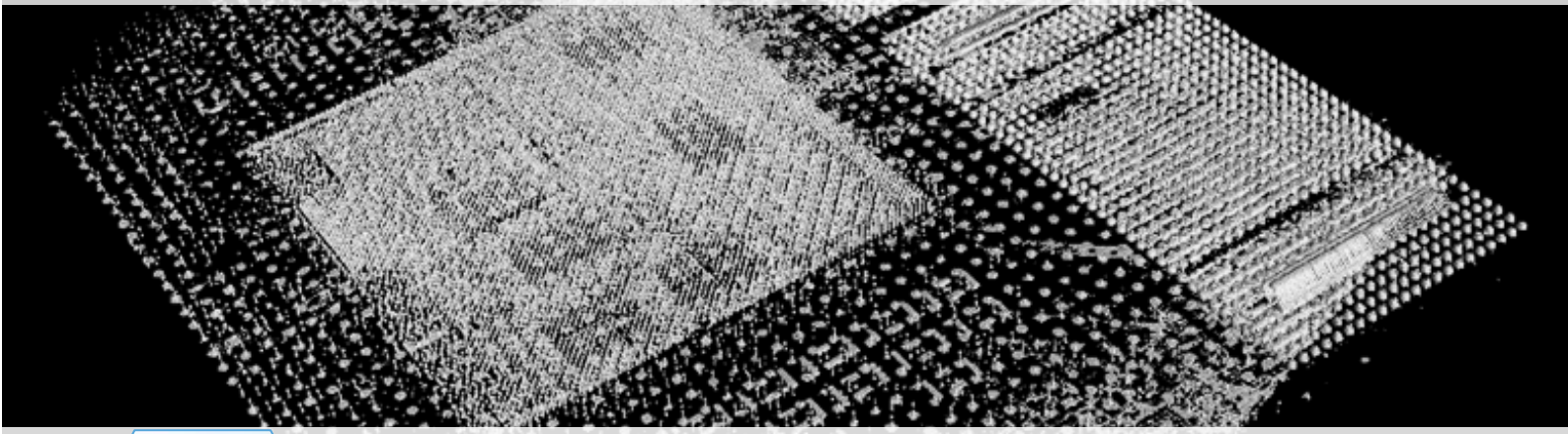
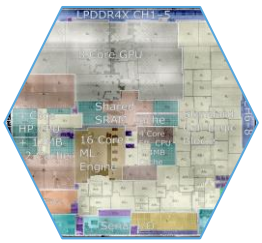


Apple M1 System-on-Chip

A deep-dive analysis of Apple's first in-house CPU for Mac.



Two new Apple MacBook models and the Mac mini are now powered by an Apple in-house System-on-Chip (SoC) design: the M1. The transition from Intel x86 processors has created shockwaves felt throughout the processor and computing world. This new, first SoC for Mac features 4-CPU high-performance cores, 4-CPU high-efficiency cores, and 8-GPU cores. The tight software-hardware integration inside Apple enabled a compact, efficient processor for personal computer that outcompetes many premium microprocessors. 16 billion transistors using TSMC 5nm process were used to build it.

To reveal all the details of this new, exceptional SoC, this report features multiple analyses: a floor plan analysis to understand the high-level chip architecture with IP block area contribution measurements, a front-end construction analysis that reveals the most interesting features of the new TSMC 5nm process, a back-end construction analysis of the packaging structure, and a detailed manufacturing cost analysis.

On the SoC side, it appears that the die area of the M1 was optimized for functionality rather than SRAM cache. There is limited on-chip cache, taking cues from mobile SoC designs relying on the universal memory architecture (UMA) concept and external LPDDR4X DRAM. Significant die area is devoted to standard cell functions, indicating that Apple is leveraging in-house chip design to optimize hardware for the operating system.

On the packaging side, the same structure is used for Apple's A12X and A12Z, with the integration of the DRAM on the SoC substrate, and embedded silicon capacitors in the substrate.

Along with a complete construction analysis using SEM cross-sections, materials analyses, and delayering, the front-end analysis employs a high-resolution TEM cross-section to expose the high mobility channel of the 5nm process, and the back-end analysis uses CT-Scan (3D X-ray) to reveal the layout structure of the package.

Title: Apple M1 SoC

Pages: 190

Date: Dec. 2020

Format:
PDF & Excel file

Price: EUR 6,490

Reference: SP20608

COMPLETE TEARDOWN WITH

- Detailed photos
- Floor plan analysis
- Precise measurements
- Materials analysis
- Front-end structural analysis with TEM
- Back-end structural analysis with CT-Scan
- Supply-chain evaluation
- Manufacturing cost analysis

TABLE OF CONTENTS

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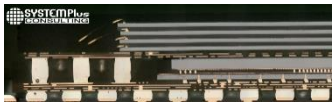

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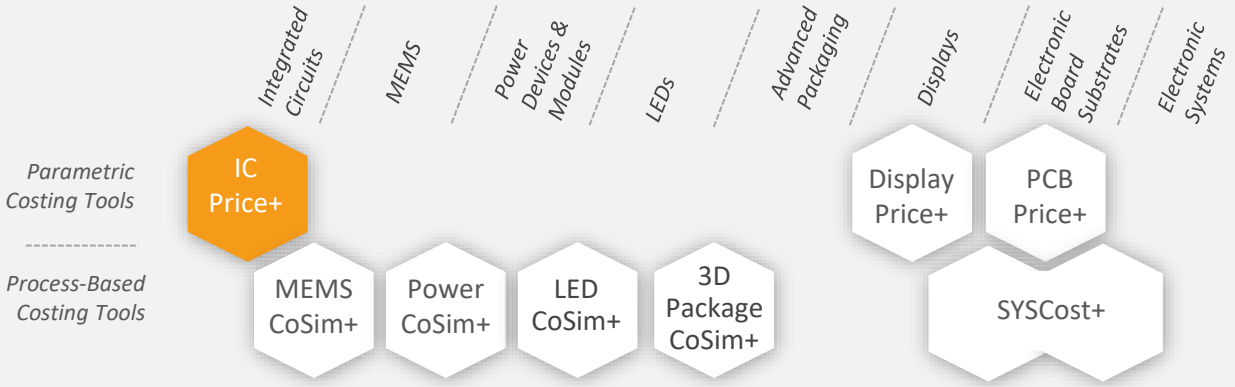

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