Fan-in wafer level package (WLP) and fan-out WLP continue to show strong growth. This report provides examples of the many products using WLP, including the supplier, number of WLPs in each product, and dimensions. Demand for flip chip in applications ranging from large die for AI accelerators to small die for amplifiers and filters is covered. Cu pillar is increasingly used for many devices. Demand continues for both 300mm and 200mm bumping and market projections in units and wafers are provided. An analysis of bumping, WLP, and FO-WLP capacity is presented for each segment by geographic region, technology, and wafer size. Panel processing developments, applications, and production plans are presented. Flip chip equipment and assembly methods are discussed. A set of 90 PowerPoint slides is included with the detailed analysis.

Executive Summary

1 Technology Developments
1.1 Fan-in and Fan-out WLPs
1.1.1 Chip Package Interaction Issues
1.1.2 Singulation and Edge Protection
1.1.3 Solder Ball Material and Pitch Trends
1.2 FO-WLP Developments
1.2.1 Large Area Panel Development
1.2.2 Panel Process Challenges
1.2.2.1 Economic Issues
1.2.2.2 Technical Issues
1.2.3 PLP Consortia Activities
1.3 Flip Chip Bump Trends
1.3.1 Pb-free Bumps
1.3.2 Cu Pillar
1.3.3 Bump Pitch Trends
1.3.4 CPI Issues
1.4 Wafer Sizes
1.5 Flip Chip Bump and WLP Price Trends
1.6 Flip Chip Substrate Trends
1.6.1 High-Density Substrate Trends
1.6.1.1 Silicon Interposers
1.6.1.2 Fan Out on Substrate
1.6.1.3 Embedded Bridge
1.6.1.4 3D Configurations
1.6.1.5 Glass Substrates
1.6.1.6 Organic Interposers
1.6.2 FC-CSP Substrate Trends
1.6.3 Warpage Challenges
1.6.4 Leadframe and Molded Substrates
1.7 Underfill Material Trends
2 Flip Chip Market Projections
2.1 Wafer Bump Capacity
2.1.1 Flip Chip Bump Capacity
2.1.2 Electroless NiAu
2.1.3 Gold Bump Capacity
2.2 Flip Chip Demand
2.2.1 Flip Chip Bumping Market Projections
2.2.2 Cu Pillar Trends
2.2.3 Gold Bumping Market Projections
2.2.4 Flip Chip Application by Device Type
2.2.4.1 High-Performance Devices
2.2.4.2 PCs and Game Consoles
2.2.4.3 Cryptocurrency
2.2.4.4 Media Chips
2.2.4.5 Pre-amps for HDDs
2.2.4.6 Mobile Phones and Tablets
2.2.4.7 RF Front-end Modules
2.2.4.8 Consumer Products and Games
2.2.4.9 Flip Chip on Leadframe
2.2.4.10 Filters
2.2.4.11 Medical
2.2.4.12 Automotive Electronics
2.2.4.13 Military and Aerospace
2.2.4.14 Integrated Photonics
2.2.4.15 DRAM
2.2.4.16 RFID Tags
2.2.4.17 High Brightness LEDs
3 WLP Trends and Market Projections
3.1 Fan-in WLP Applications
3.1.1 Mobile Phones
3.1.2 Tablets and Laptop/Tablet Hybrids
3.1.3 Wearables
3.1.3.1 Smartwatches
3.1.3.2 Smart Earbuds
3.1.4 Smart Speakers
3.1.5 AR/VR Headsets
3.1.6 Drones
3.1.7 Automotive Electronics
3.1.8 Power Devices
3.2 Fan-in WLP Market Forecast
3.3 FO-WLP Drivers and Projections
  3.3.1 FO-WLP Versions and Suppliers
  3.3.2 FO-WLP Applications
  3.3.3 FO-WLP on Substrate
  3.3.4 Panel Level FO-WLP Applications
  3.3.5 FO-WLP Market Forecast
3.4 Fan-in WLP, FO-WLP, Panel Capacity
  3.4.1 FO Panel Demand and Capacity
4 Wafer Bumping and WLP Service Providers
5 Flip Chip Assembly and Equipment
  5.1 Flip Chip Bonders
Appendix A: Bumping and WLP Services
Appendix B: Underfill Materials
Appendix C: Assembly Service Suppliers
Appendix D: Placement & Bonding Equipment
Appendix E: Laminate Substrate Suppliers

Partial List of Figures
1.1. Foveros technology with 3D face-to-face stacking.
2.2. Solder bump and copper pillar capacity.
2.3. Copper pillar 300mm wafer demand.
2.4. TSMC’s InFO PoP for A11.
2.6. Apple A12X in iPad Pro.
3.3. JCET ECP for power device.
3.5. eSiFO for SiP with 40GHz chip.
3.6. InFO in Apple watch.
3.7. Bottom PoP in FOPLP with AP and PMIC.
3.9. 5G RF package with FO panel process.
4.1. PMT’s minimal tool line.

Partial List of Tables
1.2. FO-WLP Panel Activities
1.4. Bump Pitch Trends
1.5. Examples of Laminate Substrates
2.1. Merchant and Captive Flip Chip Bump Capacity
2.2. Gold Bump Capacity Projections
2.3. Demand for Flip Chip Bumping
2.4. Flip Chip Die Size and Bump Pitch Examples
2.5. Demand for Gold Bumped ICs
2.6. Flip Chip Demand by Device Category
2.7. Large Die FC-BGA Test Vehicle
2.8. Flip Chip Examples in Smartphones
2.9. RF FEMs with Flip Chip
3.1. WLPs in iPhone XS and XS Max
3.2. WLPs in ASUS ZenFone 5Z Mid-Range Phone
3.3. WLPs in Nokia 8110 4G Feature Phone
3.4. WLPs in Galaxy Tab S4
3.5. WLPs in Surface Pro 6
3.6. WLPs in Fitbit Ionic
3.11. WLPs in Apple HomePod
3.12. WLPs in the HTC Vive Pro Headset
3.14. Fan-in Wafer Level Package Demand
3.15. Fan-out WLP Redistributed Wafer Process Types
3.16. FO-WLP Applications, Customers, and Suppliers
3.17. Fan-out WLP Examples
3.18. Radar Sensor Packages
3.19. Fan-out WLP on Substrate
3.20. TSMC’s InFO_oS Trends
3.21. FO-WLP Production Status
3.22. FO-WLP Market Projections in Units
3.23. FO-WLP Market Projections in Reconstituted Wafers
3.24. Fan-in WLP Capacity and Demand Projections
3.25. Annual Panel Demand Forecast
3.26. Estimated Annual Panel Capacity
4.1. Selected Merchant Wafer Bumping and WLP Offerings
4.2. Reconstituted Wafer and FO-WLP Suppliers

Fax to 512-372-8889 or Email to tsi@techsearchinc.com