

# MEMS AND SENSORS FOR AUTOMOTIVE

Market & Technology report - August 2017

*How will sensor technology shape the cars of the future? We are only at the very beginning of a bright future for sensor providers – be prepared for the golden age of the automotive sensor industry.*

## KEY FEATURES OF THE REPORT

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- Automotive active sensor market volume forecast through 2022
- Automotive active sensor market value forecast through 2022
- Automotive sensor and manufacturer landscape/ecosystem mapping
- Application trends: Electrification and automation impacts
- Technology trends: Sensors for autonomous/robotic transportation such as RADAR, LiDAR and imaging

## 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:

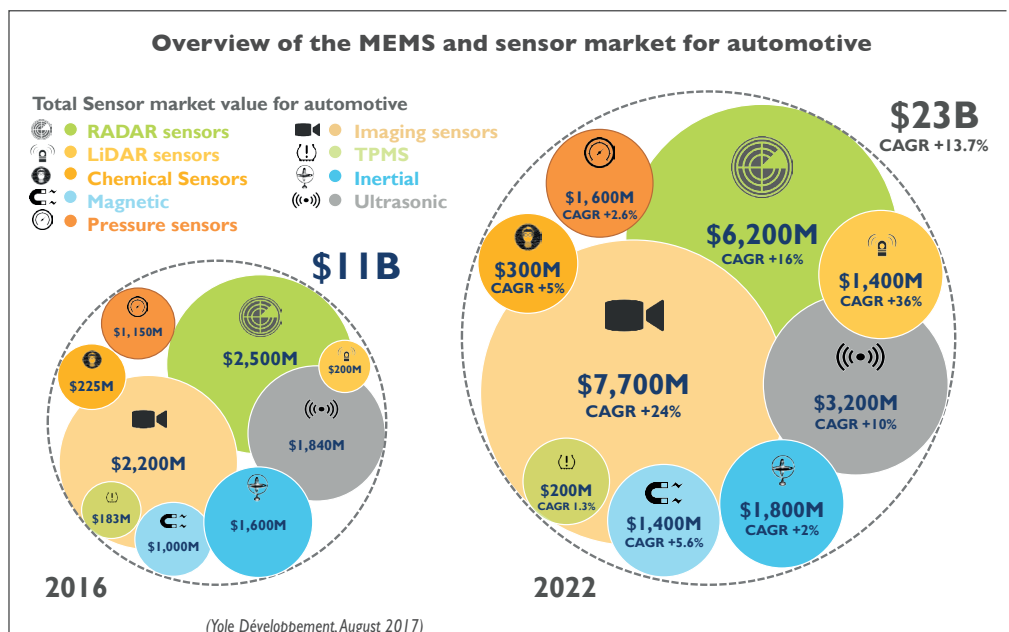
- Detailed applications by market segment
- Major players worldwide
- Technology trends
- Main technical challenges

## THE REBORN AUTOMOTIVE SENSOR MARKET WILL BE WORTH MORE THAN \$20B BY 2022

In a global automotive market worth than US\$2.3T, the little world of automotive sensors has recently been shaken up by the emergence of electric and autonomous cars. Despite just 3% growth in the volume of cars sold expected through to 2022, Yole Développement (Yole) expects an average growth rate in sensors sales volumes above 8% over the next five years, and above 14% growth in sales value. This is thanks to the expanding integration of high value sensing modules like RADAR, imaging and LiDAR. The current automotive sensing market groups MEMS and classic active sensors such as pressure, tire pressure monitoring systems (TPMS), chemical, inertial, magnetic, ultrasonic, imaging, RADAR and LiDAR. We estimate that this market is worth US\$11B in 2016 and is expected to reach US\$23B by 2022. This is mainly due to the boom in imaging, RADAR and LiDAR sensors, which will respectively be worth US\$7.7B, US\$6.2B

and US\$1.4B by 2022. Among classical sensors like pressure, chemical and magnetic sensors, the impact of electric vehicles will remain small in the short term. However, the advent of electrical vehicles will greatly change the amount and the distribution of pressure and magnetic sensors within the car in the longer term. More electric cars will mean fewer pressure sensors and a surge in magnetic sensors for battery monitoring and various positioning and detection of moving pieces. Finally, we believe that the automotive world is experiencing one of the fastest-changing eras in its evolution ever. Sensor suppliers are now engaged in a race where they need to be prepared for the golden age of the automotive world.

This report describes the applications, technologies, and players associated with the automotive sensor market's impending changes.



## BOSCH, DENSO, SENSATA, NXP AND INFINEON ARE STILL THE TOP PLAYERS IN THE AUTOMOTIVE SPACE, BUT CHANGES MAY OCCUR QUICKLY

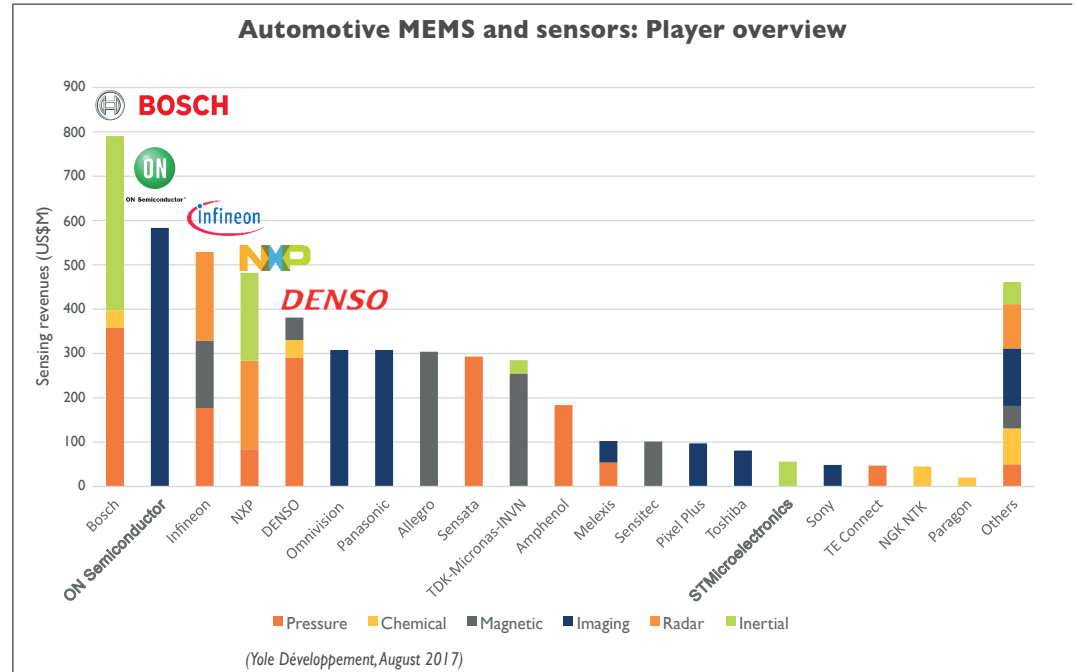
The top ten sensor suppliers generated US\$4.25 billion in revenue last year, accounting for 77% of the total sensing market at the sensor scale, excluding modules. Revenue growth was affected by price erosion for sensors designed into safety

applications, including electronic stability control (ESC) and TPMS. The pressure market remains a fragmented market dominated by Bosch, Sensata and Denso, while magnetic market is driven by Allegro, TDK-Micronas and Infineon.

Regarding the RADAR market, Infineon can be considered as the benchmark and is avidly promoting RADAR as a key technology for the future of automotive. Newcomers, especially from the LiDAR industry, may reshuffle the deck in the near future. Companies like Velodyne, Quanergy, SensL and Leddar tech are racing against giant automotive

suppliers like Continental and Valeo to commercialize reliable and affordable LiDAR solutions that can answer automotive requirements.

This report describes the associated technologies, trends and players.



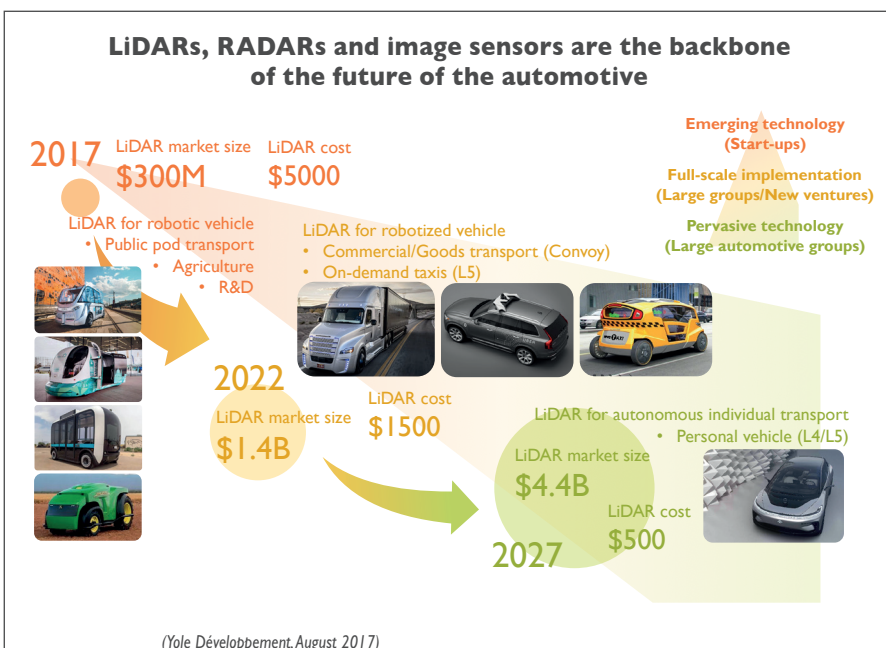
## HOW TO ENVISION THE CAR OF THE FUTURE? ELECTRIFICATION AND AUTONOMOUS DRIVING WILL DEEPLY IMPACT TRANSPORTATION

Among all sensing technologies located in the car, three main sensors will drastically change the landscape: imaging, RADAR and LiDAR sensors.

Imaging sensors were initially mounted for Advanced Driver Assistance System (ADAS) purposes in high-end vehicles, with deep learning image analysis techniques promoting early adoption. It is now a well-established fact that vision-based Autonomous

Emergency Braking (AEB) is possible and saves lives. Adoption of forward ADAS cameras will therefore accelerate. Growth of imaging for automotive is also being fueled by the park assist application, and 360° surround view camera volumes are skyrocketing. While it's becoming mandatory in the US to have a rear view camera, that uptake is dwarfed by 360° surround view cameras, which enable a "bird's eye view" perspective. This trend is most beneficial to companies like Omnicision at sensor level and Panasonic and Valeo, which have become the main manufacturers of automotive cameras.

RADAR sensors, which are often wrongly seen as competitors of imaging and LiDAR sensors, are increasingly adopted in high-end vehicles. They are also diffusing into mid-price cars for blind spot detection and adaptive cruise control, pushing Level 2/3 features as a common experience. Lastly, LiDAR remains the "Holy Grail" for most automotive players, allowing 3D sensing of the environment. In this report we highlight the different potential usages of this technology, which will transform the transportation industry completely. We expect tremendous growth of the LiDAR market within the next five years, from being worth US\$300M in 2017 to US\$4.4B by 2022. LiDAR is expected to be a key technology, but sensing redundancy will still be the backbone of the automotive world where security remains the golden rule.



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**AUTHORS**



As a Technology and Market Analyst, **Emeric Celier** is member of the MEMS and Sensor business unit at Yole Développement, the “More than Moore” market research and strategy consulting company. Thanks to his technical expertise in the semiconductor field, Emeric contributes daily to the development of MEMS and Sensor activities. He does technology and strategic scouting and produces market and technology reports and custom consulting projects. He graduated from Phelma in Grenoble, France with a specialization in Physics Nanoscience and also studied Management Innovation and Technology at INPG in Grenoble, France.



**Guillaume Girardin** works as a Market and Technology Analyst for MEMS devices and technologies at Yole Développement, the “More than Moore” market research and strategy consulting company. Guillaume holds a Ph.D. in Physics and Nanotechnology from Claude Bernard University Lyon I and a M.Sc. in Technology and Innovation Management from EM Lyon School of Business.



**Dr. Eric Mounier** has a PhD in microelectronics from the INPG in Grenoble. He previously worked at CEA LETI’s R&D lab in Grenoble, France, in the marketing dept. In 1998 he cofounded Yole Développement, a market research company based in France. At Yole Développement, Dr. Eric Mounier is in charge of market analysis for MEMS and Sensors, visible and IR imagers including CMOS image sensors and microbolometers, semiconductors, printed electronics and photonics, including silicon photonics. He has contributed to more than 200 marketing and technological analyses and 100 reports. Eric is also an expert at the Observatoire des Micro et Nanotechnologies (OMNT) for Optics.

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#### SALES CONTACTS

- North America - Steve Laferriere: +13106 008 267  
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#### CONTACTS

- For more information about :
- Consulting Services: Jean-Christophe Eloy (eloy@yole.fr)
  - Financial Services: Jean-Christophe Eloy (eloy@yole.fr)
  - Report Business: Fayçal Khamassi (khamassi@yole.fr)
  - Press relations: Sandrine Leroy (leroy@yole.fr)