The desire to capture the perfect picture used to be accomplished through complex and expensive Digital Single-Lens Reflex (DSLR) cameras and the use of interchangeable lens systems. The multiple lens possibility has therefore been the cornerstone in the pursuit of extreme imaging performance. Today’s mobile cameras follow a similar mindset but using multiple fixed lenses to improve photography performance. Quickly adopted by large manufacturers, this trend led to 10.2% year-over-year growth in 2019.

Yole Développement expects the volume of global camera module shipments to expand from 5.5B units in 2019 to 8.9B in 2025, at 8.2% Compound Annual Growth Rate (CAGR). Mobile multi-cameras started in early stage 2015-2016, moving from single to dual cameras, then maturing to triple in 2018 and 2019. Now they have moved toward quad in 2020. Diverse modules implement diverse levels of zoom or wide angle capability. This diversity is enriched by sensing camera modules. This is the case for front structured light for 3D facial recognition, the rear Time of Flight (ToF) for Augmented Reality (AR) applications, and the optical fingerprint module placed under the screen.

In the automotive market the trend is to massively adopt rear cameras and Advanced Driver Assistance System (ADAS) forward cameras. The average number of cameras per car goes up because of the need for new applications, such as the 360 degree view, in cabins and e-mirrors. Again in this market the diversity in camera design is very high.

In the consumer electronics field, vision is an important element of smart products, assistant personal robotics and consumer drones. These new applications will increase the demand for cameras, and drive the camera module market even higher in the years to come.

This latest edition of Yole Développement’s popular report offers you key insights for navigating the camera module market.

### WHAT’S NEW
- Updated mobile, consumer, automotive camera ASP/revenue forecasts through 2025
- Forecast analysis per sub-component
- Added scenario for mobile sensing camera 3D and under-display fingerprint
- Updated multiple-camera and periscope camera penetration
- Updated trends for all markets
- Technology breakdown per sub-component and new technology

### KEY FEATURES
- Camera module market forecast (in Munits and $M) through 2025
- Camera module ecosystem mapping
- Camera module application trends - mobile and consumer, automotive
- Camera module technology trends – Image sensor/Lens set/Actuator/
Camera module assembly

### REPORT OBJECTIVES
Ecosystem identification and analysis:
- Determination of the application range
- Technical market segmentation
- Market trends and forecasts
- Key players, by market and analysis

Analysis and description of markets and technologies involved:
- Detailed applications per market segment
- Major global actors
- Technology trends
- Main technical challenges

### 2019-2025 CMOS camera module market forecast by component (in $B)

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<thead>
<tr>
<th>Component</th>
<th>2025e</th>
<th>CAGR 2019-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera module assembly</td>
<td>$19.5B</td>
<td>+12.7%</td>
</tr>
<tr>
<td>CMOS image sensor</td>
<td>$14.3B</td>
<td>+9.1%</td>
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<tr>
<td>Lens set manufacturing</td>
<td>$7.6B</td>
<td>+8.1%</td>
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<tr>
<td>Actuator (AF &amp; OIS)</td>
<td>$5.7B</td>
<td>+13.5%</td>
</tr>
<tr>
<td>Total</td>
<td>$57B</td>
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### 2025e CMOS camera module market forecast by component (in $B)

<table>
<thead>
<tr>
<th>Component</th>
<th>2019</th>
<th>2025e</th>
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<tbody>
<tr>
<td>Camera module assembly</td>
<td>$2.7B</td>
<td>$19.5B</td>
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<tr>
<td>CMOS image sensor</td>
<td>$9.5B</td>
<td>$14.3B</td>
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<tr>
<td>Lens set manufacturing</td>
<td>$4.8B</td>
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</tr>
<tr>
<td>Actuator (AF &amp; OIS)</td>
<td>$5.7B</td>
<td>$5.7B</td>
</tr>
</tbody>
</table>

### CAMER A MODULE TECHNOLOGY IS DIVERSIFYING AND IS BRINGING KEY OPPORTUNITIES TO PHONE MAKERS

In the mobile world, smartphone Original Equipment Manufacturers (OEMs) are in fierce competition to add camera functions and improve camera performance with increasing pixel resolution upgrades, combined with multiple-camera designs. The competition for the supply of high-quality CMOS Image Sensors (CIS) exceeded the worldwide capacity at the end of 2019, resulting in shortages and price hikes. While the recent pandemic tamed global economics, the camera module industry is expected to maintain double digit growth for the next five years.

Yole Développement expects the revenue of the global camera module market to expand...
CMOS Camera Module Industry for Consumer & Automotive 2020

Markets are benefiting the leaders but also offering opportunities to second tier players.

Camera modules are very precise optoelectronic components, which contain image sensors, lens sets, actuators and assemblies. They have become key components of the mobile industry, expanding into a rich ecosystem that has grown and matured after more than twenty years of development. It is currently enjoying a boom in demand, which is benefiting almost all players.

The industry leader LG Innotek continues to maintain its position due to the large orders from Apple. Closing in are O-Film and Sunny Optical, who have climbed to the second and third positions by relying on the strong domestic market in China, replacing Semco and Foxconn/Sharp. In the years to come the US-China trade war could play a big role in reorganizing the ranking of Compact Camera Module (CCM) players.

Image sensor providers used to push their technology to market at their own pace, shrinking pixels and increasing resolution. But with current trends mobile phone OEMs are now more aggressively developing specific image sensors with unique features. The rankings of the top three, Sony, Samsung, and OmniVision, is now well established.

Lenses are another area where there are a few players at the top, Largan and Sunny Optical, making technical upgrades of camera modules include the “Active Alignment” process to align multiple cameras well. There will be several innovations in camera module integration, like pop-up cameras or side-up cameras, and under-screen cameras in future. These innovations will integrate different materials from various sources, which should provide a great deal of opportunity to the market and facilitate the application of camera modules to more new products.

From $31.3B in 2019 to $57.0B in 2025, at 12.8% CAGR.

Beyond the sensor itself, innovations in all the different subcomponents of the camera module are in high demand. The introduction of periscope lenses was a major event that allowed 5x or even 10x optical magnification within the existing thickness of mobile phones. Optical image stabilization (OIS) is another critical technology for photography especially for telephoto, hence players are also looking for innovations in this area, using new materials, MEMS or liquid lens to replace the Voice Coil Motor (VCM) approach.
up most of the market. Other components, such as actuators for autofocus (AF)/OIS and drivers, infrared-cut filters, substrates and connectors have benefited as the industry has reached new heights.

The car camera application has just entered its growth stage and has become a broad market with surround-view, ADAS and in-cabin applications. It has now attracted traditional tier one auto part manufacturers to enter, as well as many leading players of the mobile camera ecosystem. Sony, Ofilm and Sunny Optical are all vying to enter this market as tier two part manufacturers.

COMPANIES CITED IN THE REPORT (non-exhaustive list)


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RELATED REPORTS, MONITORS & TRACKS

- Status of CMOS Image Sensor Industry 2019
- CMOS Image Sensor Quarterly Market Monitor
- 3D Imaging and Sensing 2020
- Smartphone Camera Module Comparison 2020 Vol. I
- Apple iPad Pro LiDAR Module

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AUTHORS

Richard Liu is a Technology and Market Analyst in the Photonics, Sensing & Display division at Yole Développement, part of Yole Group of Companies. Based in Shenzhen (China), Richard is dedicated to imaging activity (Monitors) as well as the development of technology & market reports. Prior to Yole, Richard was engaged in camera module design on image sensor; AF/OIS at Onsemi, before this, he worked as a customer-application-technologist in Micron/Aptina Imaging. Richard has over 12 years post graduate experience in both of imaging semiconductor and camera module industry, he has the successful track record in developing projects for the tier one smart phone and module makers, which brought him wide industry connection in the CMOS image sensor supply chain and ecosystem. Richard graduated from Wuhan University (China) and holds an Electronics Engineering Degree.

Pierre Cambou MSc, MBA, is a Principal analyst in the Photonic and Display Division at Yole Développement (Yole). Pierre’s mission is dedicated to imaging related activities by providing market & technology analyses along with strategy consulting services to semiconductor companies. He is responsible for the CIS Quarterly Market Monitor while he has authored more than 15 Yole Market & Technology reports. He has been deeply involved in the design of early mobile camera modules and the introduction of 3D semiconductor approaches to CMOS Image Sensors (CIS). Known as an expert in the imaging industry, he is regularly interviewed and quoted by leading international media. Pierre has an Engineering degree from Université de Technologie de Compiègne (France) and a Master of Science from Virginia Tech. (VA, USA). Pierre also graduated with an MBA from Grenoble Ecole de Management (France).
CONTACT

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 120 collaborators worldwide covering MEMS and Image Sensors, Compound Semiconductors, RF Electronics, Solid-state Lighting, Displays, Software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Power Electronics, Batteries & Energy Management and Memory.

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CONTACTS
For more information about:
• Consulting & Financial Services: Jean-Christophe Eloy (eloy@yole.fr)
• Reports & Monitors: David Jourdan (david.jourdan@yole.fr) & Fayçal Khamassi (faycal.khamassi@yole.fr)
• Marketing & Communication: Camille Veyrier (camille.veyrier@yole.fr)
• Public Relations: Sandrine Leroy (sandrine.leroy@yole.fr)

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Bank code: 0505
Branch code: 0170
Account n°: 0170 200 1565 87
BIC or CLT: HKGL FR52 6900230000
IBAN: FR76 3005 6001 7001 7016 056 S87
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