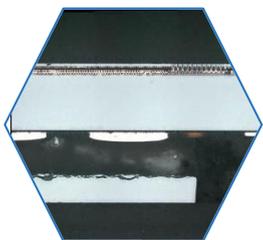
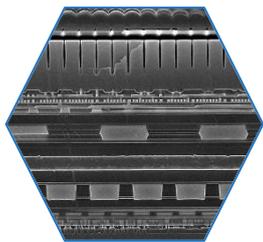




Camera Modules Comparison 2021 - Vol. 1

Technology and cost comparison of visual spectrum cameras in the 2020 flagships: The Apple iPhone 12 Pro Max, Samsung Galaxy S20 Ultra, and Huawei P40 Pro.



In this report, the results of detailed physical analyses and costing studies have been summarized to compare the cameras of the crown jewel flagships from the three smartphone market leaders: Samsung, Huawei, and Apple. These are the highest-end smartphone cameras the 2020 market had to offer, and we provide insight into the design choices, manufacturing technologies, supply chains, and costs that went into them.

Our analyses cover the visible spectrum camera modules in the Samsung Galaxy S20 Ultra, Huawei P40 Pro, and Apple iPhone 12 Pro Max, showing the complete structure, design, and cost of each module. Optical imaging and scanning electron microscopy was used to collect incredibly detailed information about the front and rear RGB cameras; at the image sensor level this includes the dimensions, pixel configurations, technology node, and stacking process.

Despite the trend of increasing module counts, all three companies decided on a triple camera setup for the rear and a single camera for the front. The rear cameras are all comprised of a wide-angle main camera module, a secondary ultra-wide module, and a telephoto module. These visible spectrum cameras are supported by infrared modules (not covered in this report) for determining depth information. Autofocus and optical image stabilization

systems have a strong presence and were found in at least two rear modules on all three smartphones. The Galaxy S20 Ultra and the P40 Pro also have autofocus systems in their front cameras. The iPhone 12 Pro Max features the first generation of Apple's new sensor-shift stabilization technology – see our dedicated report on the iPhone 12 Pro Max for a deep dive into this innovation. The manufacturing processes used to create these sensors are illustrated in this report, and a detailed manufacturing cost analysis is performed. Also included is a comparison and a study of the costs and technological choices made by each supplier.

Title: Camera Modules Comparison 2021 - Vol. 1

Pages: 142

Date: April 2021

Format: PDF & Excel file

Price: EUR 6,490

Reference: SPR21605

COMPLETE TEARDOWN WITH

- Detailed photos
- Precise measurements
- Module cross-sections
- Sensor cross-sections
- Sensor measurements
- Color-filter pattern
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Physical comparisons
- Cost and price comparisons

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Feedback

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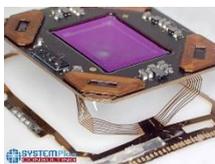


Véronique Le Troadec has joined System Plus Consulting as a laboratory engineer. Coming from Atmel Nantes, she has extensive knowledge in failure analysis of components and in deprocessing of integrated circuits.



Guillaume Chevalier has joined System Plus Consulting in 2018 to perform physical analyses. He holds a degree in technology of physical measurements and instrumentation technics, and previously worked for four years for chemistry, mechanical and mass-metrology laboratories.

RELATED REPORTS



Apple iPhone 12 Pro Max Rear Camera

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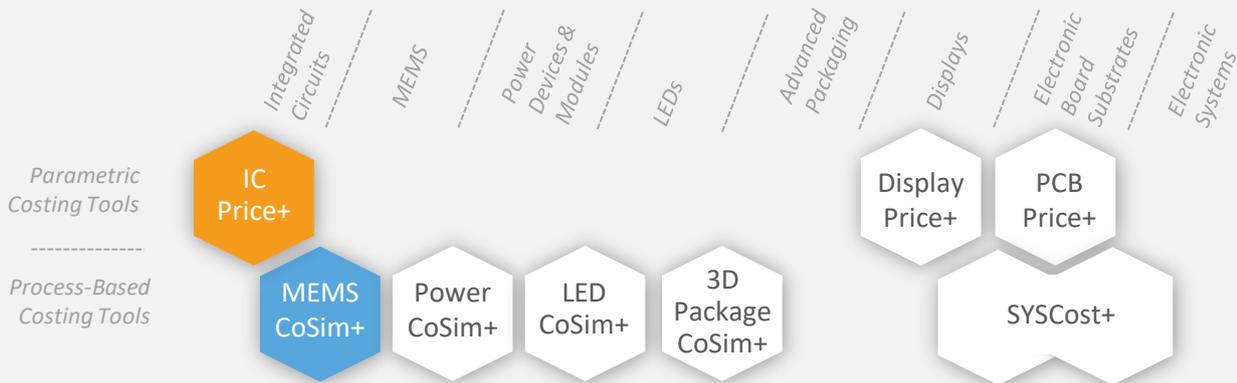


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Our analysis is performed with our costing tools IC Price+ and MEMS CoSim+.

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Reverse Costing® is the process of disassembling a device (or a system) in order to identify its technology and calculate its manufacturing cost, using in-house models and tools.



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Buyer must note that placing an order means an agreement without any restriction with these terms and conditions.

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System Plus Consulting may change its prices whenever the company thinks it necessary. However, the company commits itself in invoicing at the prices in force on the date the order is placed.

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