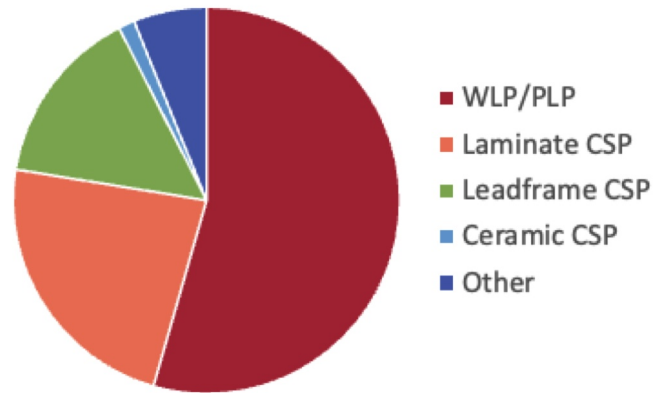


Google Pixel 7 with mmWave

Teardown from TechSearch International, Inc.



147 Packages



Contents and Highlights

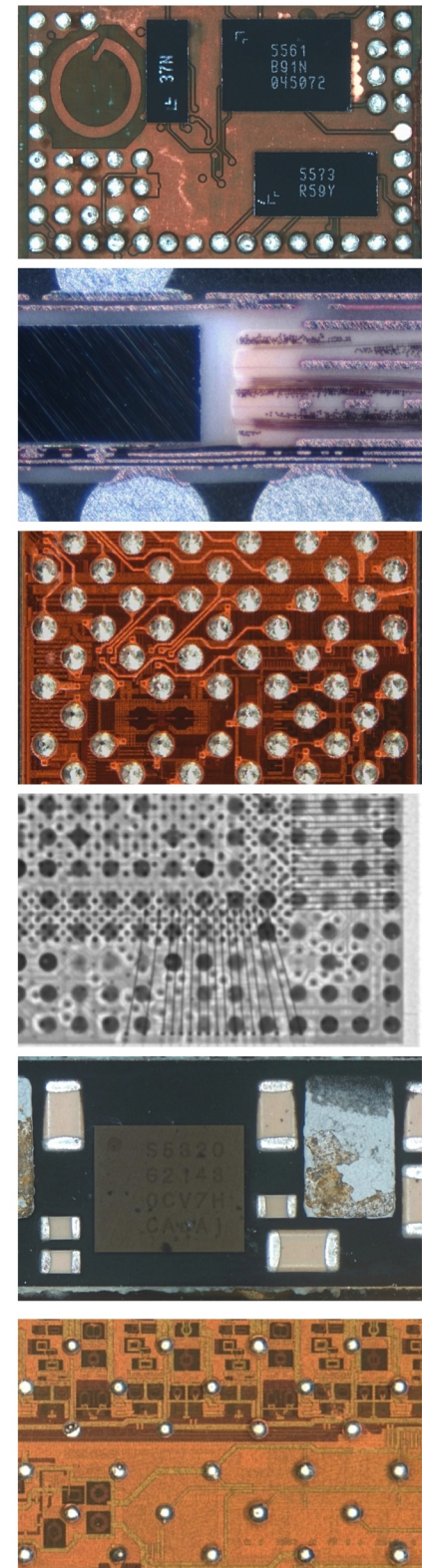
- 169-page report with package quantity summaries, photos of packages, x-rays, package dimensions, thermal management material identification, and main board cross section
- 27 slides with extra details including PoP and FO-PLP cross sections, advanced packaging technology characteristics, and interesting finds
- Deep analysis of the Google Tensor G2 application processor, co-designed by Google and Samsung, manufactured on Samsung's 5nm process, and packaged on Samsung's fan-out panel production line
- Compared to Pixel 6a, the Pixel 7 has 45% more WLPs

Teardowns backed by 35 years serving as the industry's trusted source for semiconductor packaging trend analysis

- Examination of all chips with emphasis on assembly and packaging technologies
- Superb quality photographs and x-ray images
- Both the packages and the die within are identified and characterized
- Detailed construction analysis of key chips and packages



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Sample pages from the report and slides

Google Pixel 7 with 5G mmWave

QOML3

category Smartphone (mid-range)

released Oct 2022



Package quantities (by package type)

WLP/PLP

Laminate CSP

Leadframe CSP

MIS CSP

Ceramic CSP

Other

TOTAL

147

Total areas (mm²)

Bare die solutions included

Bare die solutions excluded

Package area

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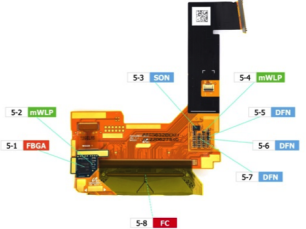
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Package = Any device that has completed final packaging steps; includes all other packaged devices as well as finished packages mounted on other packages/modules. Connectors not counted as packages.

Bare die solutions = Finished devices mounted directly on boards or flex circuits (e.g., chip on board, chip on flex, chip on substrate, etc.)

Google Pixel 7 with 5G mmWave

ASSEMBLY 5 — Display flex circuits

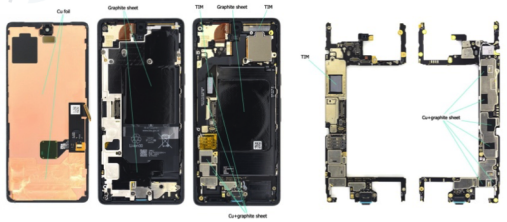


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Thermal Management Materials in Pixel 7



- To dissipate heat, Pixel 7 makes extensive use of Cu foils and graphite sheets, including sheets that combine a layer of Cu foil and a layer of graphite
- TIM gap fillers are applied to top of the AP/DRAM PoP and to the 5G mmWave module
- Pixel 7 Pro has same thermal management design; neither model has a vapor chamber

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Google Pixel 7 with 5G mmWave

PACKAGE QUANTITY DETAILS

Board-level assembled packages

WLP/PLP

Laminate CSP

Leadframe CSP

MIS CSP

Ceramic CSP

Bare die on board/flex

Other

TOTAL

WLP

mWLP

FO-WLP

FO-PLP

FBGA

FLGA

CSP-L

QFN

SON

DFN

MIS CSP

CBGA

CLGA

CSP-C

FC

WB

Other

TOTAL

Package-level assembled packages

WLP/PLP

Laminate CSP

Leadframe CSP

MIS CSP

Ceramic CSP

Other

TOTAL

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Google Pixel 7 with 5G mmWave

ASSEMBLY 1 — Main board side 1

1-14 1 Google

Titan M security processor

H1D3M

Logic

FBGA (Laminate CSP)

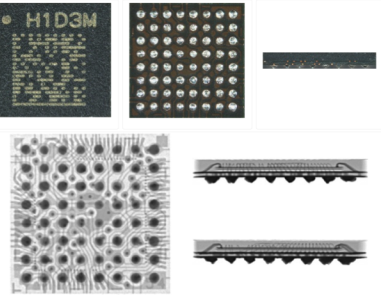
12 mm x 12 mm

12 mm

12 mm

12 mm

Wire Bond die



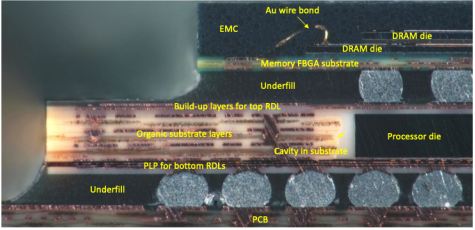
X-ray equipment provided by Creative Electron

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PoP Cross Section Details



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Google Pixel 7 with 5G mmWave

PACKAGES BY SUPPLIER LOCATION

Supplier HQ

China

Europe

Japan

Korea

N America

SE Asia

Taiwan

Other

unknown

TOTAL

147

Geographic quantities based on headquarters location of chip suppliers; includes bare die solutions

PACKAGE AREA BY CHIP TYPE

Chip Type

Analog/Mixed-signal

RF analog

Logic

Memory

Sensor-Actuator

Image sensor

Discrete

Opto

Passive

IPD

unknown

TOTAL

mm²

mm²

mm²

mm²

mm²

mm²

mm²

mm²

mm²

mm²

mm²

mm²

Measured width x length; includes bare die solutions

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Google Pixel 7 with 5G mmWave

ASSEMBLY 2 — Main board side 2

2-1 1 Samsung Semiconductor

PMIC

S2MPG13

Analog/Mix-Sig

WLP (WLP/PLP)

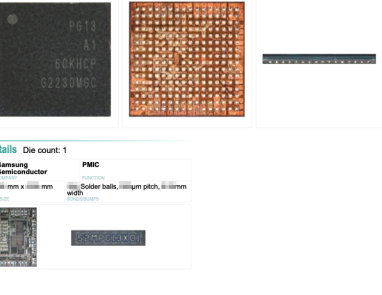
12 mm x 12 mm

12 mm

12 mm

12 mm

Underfill



Component Details

Die count: 1

2-1-1 1 Samsung Semiconductor

PMIC

WLP/PLP


12 mm x 12 mm

12 mm

12 mm

12 mm

Underfill



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WLP Counts

	Pixel 6a	Pixel 7	Pixel 7 Pro
Analog/mixed-signal			
RF Analog			
Logic			
Memory			
Sensor			
ESD/TVS diode			
Discrete transistor			
Opto			
Total			

Includes Google Tensor G2 FO-PLP in Pixel 7 and 7 Pro

- WLP Count in the Pixel 7 increased 45% compared to the Pixel 6a
- Roughly half of the WLPs in the latest Pixel phones are ESD/TVS diodes, and there was a significant increase in the quantity of these devices in the Pixel 7/7 Pro

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