

# Advanced Packaging Update: Market and Technology Trends

Vol. 3-1023

This third volume of the Advanced Packaging Update includes an economic analysis and OSAT financials. Developments in co-packaged optics are discussed. An updated analysis of panel fan-out is presented, including new players. A special section examines MicroLEDs, discussing applications and players. A status report on PFAS elimination is provided.

## Table of Contents

### 1 Industry and Economic Trends

- 1.1 Economic Growth Slows
  - 1.1.1 China's Economy
  - 1.1.2 U.S. Macroeconomic Trends
- 1.2 Smartphone and PC Growth
  - 1.2.1 PC Shipments Decline
  - 1.2.2 Smartphone Shipments Decline
    - 1.2.2.1 Apple's Smartphone Growth
    - 1.2.2.2 Huawei's Mate 60 Pro

### 2 OSAT Financial Analysis

- 2.1 Market Overview
- 2.2 OSAT Market Performance
- 2.3 Company Highlights
  - ASE, Amkor, JCET, TFME, PTI, Huatian, UTAC, KYEC, Chipbond, ChipMOS
- 2.4 Financial Metrics
  - 2.4.1 Gross Margin
  - 2.4.2 R&D
  - 2.4.3 CAPEX
- 2.5 Outlook

### 3 CPO Developments

- 3.1 Ayar Labs
- 3.2 Broadcom
- 3.3 Cisco
- 3.4 Infinera
- 3.5 Intel
- 3.6 Marvell
- 3.7 OpenLight Photonics
- 3.8 SCINTIL Photonics
- 3.9 TSMC
- 3.10 OSATs
  - Amkor Technology, ASE, IBM Bromont, SPIL
- 3.11 Research Organizations
  - AIM Photonics, CEA-Leti, Fraunhofer IZM, IME, NTT, Tyndall National Institute

### 4 MicroLEDs

- 4.1 MicroLED Developments
  - Applied Materials, Avicena, Infineon and Nichia, Innovation Semiconductor, Jade Bird Display, Micledi, Mojo Vision, PlayNitride, Porotech, Scrona, Terecircuits, Uniqarta

### 5 Panel Fan-Out

- 5.1 Advantages for Panel FO
- 5.2 Challenges for Panel FO
- 5.3 Overcoming Challenges for Panel FO
- 5.4 Panel Production Lines
  - Amkor, AOI, ASE, China Wafer Level CSP, ECHINT, Innolux, nepes, PEP Innovation, PTI, Samsung, Unimicon
- 5.5 FO Panel Demand and Capacity

### 6 PFAS Elimination

#### References

#### List of Figures

- 1.1. Monthly U.S. housing starts.
- 3.1. ASIC and SCIP CoW assembly.
- 3.2. Broadcom's detachable optical connector.
- 3.3. Silicon photonics optical interposer.
- 3.4. Edge laser vs. embedded laser structure.
- 3.5. CEA-Leti's Optical Network on Chip system.
- 3.6. FOWLP for EIC and PIC packaging.
- 4.1. microLED application spaces and technologies.
- 4.2. Co-packaged optics with microLEDs.
- 4.3. Nichia's  $\mu$ PLS integrated microLED light engine.
- 4.4. Monolithic vertical architecture.
- 5.1. Amkor panel process.

#### List of Tables

- 1.1. Huawei's Packages by Supplier Location
- 2.1. Top 20 OSATs Quarterly Revenue
- 2.2. 1H 2022 v. 1H 2023 Top 20 OSAT Revenue
- 2.3. Historical Gross Margins for Top 10 OSATs
- 2.4. R&D Spending for Top 10 OSATs
- 2.5. CAPEX Spending for Top 10 OSATs
- 4.1. Comparison of Different Display Technologies
- 4.2. MicroLED Association Members
- 5.1. FO-WLP Panel Activities
- 5.2. Annual Panel Demand Forecast
- 5.3. Annual Panel Capacity
- 6.1. SIA White Papers on PFAS
- 6.2. Government Organizations Working on PFAS

