of attaching a touch sensor using a base film and an adhesive.
- The module is completed by attaching a polarizer, 2.5D or 3D glass cover window, FPCB, COP (chip on plastic) or COF (chip on film) driver IC on the cell.

Add-on Touch Flexible OLED Structure

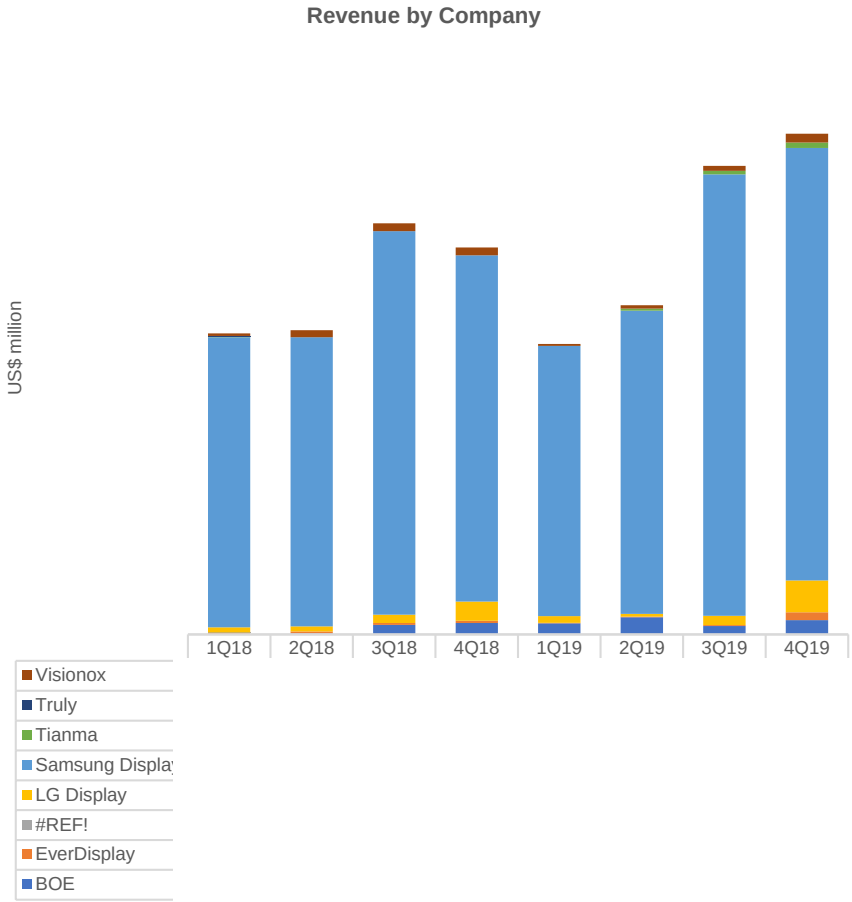


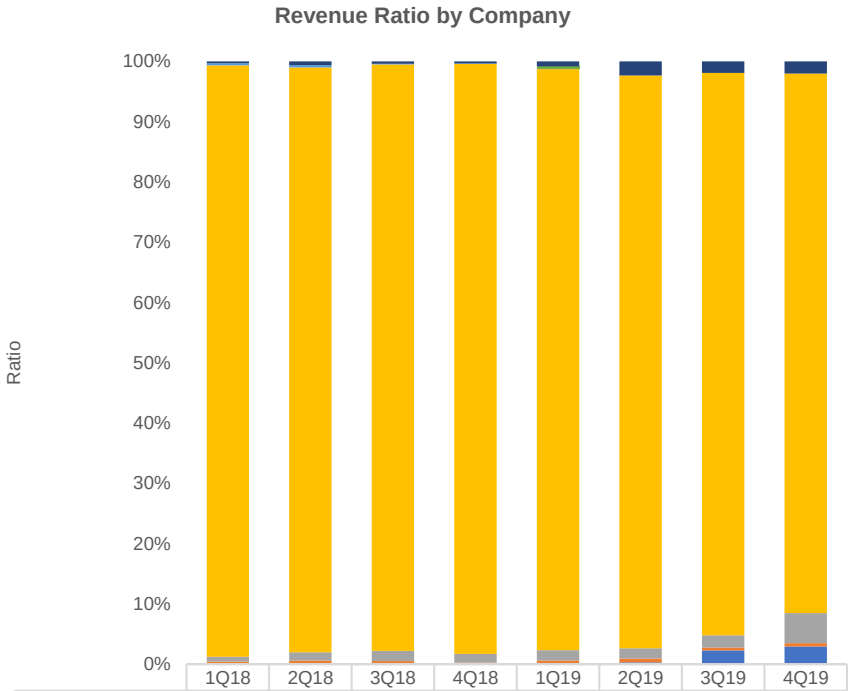
(a) Flexible OLED panel structure (b) LTPS TFT (c) Emitting layer (d) Cross section (COF structure)

Source: UBI Research DB

2.9 OLED performance analysis by company

Quarterly Sales Revenue Analysis by Company



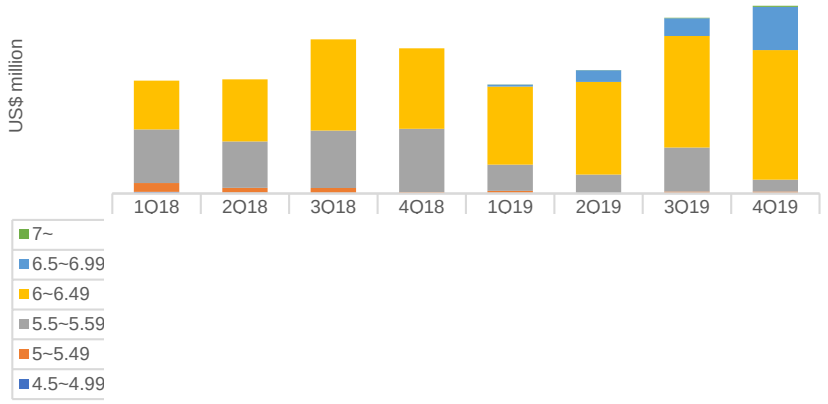


	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19
Visionox	0.3%	0.6%	0.4%	0.4%	0.8%	2.3%	1.9%	2.0%
Truly	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
Tianma	0.4%	0.4%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
Samsung Display	98.1%	97.0%	97.3%	97.9%	96.4%	95.0%	93.3%	89.5%
LG Display	0.8%	1.4%	1.7%	1.4%	1.7%	1.7%	2.0%	5.0%
EverDisplay	0.5%	0.6%	0.5%	0.3%	0.5%	0.7%	0.5%	0.6%
BOE	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	2.3%	2.9%

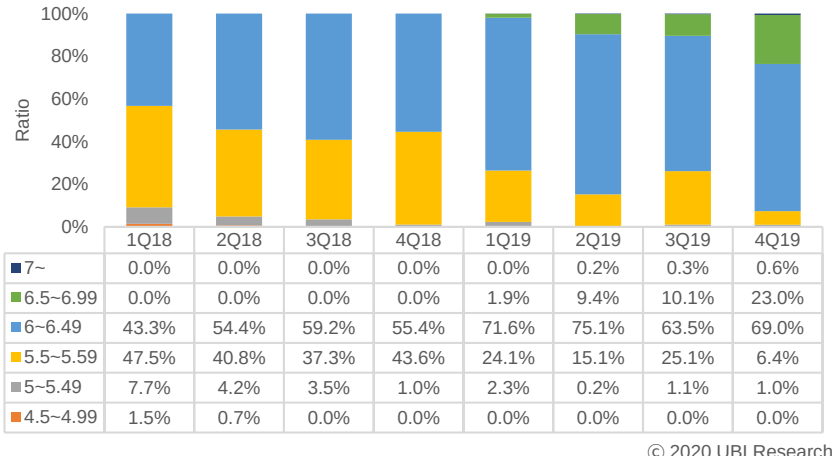
2.10 OLED performance analysis by size

Quarterly Sales Revenue Analysis

Revenue by Size (inch)

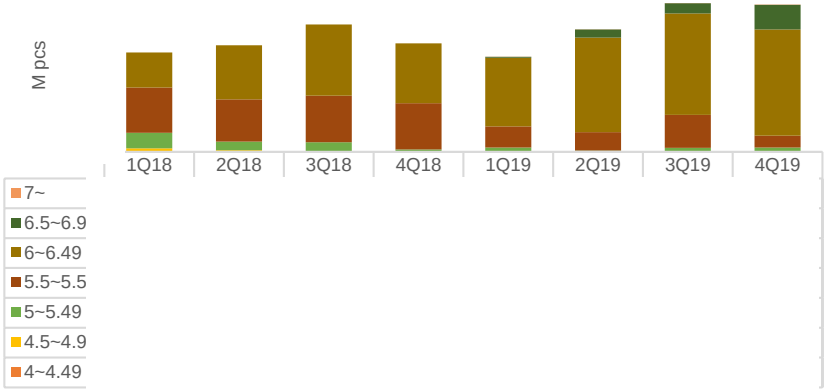


Revenue Ratio by Size (inch)

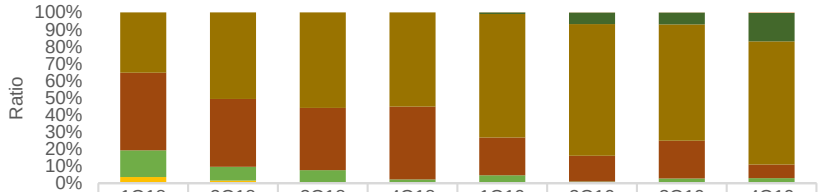


	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19
7~	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.6%
6.5~6.99	0.0%	0.0%	0.0%	0.0%	1.9%	9.4%	10.1%	23.0%
6~6.49	43.3%	54.4%	59.2%	55.4%	71.6%	75.1%	63.5%	69.0%
5.5~5.59	47.5%	40.8%	37.3%	43.6%	24.1%	15.1%	25.1%	6.4%
5~5.49	7.7%	4.2%	3.5%	1.0%	2.3%	0.2%	1.1%	1.0%
4.5~4.99	1.5%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Shipment by Size



Shipment Ratio by Size

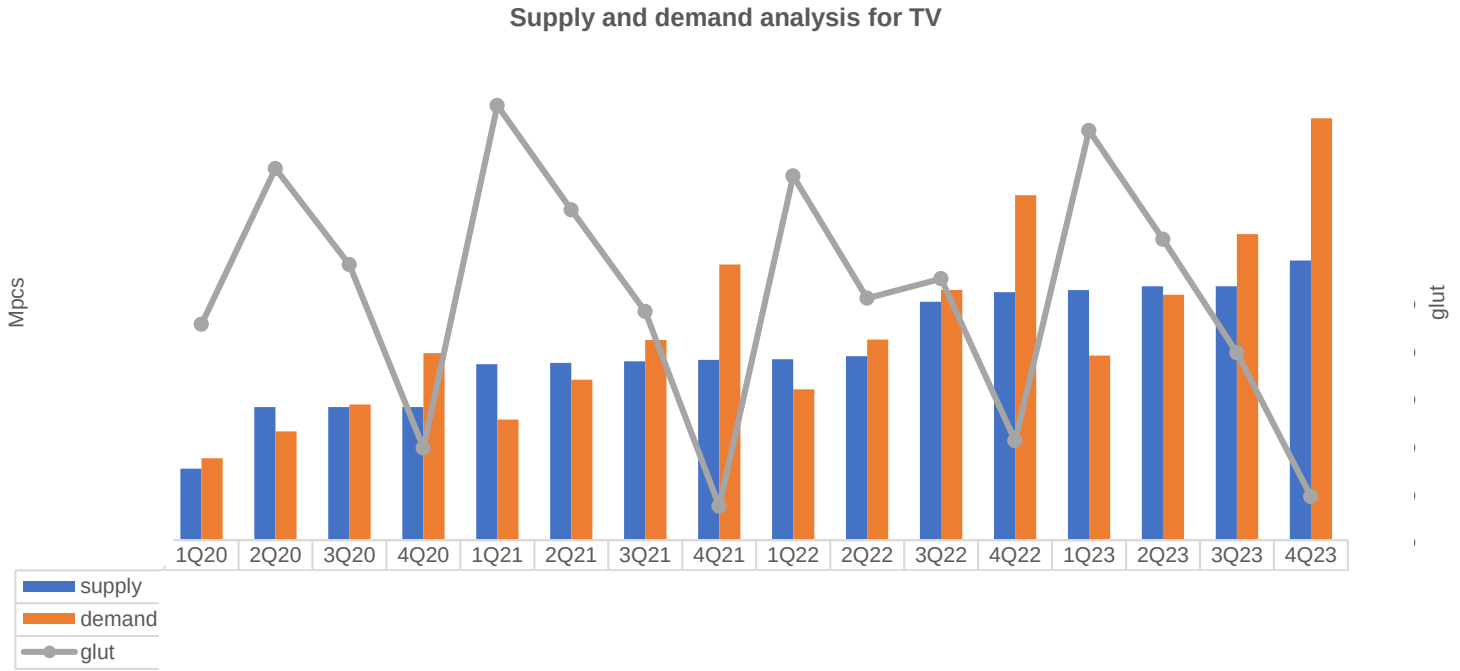


	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19
7~	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%
6.5~6.99	0.0%	0.0%	0.0%	0.0%	1.0%	6.7%	7.0%	16.7%
6~6.49	35.3%	50.7%	55.9%	55.2%	72.2%	77.1%	68.1%	72.1%
5.5~5.59	45.4%	39.7%	36.5%	42.5%	22.2%	15.0%	22.1%	8.0%
5~5.49	15.7%	8.1%	7.6%	2.3%	4.6%	1.1%	2.8%	2.9%
4.5~4.99	3.6%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4~4.49	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

3.8 OLED Demand and Supply Analysis

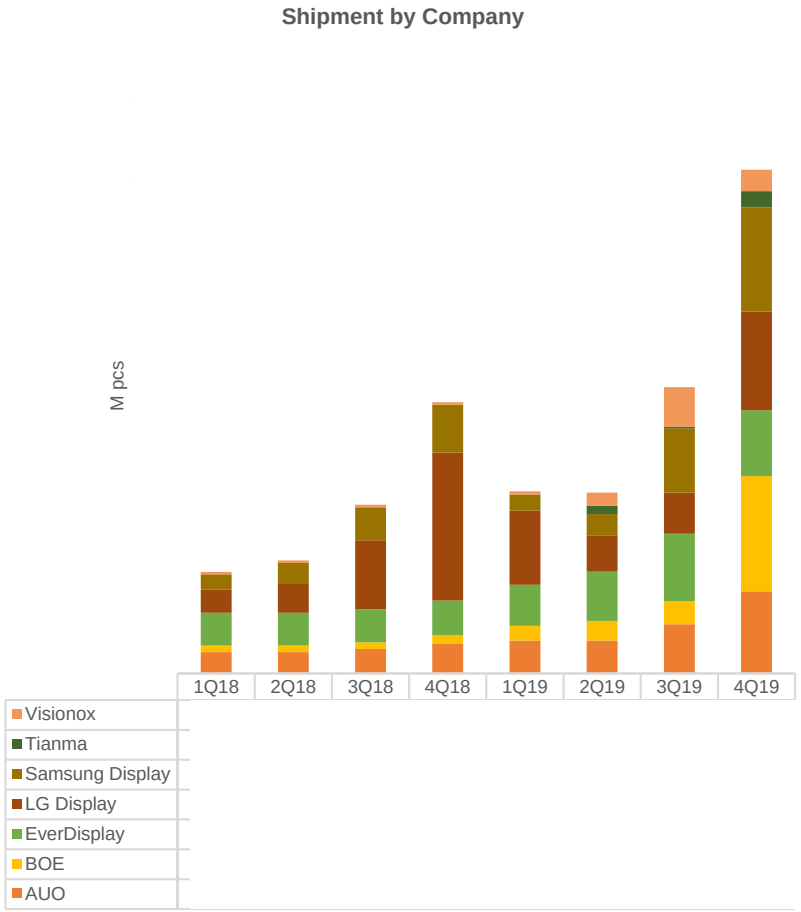
Quarterly Supply-Demand Analysis

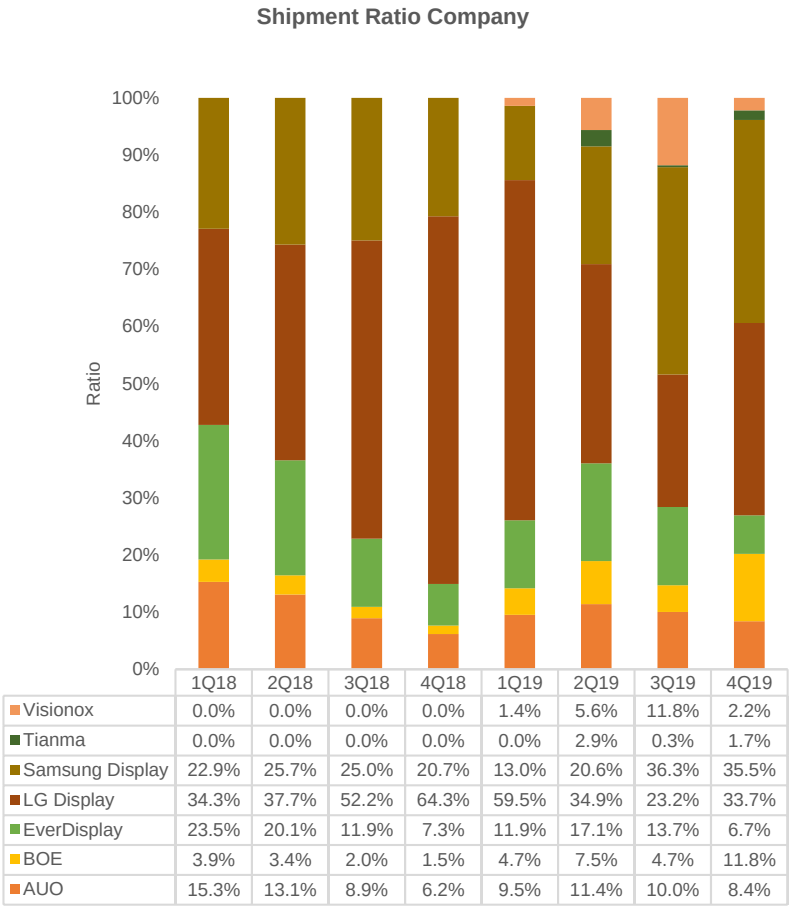
- LG Display's Guangzhou plant is expected to be difficult to supply panels in the first quarter of 2020, supplying 750,000 units. If panels are supplied from the Guangzhou plant in the second quarter, it is estimated that 1.4 million panels will be available per quarter by the end of 2020.
- From 2021, QD-OLED panel production will be possible at Samsung Display, and set makers' demand will surge.



4.5 OLED performance analysis by company

- **Quarterly Shipment Analysis**





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Tianma	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.3%	1.7%
Samsung Display	22.9%	25.7%	25.0%	20.7%	13.0%	20.6%	36.3%	35.5%
LG Display	34.3%	37.7%	52.2%	64.3%	59.5%	34.9%	23.2%	33.7%
EverDisplay	23.5%	20.1%	11.9%	7.3%	11.9%	17.1%	13.7%	6.7%
BOE	3.9%	3.4%	2.0%	1.5%	4.7%	7.5%	4.7%	11.8%
AUO	15.3%	13.1%	8.9%	6.2%	9.5%	11.4%	10.0%	8.4%

6. Automotive OLED Industry Analysis

6.1 Automotive Display Trend Analysis

- **Cluster**
  - CONTINENTAL exhibited 'Big Curved Plastic Lenses', a cockpit for the driver's seat using two 12.3-inch flexible OLEDs at CES ASIA 2019.
  - The plastic cover material of Big Curved Plastic Lenses is PET, which is safer than glass because of the risk of breakage, and because of its price advantage.
  - The reason why OLED is used in cockpit for driver's seat is because it is possible to realize flexible display and its contrast ratio and image quality are superior to LCD.
  - The future development direction of CONTINENTAL is the development of OLED cockpit with touch function.

CONTINENTAL's Flexible OLED Cockpit

Source: UBI Research DB

8.5 Mass Production Capa Forecast by Generation

- **Quarterly Mass Production Capa Forecast**