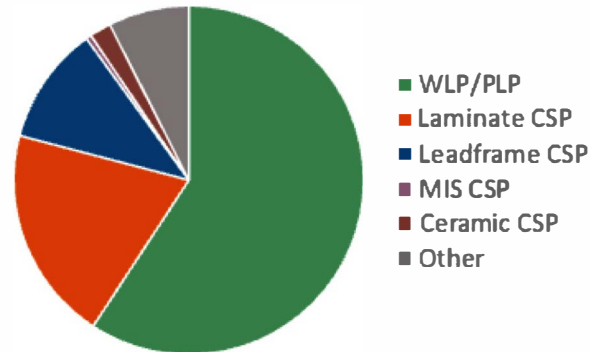


Apple iPhone 16 Pro Max

Teardown from TechSearch International, Inc.



201 Packages Examined



Contents and Highlights

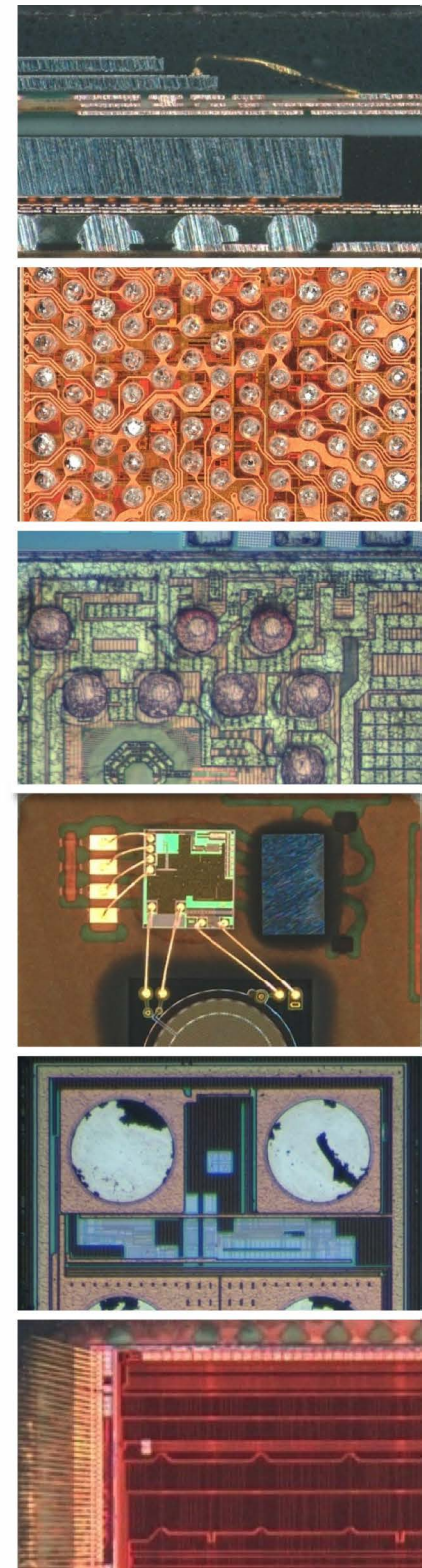
- 263-page report with package quantity summaries, high-resolution photos and x-rays, package dimensions, thermal management material analysis
- 44 additional slides with extra details including PoP and main board cross sections, advanced packaging technology characteristics, and interesting finds
- Every package in the phone examined, including decapsulation and analysis of the die contained within
- Deep analysis of Apple's A18 Pro application processor in FO-WLP, including layer and Cu stud metrics from cross sections
- Total package count has exceeded 200 for the first time

Teardowns backed by 37 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

Apple iPhone 16 Pro Max

A3084

category Smartphone (high-end)
released Sep 2024



Package quantities (by package type)

WLP/PLP	
Laminate CSP	
Leadframe CSP	
MIS CSP	
Ceramic CSP	
Other	
TOTAL	201

Die quantities (by die interconnect type)

RDL/WLP	
Flip chip	
Wire bond	
Clip	
Ribbon	
TOTAL	

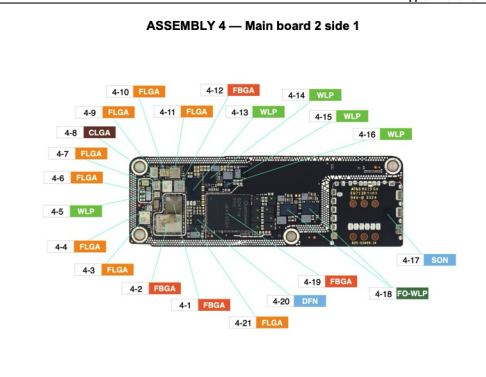
Total area (mm²)
Bare die solutions included: 1,954
excluded: 1,954

Package area
Die area
Die / package

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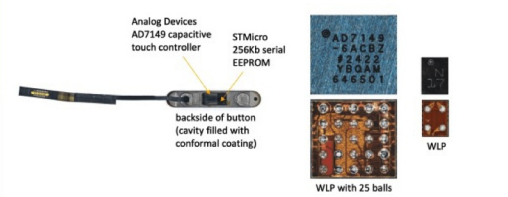
ASSEMBLY 4 — Main board 2 side 1



Apple iPhone 16 Pro Max

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Chips for New Camera Control Button



- ADI's AD7149 is same chip Apple previously used for the Home button on the front of the iPhone 8 (and older) as well as in various other products such as Apple Watch, HomePod, and AirPods Pro
- Both chips underfilled

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Apple iPhone 16 Pro Max

PACKAGE QUANTITY DETAILS

Board-level assembled packages	Board-level	Package-level
WLP/PLP		
Laminate CSP		
Leadframe CSP		
MIS CSP		
Ceramic CSP		
Bare die on board/flex		
Other		
TOTAL		

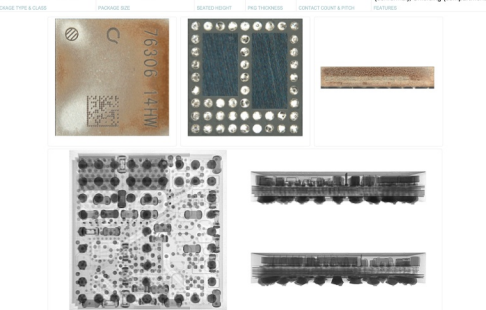
Package-level assembled packages	Board-level	Package-level
WLP/PLP		
Laminate CSP		
Leadframe CSP		
MIS CSP		
Ceramic CSP		
Other		
TOTAL		

Board-level = Packaged devices mounted to boards, flex circuits, etc. during electronics assembly
Package-level = Pre-packaged devices assembled inside other encapsulated packages or modules
L = Laminate substrate; C = Ceramic substrate

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ASSEMBLY 4 — Main board 2 side 1

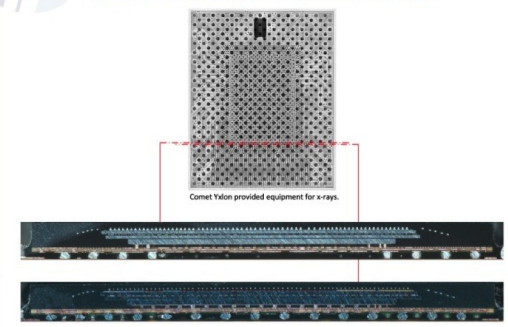
REF	QTY	COMPONENT	DESCRIPTION	UNIT WEIGHT	UNIT VALUE
4-1	1	Qorvo	RF PAM (5G)	3.73 mm x 3.63 mm	48, 0.4 mm
			FBGA (Laminate CSP)		



Comet Xylon provided equipment for x-rays

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Qualcomm Snapdragon X71M Modem (2 of 2)



Comet Xylon provided equipment for x-rays.

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Apple iPhone 16 Pro Max

PACKAGES BY SUPPLIER LOCATION

Supplier HQ	Count
China	
Europe	
Japan	33
Korea	
N America	
SE Asia	
Taiwan	
Other	
unknown	
TOTAL	201

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

PACKAGE AREA BY CHIP TYPE

Chip Type	Area (mm ²)
Analog/Mixed-signal	
RF analog	
Logic	
Memory	
Sensor-Actuator	
Image sensor	221.2
Discrete	
Op-amp	
RF Passive	
IPD	
unknown	
TOTAL	

Measured width x length; includes bare die solutions

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ASSEMBLY 4 — Main board 2 side 1

Component Details

Die count: 10

REF	QTY	COMPONENT	DESCRIPTION	UNIT WEIGHT	UNIT VALUE
4-1-1	1	Qorvo	RF LNA	1.14 mm x 2.42 mm	42 Solder bumps, 0.15mm pitch, 77µm width
			Flip chip		
4-1-2	1	Qorvo	RF switch	4.3 mm x 3.0 mm	43 Solder bumps, 0.15mm pitch, 77µm width
			Flip chip		
4-1-3	1	Qorvo	IB-V PA	13 Cu pillars, 0.15mm pitch, 115µm width	
			Flip chip		
4-1-4	1	Qorvo	IB-V PA	13 Cu pillars, 0.15mm pitch, 115µm width	
			Flip chip		
4-1-5	1	Qorvo	RF IPD	15 Cu pillars, 0.15mm pitch, 8.5mm width	
			Flip chip		
4-1-6	1	Qorvo	BAW filter	15 Cu pillars, 0.15mm pitch, 145µm width	
			Flip chip		

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REF	QTY	COMPONENT	DESCRIPTION	UNIT WEIGHT	UNIT VALUE						
5.6	1	Broadcom (Avago)	AFEM 8234	RF PAM (5G and LTE, HBWB)	RF Analog	FBGA	5.77 x 5.64 x 0.66	173	32	24	Flip chip, Sheeting (conformal), Sheeting (conformal), Double sided
5.7	1	Qorvo	QM76307	RF PAM (5G)	RF Analog	FBGA					
5.8	1	Skyworks	SKY5602-16	Sky56 PAM (2G)	RF Analog	FLGA					
5.9	1	Semiconductor	CXA4487	Antenna switch	RF Analog	WLP					
5.10	1	Broadcom (Avago)		Antenna filter	RF Passive	FLGA					
5.11	1	Murata		Antenna duplexer	RF Passive	CLGA					
5.12	1	Murata	158	2.4GHz WLF1 FEM	RF Analog	FLGA					
5.12.3	1	Texas Instruments	TPS7A21	LDO regulator	Analog/Mix-Sig	WLP					
5.13	1	Skyworks		Antenna coupler	RF Analog	FLGA					
5.14	1	Skyworks	SKY5615	Sky56 SGL1 WLF1 FEM	RF Analog	FLGA					
5.15	1	STMicroelectronics	ST33J2M0	32-bit secure MCU	Logic	WLP					
5.16	1	Murata	XM Series (0485-002)	RF switch	RF Analog	MIS					
5.17	2	Qualcomm	SDR735	RF transceiver	RF Analog	FBGA					
5.18	1	Qualcomm	SMR546	mMIM RF transceiver	RF Analog	FBGA					
5.19	1	Qualcomm	PM68450	Clock distribution IC	Logic	FO-WLP					
5.20	1	STMicroelectronics	M24C08	8Kb I2C serial EEPROM	Memory	WLP	0.7 x 0.7 x 0.3	4	0.4	1	
5.21	1	Qualcomm	PM685	PMIC for baseband	Analog/Mix-Sig	FO-WLP					
5.22	5	unknown supplier		2-4µm ESD protection diode	Discrete	mWLP					
6.1	1	USI	338M0287	5G mmWave transceiver module	RF Analog	FLGA					
6.2	1	USI		Passive 5G mmWave antenna	RF Passive	FLGA					

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For pricing, please call +1-512-372-8887