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Prior to Yole, Pierrick has worked in several companies where he developed his knowledge on general lighting and on automotive lighting. In the past, he has mostly worked in R&D department for LED lighting applications. Pierrick holds a master degree in Electronics (ESEO – Angers, France).

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AUTOMOTIVE LIGHTING MARKET

IN SCOPE

➢ Headlights technologies:
  Advanced front lighting system
  • Light sources: LED, laser diode
  • Front lighting functions
  • Applications
  • Lighting, sensing computing, software controlling
  • Future technologies
  • Specifications & requirements
  • System development trends
  • ADAS

OUT OF SCOPE

➢ Interior & ambient lighting
➢ Rear Combination Lamp (RCL)
➢ OLED panel for automotive lighting
➢ Car body lighting

Yours needs are out of the report’ scope?
Contact us for a custom:
COMPANIES CITED IN THIS REPORT

REPORT METHODOLOGY

Yole’s market forecast model is based on the matching of several sources:

- Comparison with existing data
- Monitoring of corporate communication
- Using other market research data
- Yole analysis (consensus or not)

- Comparison with prior Yole reports
- Recursive improvement of dataset
- Customer feedback

Preexisting information

Top-to-bottom approach
Aggregate of market forecasts
@ System level

Bottom-up approach
Ecosystem analysis
Aggregate of all players’ revenue
@ System level

Top-to-bottom approach
Aggregate of market forecast
@ Semiconductor device level

Bottom-up approach
Ecosystem analysis
Aggregate of key players’ revenues
@ Semiconductor device level

Primary data
- Reverse costing
- Patent analysis
- Annual reports
- Direct interviews

Secondary data
- Press releases
- Industry organization reports
- Conferences

Information Aggregation

Market
Volume (in Munits)
ASP (in $)
Revenue (in $M)

Semiconductor foundry activity
Capacity investments and equipment needs
WHAT WE GOT RIGHT, WHAT WE GOT WRONG

- The trend of digitalization of light is present.
- Lighting functions converge to ADAS.
- Penetration of LED technology is increasing in all car segments.

- Previous forecast didn’t take account such 2018 downturn in the automotive industry and potential short-term impacts.
- The penetration of LED matrix headlights is higher than we expected.
LEDS SERVE AS THE KEY TECHNOLOGY FOR THE ATTRACTIVE STYLING OF HEADLIGHTS AND DEFINITION OF BRAND SIGNATURES

• With the integration of light emitting diode (LED) technology, lighting has evolved from a basic, functional feature to a distinctive feature with high-value potential in the automotive industry. Indeed, LED technology has given manufacturers the opportunity for strong differentiation via lighting design and additional functionalities. This is particularly true for exterior lighting, which is profoundly mutating in terms of both technology and supply chain. Following the trend of individualization, automakers are searching for possibilities to distinguish their car models. The styling of 3D-shaped Daytime Running Lights (DRLs), miniaturization of low and high beam headlamps and new supplemental lamps contribute to strong car brand identity. Besides the original functional lighting, new styling illumination is on the way, such as dynamic lighting and animation, logo illumination, welcome scenario projection and glowing bodies. Additional lighting modules such as laser boosters or digital micromirror devices (DMDs) can increase lighting distance massively, up to 600m, or deliver new functions due to their high-resolution.

• LEDs are rapidly gaining popularity as their cost decreases and efficiency, luminance and package size improves. Full LED headlamps are now being commercialized in emerging markets. Nowadays, nearly all car makers and Tier-1 part suppliers have developed full LED-based headlamp systems and such technology is a must-have in the C and also the D, large vehicle, automotive segments. This implementation continues in the lower B, small car, segment. Renault Clio and Opel Corsa models come equipped with full-LED lighting as standard on the base model or LED Matrix headlights as an option. The strategies of light source suppliers indicate “LEDification” – implementing lower-cost solutions for emerging markets will propel automotive lighting revenue.

• In this context, the automotive lighting market totaled $29B in 2018 and is expected to reach $38.8B in 2024 at a compound annual growth rate for 2018-2024 (CAGR_{2018-2024}) of 4.9%. This growth is driven by natural LED cost erosion coupled with standardization and optimization of LED modules, which result in more vehicles equipped with this technology. Indeed, whereas SSL technologies represented 66% of automotive lighting value in 2018, this share is likely to reach 87% by 2024.
DIGITAL LIGHTING WILL FURTHER REVOLUTIONIZE AUTOMOTIVE LIGHTING

• Digitalization of cars is a megatrend in the automotive industry, heading to electric and autonomous vehicles. The developments related to this trend lead to new approaches to safety, comfort and information services.

• Exterior lighting is gaining significance because the trend in autonomous driving shows the importance of communication between all road users. Digital lights will allow smarter lighting functionalities, safer Adaptive Driving Beam (ADB) designs with cameras and artificial intelligence in the loop.

• Several different beam shaping technologies have the potential to take high definition (HD), high resolution pixel light to the next level. With various systems like micro-structured Adaptive Front-lighting Systems (μAFS), liquid crystal displays (LCDs), MEMS laser scanners or DMDs, different functions are possible.

• Additionally, the advanced front lighting system (AFLS) architecture integrates other inevitable building blocks. These include cameras and sensors enabling detection and identification of objects, and engine control units (ECUs) for fast computing of information and software for effective image processing and automation of functions.

• Based on image processing functions and intelligent settings in the projection module, critical areas of oncoming traffic that might face glare are removed from the high-beam distribution, but the rest of the high-beam field remains intact for the driver’s convenience. New technologies are still being developed to increase functionality and efficacy of such systems.

• An interesting fact is that such lighting systems are providing ever more synergy with projection/display systems as their function is evolving toward communication, like projecting information onto the road. The efficiency of ADB functions are given by pixel density. Adding more columns to the currently available systems leads to diminishing returns in terms of functionality. It seems the pixel race has started, as it did several years ago in the digital camera world.

• However several barriers have still to be overcome in areas including technology, manufacturing, and regulation. Those challenges will be reinforced as digital light further tightens the relationship between lighting, automotive sensors and data processing.
AUTOMOTIVE LIGHTING: A MUTATING INDUSTRY

• The market is already booming. And now, automotive lighting is becoming one potential critical node for autonomous driving, because lighting systems could represent a key location for integrating sensors such as local cameras, radar and light detection and ranging (LiDAR).

• Furthermore, technology and application evolution brings more complex systems, more components and subassemblies, while maintaining quality. This requires new strategies for cost reduction in particular. Implementing costly advanced front lighting systems including intelligent lighting, precise sensing, fast computing and software control will have to be standardized, creating a platform and architecture that can be used across different cars.

• New engineering and manufacturing methods enable additional integration and thus create new modules. More integrated components enhance the functional content of headlamps supporting freedom of design and at the same time, reduce the number of interfaces and improve reliability. However, miniaturization and integration of the new components is not enough in the automotive industry. More sensor competence is greatly needed. Companies are therefore paying ever more attention to this mutating industry.

• This industry’s evolution is likely to continue as solid state lighting technologies are integrated. The rapid evolution of these technologies, coupled with the AFLS trend and increased use of non-visible lighting systems such as LiDAR, radar, and cameras and autonomous emergency braking (AEB) might further change things in an industry that’s already mutating.
Recent downturn - Drivers

- Global trade uncertainty due to the US tariffs and increasing trade restrictions for threaten to destabilize economies around the world.
- Two traditional biggest regions have enjoyed unprecedented growth in recent years, the phase of auto industry is beginning.
Current market growth is mostly related to increase of LED penetration rate in middle- and lower-class segment!

### 2018 Automotive Lighting Growth Drivers

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>2018/2019 Impact</th>
<th>2024 Impact</th>
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<tr>
<td>STRONG Negatively!</td>
<td>STRONG Positively!</td>
<td>MEDIUM</td>
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<tr>
<td>MEDIUM</td>
<td>LOW</td>
<td>MEDIUM</td>
<td>STRONG</td>
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<td>LOW</td>
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2018-2024 AUTOMOTIVE FRONT LIGHTING MARKET FORECAST

2018-2024 LED headlamp market forecast - Split by technology type

- Basic full LED headlamps are expected to drive the market and will still represent almost 75% of the market share in 2023.
- The penetration rate of matrix LED systems and hybrid "LED+laser" is accelerating and these two categories are expected to represent 15% of LED headlamp revenues by 2019.

Basic LED headlamp will drive the LED headlamp market due to lower cost of adoption.
Revenue in automotive lighting systems increased +6% in 2018 thanks to democratization of LED technology.

**Revenue for automotive lighting systems increased almost x%, from US$ xx.xB in 2017 to US$ xx.xB.**

**Such growth was mostly driven by:**
- More favorable market conditions, driven by the strong adoption of LED headlamps and the high added-value of AFLS - a trend consistent with the record sales figures announced by most premium car manufacturers.
- Increased ASP at system level (i.e. revenue increased due to the higher cost of LED technology compared to halogen or xenon).

*Note: Evolution of exchange rate in 2018 (vs. 2017) as well as unification of fiscal years are also factors explaining the growth.*
The top five players have a combined xx% market share, led by Koito (xx%). Revenues from Valeo and Hella increased while those from Marelli remained stable.

- In 2017 tier-1 leader Valeo took over Ichikoh to reinforce their position. After the acquisition the revenue has grown more than xx%. ZKW develop edge leading lighting technologies implementing them into high-end car models. They benefit from the focus on styling aspect and higher lighting value of these cars. Varroc has kicked off an Initial Public Offering (IPO) process to raise capital.

In this analysis, it is important to understand that all revenues have been converted to USD (for comparison) and fiscal years of all players have been unified to calendar year. As a result the presented revenues are dependent on annual exchange rate and unified fiscal years.
Different business strategies are being implemented by main Tier-1s. Out of technological and geographical development, there is a clear trend toward ADAS also.
AUTOMOTIVE MARKET - MEGATRENDS

Lighting as a strategic element for autonomous vehicle?

• To reach higher levels of autonomy, vehicles need to integrate an increasing number of sensors. These sensors are used to monitor the surroundings of vehicles for different applications.
  • Redundancy between sensors will be necessary and therefore, different types of sensors will be implemented.

• Headlamps and rear lamps could become strategic elements that integrate sensors used for autonomous vehicles.

• Cameras, radars and LiDARs will be the sensors that will be needed for the different ADAS functions. As headlamps and rear lamps are situated at the corners of a vehicle, they could become strategic places to integrate sensors.
  • Therefore, tier-1 like Valeo, Magneti Marelli and others are thinking about integrating sensors in headlamps. This could be also an opportunity for them to increase the value of their product.
  • Some challenges related to aesthetic, cleaning, heat management or optics steel need to be solved and other places like the bumper, behind the windshield or the grill are also taken into consideration.
Technology comparison/benchmark - Based on current development

- Today subtractive lighting systems (DMD, LCD) can achieve higher resolution opposed to additive systems (matrix LED, mini LED).
- However, the complexity and size are higher and efficiency is lower than LED arrays.
- Future mini and micro LED arrays will get much better resolution in comparison to nowadays.
Full LED headlamps have progressed from optional to standard systems on luxury and premium cars. They are now more and more offered as standard on C-segment and start being offered as option on B-segment.
AFLS - BUILDING BLOCKS

Sensing - Integration of existing sensor

Matrix LED + Camera + Sensors

New functionalities and detection/identification of what is in front of the vehicle.

Speed sensor
Steering wheel angle sensor
Turn signal sensor will take
Rain sensor
RADAR
LiDAR

Data processing

New functionalities use multiple sensors to optimize the beam shape.

Different beam shapes with matrix LED system
Source: Opel
AFLS - LIGHTING TECH. EFFICACY ASPECTS

Lighting system resolution vs. System efficiency

• Balance between the influencing factors:

- Performance
- Functionality (Resolution)
- Efficient dimming/switching
- Cost + CO₂
- Style

Increase number of LEDs within one headlight leads to not only higher performance and more functionalities but also higher power consumption.

Goal of digital lighting power consumption

Source: Varroc
AFLS Driver benefits

• As LED headlights consist of a matrix of individual LEDs or arrays, they bring for the first time the possibility to either switch individual LEDs/arrays on or off in order to produce a very specific light distribution or to change their position via electronically controlled actuators such as stepper motors to achieve the same effect.

• Examples of the multitude of helpful lighting pattern variations that are already part of an AFS solution: Bending Light (BL), Adverse Weather Light (AWL), High Beam (HB), Motorway Light (ML), Country Light (CL), Town Light (TL), and Front Fog-Light (FFL).
AFLS - SYSTEM DEVELOPMENT TRENDS

AFLS penetration into the different car segments

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<tr>
<td>All</td>
<td>C – J – D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>Number of LEDs (Pixels)</td>
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</table>

- C – J – D
- E
- F

2014 – 2016
- All
- C – J – D
- E
- F

2017
- All
- C – J – D
- E
- F

2018 – 2019
- All
- C – J – D
- E
- F
AFLS - SYSTEM DEVELOPMENT TRENDS

Cost breakdown of LED headlamps

Basic LED headlight

Matrix LED headlight Audi 32px

Matrix LED headlight Mercedes-Benz 84px

*Single row matrix up to 12 px
Value chain (dynamics) evolution

CHALLENGES
- High speed innovation
- Disruption evolution
- Cost pressure
- Unclear OEM and term strategy

TECHNOLOGY

CONSEQUENCES
- Increasing financial risks
- Increasing complexity
- Cost cutting
- Reorganization for more efficiency
- Pivotal product and technology roadmaps

COST

TIER-1s
There are synergies between headlamps and sensors and integrating sensors inside headlamp could be possible.
AFLS - ADAS AND LIGHTING TECHNOLOGIES
ADAS - Cost factors

Automakers and suppliers search for the right balance between sensor optimization and sensor count.

**Scenario 1.**
 Sensors are integrated into the front and rear lights

**Scenario 2.**
 Sensors and cameras are individually replaceable

- Conclusion: search for lowest component count, highest versatility, lowest cost
- Diversity of vehicles and ADS/ADAS will never give universal approach
LiDAR for Automotive and Industrial Applications 2019

Light Shaping Technologies for Consumer and Automotive Applications 2019

Automotive Lighting: Technology, Industry and Market Trends 2018

Imaging for Automotive 2019
System Plus Consulting

Valeo SCALA Laser Scanner
YOLE DEVELOPPEMENT – FIELDS OF EXPERTISE WITHIN 3 MAIN DOMAINS

**Semiconductor & Software**
- Semiconductor Packaging and Substrates
- Semiconductor Manufacturing
- Memory
- Computing and Software

**Photonics & Sensing**
- Photonics
- Lighting
- Imaging
- Sensing & Actuating
- Display

**Power & Wireless**
- RF Devices & Technologies
- Compound Semiconductors & Emerging Materials
- Power Electronics
- Batteries & Energy Management
4 BUSINESS MODELS

- **Consulting and Analysis**
  - Market data & research, marketing analysis
  - Technology analysis
  - Strategy consulting
  - Reverse engineering & costing
  - Patent analysis
  - Design and characterization of innovative optical systems
  - Financial services (due diligence, M&A with our partner)

- **Syndicated reports**
  - Market & technology reports
  - Patent investigation and patent infringement risk analysis
  - Teardowns & reverse costing analysis
  - Cost simulation tool [www.i-Micronews.com/reports](http://www.i-Micronews.com/reports)

- **Monitors**
  - Monthly and quarterly update
  - Excel database covering supply, demand, and technology
  - Price, market, demand and production forecasts
  - Supplier market shares [www.i-Micronews.com/reports](http://www.i-Micronews.com/reports)

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- Teardown and reverse engineering
- Cost simulation tools
- [www.systemplus.fr](http://www.systemplus.fr)

**KnowMade**
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- Patent assessment
- [www.knowmade.fr](http://www.knowmade.fr)

**Piseo**
- Design and characterization of innovative optical systems
- [www.piseo.fr](http://www.piseo.fr)

**Blumorpho**
- Innovation and business maker
- [www.blumorpho.com](http://www.blumorpho.com)

**Yole Finance**
- Due diligence
- [www.yole.fr](http://www.yole.fr)
OUR GLOBAL ACTIVITY

40% of our business

30% of our business

30% of our business
ANALYSIS SERVICES - CONTENT COMPARISON

- Technology and Market Report
- Leadership Meeting
- Q&A Service
- Meet the Analyst
- Custom Analysis

Depth of the analysis

Breadth of the analysis

High

Low
SERVING THE ENTIRE SUPPLY CHAIN

Integrators, end-users and software developers

Device manufacturers

Suppliers: material, equipment, OSAT, foundries...

Financial investors, R&D centers

Our analysts provide market analysis, technology evaluation, and business plans along the entire supply chain.
SERVING MULTIPLE INDUSTRIAL FIELDS

We work across multiple industries to understand the impact of More-than-Moore technologies from device to system.
Over the course of more than 20 years, Yole Développement has grown to become a group of companies. Together with System Plus Consulting and KnowMade, we now provide marketing, technology and strategy consulting, media and corporate finance services, reverse costing, structure, process and cost analysis services and well as intellectual property (IP) and patent analysis. Together, our group of companies is collaborating ever closer and therefore will offer, in 2019, a collection of over 125 reports, 10 new monitors and 120 teardowns. Combining respective expertise and methodologies from the three companies, they cover:

- MEMS & Sensors
- RF devices & technologies
- Medical technologies
- Semiconductor Manufacturing
- Advanced packaging
- Memory
- Batteries and energy management
- Power electronics
- Compound semiconductors
- Solid state lighting
- Displays
- Software
- Imaging
- Photonics

If you are looking for:
- An analysis of your product market and technology
- A review of how your competitors are evolving
- An understanding of your manufacturing and production costs
- An understanding of your industry’s technology roadmap and related IPs
- A clear view supply chain evolution

Our reports and monitors are for you!

Our team of over 70 analysts, including PhD and MBA qualified industry veterans from Yole Développement, System Plus Consulting and KnowMade, collect information, identify trends, challenges, emerging markets, and competitive environments. They turn that information into results and give you a complete picture of your industry’s landscape. In the past 20 years, we have worked on more than 2,000 projects, interacting with technology professionals and high-level opinion makers from the main players of their industries and realized more than 5,000 interviews per year.

WHAT TO EXPECT IN 2019?
In 2019 we will extend our offering with a new ‘monitor’ product which provides more updates on your industry during the year. The Yole Group of Companies is also building on and expanding its investigations of the memory industry. Moreover, in parallel, the Yole Group reaffirms its commitment to a new collection of reports mixing software and hardware and is increasing its involvement in displays, radio-frequency (RF) technology, advanced substrates, batteries and compound semiconductors. Last but not least, System Plus Consulting is developing its teardowns service providing 120+ offers related to phones, smart home, wearables and connected devices. Discover our 2019 program right now, and ensure you get a true vision of the industry. Stay tuned!
18 fields of excellence combined with six markets to provide a complete picture of your industry landscape

Market – Technology – Strategy – by Yole Développement
Yole Développement (Yole) offers market reports including quantitative market forecasts, technology trends, company strategy evaluation and indepth application analyses. Yole will publish more than 55 reports in 2019, with our partner PISEO contributing to some of the lighting reports.

The Reverse Costing® report developed by System Plus Consulting provides full teardowns, including detailed photos, precise measurements, material analyses, manufacturing process flows, supply chain evaluations, manufacturing cost analyses and selling price estimations. The reports listed below are comparisons of several analyzed components from System Plus Consulting. More reports are however available, and over 60 reports will be released in 2019. The complete list is available at www.systemplus.fr.

Patent Reports – by KnowMade
More than describing the status of the IP situation, these analyses provide a missing link between patented technologies and market, technological and business trends. They offer an understanding of the competitive landscape and technology developments from a patent perspective. They include key insights into key IP players, key patents and future technology trends. For 2019 KnowMade will release over 15 reports.

The markets targeted are:
- Mobile & Consumer
- Automotive & Transportation
- Medical
- Industrial
- Telecom & Infrastructure
- Defense & Aerospace

Linked reports are dealing with the same topic to provide a more detailed analysis.
OUR 2019 REPORTS COLLECTION (1/5)

18 fields of excellence combined with six markets to provide a complete picture of your industry landscape

MEMS & SENSORS
- MARKET AND TECHNOLOGY REPORT
  - Status of the MEMS Industry 2019 - Update
  - Status of the Audio Industry 2019 - New
  - Uncooled Infrared Imagers and Detectors 2019 – Update
  - Consumer Biometrics: Technologies and Market Trends 2018
  - MEMS Pressure Sensor Market and Technologies 2018
  - Gas & Particle Sensors 2018
- STRUCTURE, PROCESS & COST REPORT
  - MEMS & Sensors Comparison 2019
  - MEMS Pressure Sensor Comparison 2018
  - Particle Sensors Comparison 2019
  - Miniaturized Gas Sensors Comparison 2018
- PATENT REPORT
  - MEMS Foundry Business Portfolio 2019 - New
  - Miniaturized Gas Sensors 2019 - New

PHOTONIC AND OPTOELECTRONICS
- MARKET AND TECHNOLOGY REPORT
  - Silicon Photonics and Photonic Integrated Circuits 2019
  - LiDARs for Automotive and Industrial Applications 2019 - Update
- PATENT REPORT
  - Silicon Photonics for Data Centers: Optical Transceiver 2019 - New
  - LiDAR for Automotive 2018

RF DEVICES AND TECHNOLOGIES
- MARKET AND TECHNOLOGY REPORT
  - 5G's Impact on RF Front-End Module and Connectivity for Cell Phones 2019 – Update
  - 5G Impact on Telecom Infrastructure 2019 - New
  - Radar and Wireless for Automotive: Market and Technology Trends 2019 - Update
  - Passive & Active Antenna Systems for Telecom Infrastructure 2019 - New
  - RF Standards and Technologies for Connected Objects 2018
- STRUCTURE, PROCESS & COST REPORT
  - RF Front-End Module Comparison 2019 - Update
  - Automotive Radar RF Chipset Comparison 2018
- PATENT REPORT
  - Antenna for 5G Wireless Communications 2019 - New
  - RF Front End Modules for Cellphones 2018
  - RF Filter for 5G Wireless Communications: Materials and Technologies 2019
  - RF GaN 2019 – Patent Landscape Analysis

Update : 2018 version still available

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OUR 2019 REPORTS COLLECTION (2/5)

18 fields of excellence combined with six markets to provide a complete picture of your industry landscape

IMAGING
- MARKET AND TECHNOLOGY REPORT
  - Status of the CIS Industry 2019: Technology and Foundry Business - Update
  - Imaging for Automotive 2019 - Update
  - Neuromorphic Sensing and Computing 2019 - Update
  - Status of the Camera Module Industry 2019 - Focus on Wafer Level Optics – Update
  - 3D Imaging & Sensing 2018
  - Machine Vision for Industry and Automation 2018

- STRUCTURE, PROCESS & COST REPORT
  - Compact Camera Modules Comparison 2019
  - CMOS Image Sensors Comparison 2019

- PATENT REPORT
  - Facial & Gesture Recognition Technologies in Mobile Devices 2019 - New
  - Apple iPhone X Proximity Sensor & Flood Illuminator 2018

MEDICAL IMAGING AND BIOPHOTONICS
- MARKET AND TECHNOLOGY REPORT
  - X-Ray Detectors for Medical, Industrial and Security Applications 2019 - New
  - Microscopy Life Science Cameras: Market and Technology Analysis 2019
  - Ultrasound technologies for Medical, Industrial and Consumer Applications 2018

- PATENT REPORT
  - Optical Coherence Tomography Medical Imaging 2018

MICROFLUIDICS
- MARKET AND TECHNOLOGY REPORT
  - Status of the Microfluidics Industry 2019 - Update
  - Organs-on-chips Market and Technology Landscape 2019 - Update
  - Point-of-Need Testing Application of Microfluidic Technologies 2018
  - Liquid Biopsy: from Isolation to Downstream Applications 2018
  - Chinese Microfluidics Industry 2018

- PATENT REPORT
  - Microfluidic Manufacturing Technologies 2019 – New
  - Nanopore Sequencing 2019 - New

INKJET AND ACCURATE DISPENSING
- MARKET AND TECHNOLOGY REPORT
  - Inkjet Printheads - Dispensing Technologies & Market Landscape 2019 - Update
  - Emerging Printing Technologies for Microsystem Manufacturing 2019 - New
  - Piezoelectric Devices from Bulk to Thin Film 2019 - New
  - Inkjet Functional and Additive Manufacturing for Electronics 2018

- STRUCTURE, PROCESS & COST REPORT
  - Piezoelectric Materials from Bulk to Thin Film Comparison 2019
OUR 2019 REPORTS COLLECTION (3/5)

18 fields of excellence combined with six markets to provide a complete picture of your industry landscape

**BIOMEMS & MEDICAL MICROSYSTEMS**
- **MARKET AND TECHNOLOGY REPORT**
  - Medical Wearables: Market & Technology Analysis 2019 - New
  - Neurotechnologies and Brain Computer Interface 2018
  - BioMEMS & Non-Invasive Sensors: Microsystems for Life Sciences & Healthcare 2018
- **PATENT REPORT**
  - 3D Cell Printing 2019 - New
  - Circulating Tumor Cells Isolation 2019 - New

**SOFTWARE AND COMPUTING**
- **MARKET AND TECHNOLOGY REPORT**
  - Artificial Intelligence Computing For Automotive 2019 - New
  - Artificial Intelligence Computing for Consumer 2019 - Update
  - Image Signal Processor and Vision Processor Market and Technology Trends 2019
  - xPU (Processing Units) for Cryptocurrency, Blockchain, HPC and Gaming 2019 – New
  - Artificial Intelligence for Medical Imaging 2019 - New
- **PATENT REPORT**
  - Artificial Intelligence for Medical Diagnostics - New

**MEMORY**
- **MARKET AND TECHNOLOGY REPORT**
  - Status of the Memory Industry 2019 - New
  - MRAM Technology and Business 2019 - New
  - Emerging Non Volatile Memory 2018
- **STRUCTURE, PROCESS & COST REPORT**
  - Memory Comparison 2019
- **PATENT REPORT**
  - Magnetoresistive Random-Access Memory (MRAM) 2019 - New
  - 3D Non-Volatile Memory 2018

**ADVANCED PACKAGING**
- **MARKET AND TECHNOLOGY REPORT**
  - Fan Out Packaging Technologies and Market Trends 2019 - Update
  - 2.5D/3D TSV & Wafer-Level Stacking:Technology & Market Updates 2019- Update
  - Advanced RF SiP for Cellphones 2019 - Update
  - Status of the Advanced Packaging Industry 2019 - Update
  - Status of the Advanced Substrates 2019 - Update
  - Automotive Packaging Market & Technology Trends 2019 - New
  - Trends in Automotive Packaging 2018
  - Thin-Film Integrated Passive Devices 2018
  - Die Attach Equipment Trends 2019 en Semiconductor Manufacturing - New
- **STRUCTURE, PROCESS & COST REPORT**
  - Advanced RF SiP for Cellphones Comparison 2019

Update: 2018 version still available
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OUR 2019 REPORTS COLLECTION (4/5)

18 fields of excellence combined with six markets to provide a complete picture of your industry landscape

**SEMI CONDUCTOR MANUFACTURING**

- **MARKET AND TECHNOLOGY REPORT**
  - Nano-Imprint Technology Trends for Semiconductor Applications 2019 - New
  - Equipment and Materials for Fan Out Packaging 2019 - Update
  - Equipment for More than Moore: Thin Film Deposition & Etching 2019 - New
  - Wafer Starts for More Than Moore Applications 2018
  - Polymeric Materials at Wafer-Level for Advanced Packaging 2018
  - Bonding and Lithography Equipment Market for More than Moore Devices 2018

- **STRUCTURE, PROCESS & COST REPORT**
  - Wafer Bonding Comparison 2018

- **PATENT REPORT**
  - Hybrid Bonding for 3D Stack 2019 - New

**SOLID STATE LIGHTING**

- **MARKET AND TECHNOLOGY REPORT**
  - Status of the Solid-State Lighting Source Industry 2019 - New
  - Edge Emitting Lasers (EELS) 2019 - New
  - Light Shaping Technologies 2019 – New
  - Automotive Advanced Front Lighting Systems 2019 - New

- **MARKET AND TECHNOLOGY REPORT**
  - VCSELs – Market and Technology Trends 2019 - Update
    - IR LEDs and Laser Diodes – Technology, Applications, and Industry Trends 2018
    - UV LEDs - Technology, Manufacturing and Application Trends 2018
    - LiFi: Technology, Industry and Market Trends 2018

- **STRUCTURE, PROCESS & COST REPORT**
  - VCSEL Comparison 2019

- **PATENT REPORT**
  - VCSELS 2018

**DISPLAY**

- **MARKET AND TECHNOLOGY REPORT**
  - Next Generation 3D Displays 2019 - New
  - Next Generation Human Machine Interaction (HMI) in Displays 2019 - New
  - MicroLED Displays 2019 - Update
  - MiniLED 2019 - Update
  - Displays & Optical Vision Systems for VR, AR & MR 2018

- **PATENT REPORT**
  - MicroLED Displays : Intellectual Property Landscape 2018

Update : 2018 version still available
OUR 2019 REPORTS COLLECTION (5/5)

18 fields of excellence combined with six markets to provide a complete picture of your industry landscape.

**POWER ELECTRONICS**
- **MARKET AND TECHNOLOGY REPORT**
  - Power SiC: Materials, Devices and Applications 2019 - Update
  - Power Electronics for EV/HEV and e-mobility: Market, Innovations and Trends 2019 - Update
  - Status of the Power Electronics Industry 2019 - Update
  - Discrete Power Packaging: Material Market and Technology Trends 2019 - New
  - Status of the Power ICs Industry 2019 - Update
  - Status of the Inverter Industry 2019 - Update
  - Status of the Power Module Packaging Industry 2019 - Update
  - Wireless Charging Market Expectations and Technology Trends 2018
  - Power GaN 2018: Epitaxy, Devices, Applications and Technology Trends
  - **STRUCTURE, PROCESS & COST REPORT**
    - Automotive Power Module Packaging Comparison 2018
    - GaN-on-Silicon Transistor Comparison 2019
    - SiC Transistor Comparison 2019
  - **PATENT REPORT**
    - Power SiC: Materials, Devices and Modules 2019 - New
    - Power GaN: Materials, Devices and Modules 2019 – Update

**BATTERY & ENERGY MANAGEMENT**
- **MARKET AND TECHNOLOGY REPORT**
  - Status of the Rechargeable Li-ion Battery Industry 2019 - New
  - **PATENT REPORT**
    - Battery Energy Density Increase: Materials and Emerging Technologies 2019 - New
    - Solid-State Batteries 2019 - New
    - Status of the Battery Patents 2018

**COMPOUND SEMI.**
- **MARKET AND TECHNOLOGY REPORT**
  - Emerging Semiconductor Substrates: Market & Technology Trends 2019- New
  - InP Wafer and Epiwafer Market - Photonic and RF Applications 2019- New
  - GaAs Wafer and Epiwafer Market: RF, Photonics, LED and PV Applications 2018
  - **PATENT REPORT**
    - GaN-on-Silicon Substrate: Materials, Devices and Applications 2019 - Update

**BIOTECHNOLOGIES**
- **MARKET AND TECHNOLOGY REPORT**
  - CRISPR-Cas9 Technology: From Lab to Industries 2018
  - **PATENT REPORT**
    - Personalized Medicine 2019 – New
Get the most updated overview of your market to monitor your strategy

Yole Développement, System Plus Consulting and KnowMade, all part of the Yole Group of Companies, are launching a collection of 10 monitors in 2019. The monitors aim to provide updated market, technology and patent data as well dedicated quarterly analyses of the evolution in your industry over the previous 12 months. Furthermore, you can benefit from direct access to the analyst for an on-demand Q&A and discussion session regarding trend analyses, forecasts and breaking news. Topics covered will be compact camera modules (CCMs), advanced packaging, compound semiconductors, microfluidics, batteries, RF and memory.

**MARKET MONITOR** by Yole Développement

**A FULL PACKAGE:**
The monitors will provide the evolution of the market in units, wafer area and revenues. They will also offer insights into what is driving the business and a close look at what is happening will also be covered in it.

The following deliverables will be included in the monitors:
- An Excel database with all historical and forecast data
- A PDF slide deck with graphs and comments/analyses covering the expected evolutions

**ADVANCED PACKAGING – NEW**
This monitor will provide the evolution of the advanced packaging platforms. It will cover Fan-Out Wafer Level Packaging (WLP), Fan-Out Panel Level Packaging (PLP), Wafer-Level Chip Scale Packaging (WLCSP), Flip Chip packaging platforms, and 2.5D and 3D Through Silicon Via (TSV) integration. **Frequency: Quarterly, starting from Q4 2019**

**CMOS IMAGE SENSORS – NEW**
This monitor will provide the evolution of the imaging industry, with a close look at image sensor, camera module, lens and VCM. Volumes, revenues and momentum of companies like Sony, Samsung, Omnivision and OnSemi will thus be analysed. **Frequency: Quarterly, starting from Q3 2019**

**MEMORY – UPDATE**
For the memory industry you can have access to a quarterly monitor, as well as an additional service, a monthly pricing. Both services can be bought separately:
- DRAM Service: Including a quarterly monitor and monthly pricing.
- NAND Service: Including a quarterly monitor and monthly pricing.

**REVERSE TECHNOLOGY MONITOR** by System Plus Consulting

**SMARTPHONES – NEW**
To stay updated on the latest components, packaging and silicon chip choices of the smartphone makers, System Plus Consulting has created its first Smartphone Reverse Technology monitor. This year, get access to the packaging and silicon content database of at least 20 different flagship smartphones – more than five per quarter. Starting at the beginning of 2020, the monitor will include an Excel database report for each phone and a quarterly comparison.
OUR 2019 MONITORS COLLECTION (2/2)

Get the most updated overview of your market to monitor your strategy

PATENT MONITOR by KnowMade

A FULL PACKAGE:
Starting at the beginning of the year, the KnowMade monitors include the following deliverables:

• An Excel file including the monthly IP database of:
  • New patent applications
  • Newly granted patents
  • Expired or abandoned patents
  • Transfer of IP rights through re-assignment and licensing
  • Patent litigation and opposition

• Quarterly report including a PDF slide deck with the key facts & figures of the quarter: IP trends over the three last months, with a close look to key IP players and key patented technologies.

○ GaN for Power & RF Electronics
  Wafers and epiwafers, GaN-on-SiC, silicon, sapphire or diamond; semiconductor devices such as transistors, and diodes, devices and applications including converters, rectifiers, switches, amplifiers, filters, and Monolithic Microwave Integrated Circuits (MMICs), packaging, modules and systems.

○ GaN for Optoelectronics & Photonics
  Wafers and epiwafers, GaN-on-sapphire, SiC or silicon; semiconductor devices such as LEDs and lasers; and applications including lighting, display, visible communication, photonics, packaging, modules and systems.

○ Li-ion Batteries
  Anodes made of lithium metal, silicon, and lithium titanate (LTO); cathodes made of Lithium Iron Phosphate (LFP), Nickel-Manganese-Cobalt (NMC), Lithium Nickel Cobalt Aluminium Oxide (NCA), Lithium Nickel Metal Dioxide (LiNiM02), Lithium Metal Phosphate (LiMPO4), and Lithium Metal Tetroxide (LiMO4); electrolytes including liquid, polymer/gel, and solid inorganics; ceramic and other separators; battery cells including thin film/microbattery, flexible, cylindrical and prismatic; and battery packs and systems.

○ Post Li-ion Batteries
  Battery technologies including redox-flow batteries, sodium-ion, lithiumsulfur, lithium-air, and magnesium-ion, and their supply chains, including electrodes, electrolytes, battery cells and battery packs/systems.

○ Solid-State Batteries
  Supply chain including electrodes, battery cells, battery packs/systems and electrolytes, including polymer, inorganic and inorganic/polymer, inorganic materials, including argyrodites, Lithium Super Ionic CONductor, (LISICONs), Thio-LISICONs, sulfide glasses, oxide glasses, perovskites, anti-perovskites and garnets.

○ RF Acoustic Wave Filters
  Including Surface Acoustic Wave (SAW), Temperature Compensated (TC)- SAW, Bulk Acoustic Wave- Free-standing Bulk Acoustic Resonator (BAWFBAR), BAW-Solidly-Mounted Resonator (BAW-SMR), and Packaging.

○ RF Power Amplifiers
  Including Low Noise Amplifiers, Doherty Amplifiers, Packaging, and Millimeter-Wave technology.

○ RF Front-End Modules

○ Microfluidics
  From components to chips and systems, including all applications.
To meet the growing demand for market, technological and business information, i-Micronews Media integrates several tools able to reach each individual contact within its network.

We will ensure your company benefits from this

ONLINE
i-Micronews e-newsletter
i-Micronews.com
FreeFullPDF.com

Unique, cost-effective ways to reach global audiences.
Online display advertising campaigns are great strategies for improving your product/brand visibility. They are also an efficient way to adapt with the demands of the times and to evolve an effective marketing plan and strategy.

#15,800+ monthly unique visitors on i-Micronews.com
#10,900+ weekly readers of i-Micronews e-newsletter

ONSITE
Events

Brand visibility, networking opportunities
Today’s technology makes it easy for us to communicate regularly, quickly, and inexpensively – but when understanding each other is critical, there is no substitute for meeting in-person. Events are the best way to exchange ideas with your customers, partners, prospects while increasing your brand/product visibility.

#110 attendees on average
#7+ key events planned for 2019 on different topics

INPERSON
Webcasts

Targeted audience involvement equals clear, concise perception of your company’s message. Webcasts are a smart, innovative way of communicating to a wider targeted audience. Webcasts create very useful, dynamic reference material for attendees and also for absentees, thanks to the recording technology.

#380 registrants per webcast on average to gain new leads for your business

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