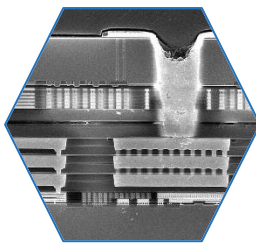
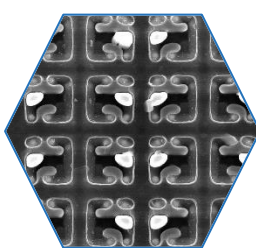




Camera Module Comparison 2021 Vol. 3 – Samsung Galaxy S Evolution

Samsung Galaxy S camera design choices, technical and cost evolution from the S7 to the S21 Ultra.



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Samsung's Galaxy S series has long been at the forefront of smartphone cameras. That includes the dual-pixel autofocus in the Galaxy S7, the Voice Coil Motor (VCM)-controlled aperture in the S9+ and most recently the 100x "Space Zoom" made possible by the periscope module in the S20 Ultra. Now that the S21 Ultra has launched, we continue our series of camera module comparison reports by summarizing the results of detailed physical analyses and costing studies to compare the cameras of the Galaxy S7, S8, S9+, S10+, S20 Ultra and S21 Ultra. This report aims to offer insights into the physical and cost evolution of the camera modules and CMOS Image Sensors (CIS) in the last six years of Samsung flagship smartphones.

The report analyzes the rear and front-facing photography camera modules. The analysis includes the complete structure, design, and component list of the camera modules. It also describes the dimensions, technology node and stacking technology in the CIS.

Over the years, the Galaxy S series rear cameras have led the market, increasing module count from one to four. The Galaxy S20 Ultra was a big step up, debuting the 108 megapixel HM1 CIS and the periscope module with a 4x optical zoom that made possible a 100x hybrid "Space" zoom. The S21 Ultra improved upon this by debuting the HM3 CIS and including a larger

periscope module with a double bounce and 10x optical zoom. This results in higher-quality long-distance photography by relying less on digital zoom. This also allowed Samsung to use larger pixels and lower resolution for the periscope module, but the super long focal length required a conventional telephoto module to cover intermediate focal distances.

Samsung has opted to mostly rely on its own ISOCELL CIS line, but occasionally includes sensors from Sony's Exmor RS line. Some modules can come with either an ISOCELL CIS or an equivalent Exmor RS as a supply chain alternative. This report will only include the CIS in the module versions that we happened to analyze.

The report does not cover special purpose and depth cameras, such as the iris scanner in the Galaxy S8 or the ToF camera in the S20 Ultra.

COMPLETE TEARDOWN WITH

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

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AUTHOR



Peter Bonanno, PhD. is a Technology & Cost Analyst, Imaging at System Plus Consulting. With a strong expertise in the field of imaging and optical sensors, Peter performs reverse engineering & costing analyses as well as custom projects.

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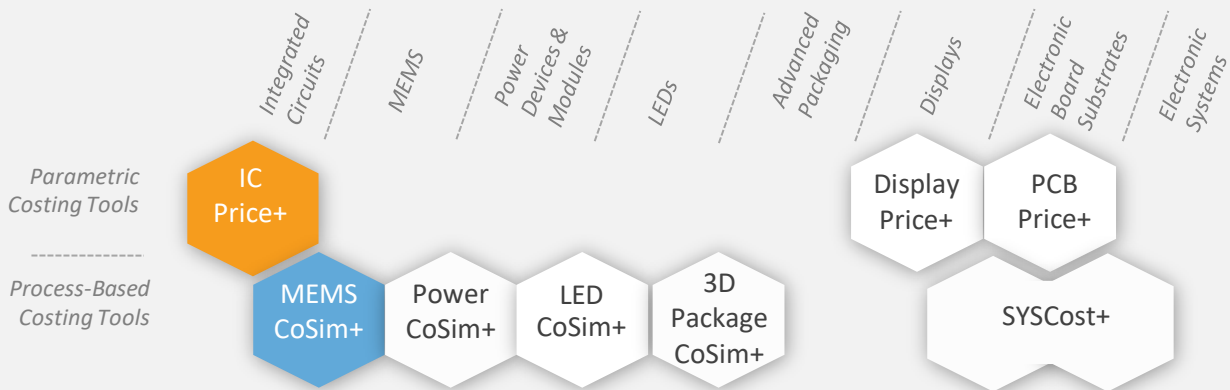


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CONTACTS

Headquarters

22, bd Benoni Goullin
Nantes Biotech
44200 Nantes
France
+33 2 40 18 09 16
sales@systemplus.fr

Europe Sales Office

Lizzie LEVENEZ
Frankfurt am Main
Germany
+49 151 23 54 41 82
llevenez@systemplus.fr

America Sales Office

Steven LAFERRIERE
Western USA & Canada
+1 310-600-8267
laferriere@yole.fr

Chris YOUMAN
Eastern USA & Canada
+1 919-607-9839
chris.youman@yole.fr

Asia Sales Office

Takashi ONOZAWA
Japan & Rest of Asia
+81 80 4371 4887
onozawa@yole.fr

Mavis WANG
Greater China
TW +886 979 336 809
CN +8613661566824
wang@yole.fr

Peter OK
Korea
+82 10 4089 0233
peter.ok@yole.fr

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1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email or to the Buyer's address. In the absence of any confirmation in writing, orders shall be deemed to have been accepted.

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2.1 Products are sent by email to the Buyer:

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- Within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 The Seller shall by no means be responsible for any delay in respect of article 2.1 above, and including in cases where a new event or access to new contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department or automatically online via an email/password. If the Product's electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

2.6 No return of Products shall be accepted without prior information to the Seller, even in case of delayed delivery. Any Product returned to the Seller without providing prior information to the Seller as required under article 2.5 shall remain at the Buyer's risk.

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HSBC, 1 place de la Bourse 69002 Lyon France

Bank code: 30056

Branch code: 00170

Account n°: 0170 200 1565 87

BIC or SWIFT code: CCFRFRPP

IBAN: FR76 3005 6001 7001 7020 0156 587

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The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labour difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

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6.7 As a matter of fact the investor of a company, external consultants, the joint venture done with a third party, and so on cannot access the report and should pay a full license price.

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