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<thead>
<tr>
<th>CEST</th>
<th>Topic</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>13:00</td>
<td>Delivering double digit revenue growth with diverse portfolio of growth vectors</td>
<td>Alexander Everke</td>
</tr>
<tr>
<td>13:30</td>
<td>Innovation leadership in optical technologies</td>
<td>Thomas Stockmeier</td>
</tr>
<tr>
<td>14:00</td>
<td>Integration, synergies, manufacturing and portfolio management</td>
<td>Mark Hamersma / Mike Lusk</td>
</tr>
<tr>
<td>14:25</td>
<td>Financial model and path to financial targets</td>
<td>Ingo Bank</td>
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<tr>
<td>14:50</td>
<td>Break</td>
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<tr>
<td>15:00</td>
<td>Key Automotive growth drivers</td>
<td>Robert Feurle</td>
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<tr>
<td>15:25</td>
<td>Key Consumer growth drivers</td>
<td>Jennifer Zhao</td>
</tr>
<tr>
<td>15:50</td>
<td>Key Industrial &amp; Medical growth drivers</td>
<td>Jens Milnikel</td>
</tr>
<tr>
<td>16:15</td>
<td>Closing remarks</td>
<td>Alexander Everke</td>
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<tr>
<td>16:20</td>
<td>Q&amp;A Session</td>
<td>Moderated by Moritz Gmeiner</td>
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<td>17:00</td>
<td>End of event</td>
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</table>
Speakers today

**Alexander Everke**
CEO
ams OSRAM, NXP, Infineon
31 years industry experience

**Ingo Bank**
CFO
ams OSRAM, Parexel, Philips
23 years industry experience

**Thomas Stockmeier**
CTO
ams OSRAM, SEMIKRON, ABB
37 years industry experience

**Mark Hamersma**
CBO
ams OSRAM, NXP, Philips, McKinsey
21 years industry experience

**Robert Feurle**
BU Opto Semiconductors
ams OSRAM, Infineon, Siemens, Qimonda, Micron
25 years industry experience

**Jennifer Zhao**
BU Advanced Optical Sensors
ams OSRAM, Nesperia, NXP
22 years industry experience

**Jens Milnikel**
BU Image Sensor Solutions
ams OSRAM, Zumtobel, Philips, Infineon, Roland Berger
21 years industry experience

**Mike Lusk**
Semiconductor Operations
ams OSRAM, NXP, Freescale, Motorola
47 years industry experience
Delivering double digit revenue growth with diverse portfolio of growth vectors

Alexander Everke
Chief Executive Officer
Delivering double digit revenue growth with diverse portfolio of growth vectors

Alexander Everke (CEO)

Outline

1. Strong growth and integration track record
2. Becoming the leader in optical solutions
3. Delivering double digit revenue growth
4. Next steps in the ams OSRAM journey
Our track record

- Pursuing a growth strategy with complementary M&A that resulted in outgrowing semiconductor peers over the past decade

- After 6x revenue growth in Consumer over the period 2016-2020, we experienced a market share loss in 2021, while being engaged in a broad & robust design-in pipeline to return the business to growth

- Our Automotive and Industrial & Medical businesses have shown consistent growth over the last 5 years with the exception of 2019, growing 23% in 2020-2021 on a pro forma basis

- Successfully executing on commitments made in the OSRAM acquisition and integration, expect to complete related divestments in 2022 to create the new base for the company
Pursuing a clear growth strategy with complementary M&A

Revenue in M€

Key M&A:
- CMOSIS
- HEPTAGON™
- PRINCETON OPTRONICS
- OSRAM

Revenue run-rate at close of ~150M€
ams OSRAM has outgrown semiconductor peers

Revenue in M€

- analog mixed-signal ASICs
- Optical sensor solutions
- Optical sensing, illumination and visualization solutions

- ams OSRAM semis (CAGR 2011-21 = 28%)
- Indexed WSTS semi market growth (CAGR 2011-21 = 8%)
- Indexed top 20 players in 2021 growth (CAGR 2011-21 = 11%)

Source: ams OSRAM, WSTS, OMDIA
Successfully executing on OSRAM acquisition and integration commitments

Operational control only since DPLTA effective date in March 2021

<table>
<thead>
<tr>
<th></th>
<th>Strong achievements across areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Deal close 1H20 and DPLTA Dec 2020</td>
</tr>
<tr>
<td>2.</td>
<td>Diversification of revenue mix</td>
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<td>3.</td>
<td>Accelerate in new breakthrough optical solutions</td>
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<tr>
<td>4.</td>
<td>Complementary go-to-market</td>
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<tr>
<td>5.</td>
<td>Synergies ~300M€ by year 3</td>
</tr>
<tr>
<td>6.</td>
<td>~390M€ one-off integration costs</td>
</tr>
<tr>
<td>7.</td>
<td>Semis footprint optimization</td>
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<tr>
<td>8.</td>
<td>Dissolve Conti-JV and divest non-core business</td>
</tr>
<tr>
<td>9.</td>
<td>2021 net debt / adj. EBITDA ~2x</td>
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</tbody>
</table>

Note: Synergies refer to pre-tax run-rate gross synergies against original baseline Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business
Delivering double digit revenue growth with diverse portfolio of growth vectors

Alexander Everke (CEO)

Outline

1. Strong growth and integration track record
2. Becoming the leader in optical solutions
3. Delivering double digit revenue growth
4. Next steps in the ams OSRAM journey
Vision and mission for ams OSRAM
To create the uncontested leader in optical solutions

Sensing

Illumination

Visualization

Become the uncontested leader in optical solutions through bold investments in disruptive innovation and continuous transformation delivering best in class profitability and growth
## Clear investor value proposition

<table>
<thead>
<tr>
<th>Commitment to growth</th>
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</thead>
<tbody>
<tr>
<td>Leader in optical solutions driven by secular growth trends in Automotive, Consumer and Industrial &amp; Medical</td>
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</table>

<table>
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<tr>
<th>Path to strong sustainable profitability</th>
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</thead>
<tbody>
<tr>
<td>Target to double adjusted EBIT margin driven by portfolio optimization, manufacturing footprint consolidation, synergy realization and revenue growth</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Balanced and diversified business mix</th>
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</thead>
<tbody>
<tr>
<td>Balanced application end-market exposure and diversified global customer base creates broadly supported earnings streams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prudent financial policy</th>
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</thead>
<tbody>
<tr>
<td>De-lever based on strong operational cash flows and proceeds from divestments, while maintaining investment for growth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Focus on long-term value generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-invest in differentiating technology &amp; innovation and related organic growth opportunities, in alignment with ESG focus</td>
</tr>
</tbody>
</table>
Our overall stakeholder value proposition

**Customers**
We develop leading edge optical technologies that enable our customers to create innovative solutions that open up new markets.

We bring intelligence to light and passion to innovation.

**Employees**
We provide a motivating, empowering and collaborative environment with significant personal development opportunities in a high-performance organization.

We attract, develop and retain the best talent.

**Shareholders**
We outgrow the market and achieve the #1 market position based on our innovation leadership, which in turn delivers industry-leading profitability and sustainable growth in value.

We responsibly create sustaining value.

**Society**
We boldly invest in disruptive innovation that meaningfully improves the quality of life in terms of health, safety and convenience, while reducing impact on the environment.

We make life better.

Sensing is life
Our commitment to ESG

Building a strong ESG framework for ams OSRAM

- Group-wide ESG strategy in detailed definition phase to be ready by end of 2022
- Group-wide compliance processes, code of conduct & whistleblower tool implemented
- Combined sustainability report to be published in May 2022 (GRI compliant)
- ESG-related KPIs to be included in 2023 management remuneration targets
First major targets defined

**Climate 2030**
Carbon neutral by 2030, endeavor towards net zero ambition

**Diversity 2026**
25% women in leadership positions by 2026 (increase from 21% in 2021)
Key societal megatrends drive demand for our optical solutions

- **Digitalization**
  - Consumer: Consumer 3D sensing, camera enhancement
  - Automotive: Advanced displays, smart surfaces, head-up display/projected lighting
  - Industrial: Industrial automation, robotics & drones
  - Medical: Medical imaging

- **Smart Living (IoT)**
  - Consumer: AR/VR glasses sensing & visualization, vital signs monitoring
  - Automotive: ADAS/AD (LiDAR), in-cabin sensing, dynamic forward & signal lighting
  - Industrial: HABA, Outdoor & industry lighting
  - Medical: Home diagnostics

- **Energy efficiency & sustainability**
  - Consumer: BOLED ALS/Spectral display management, microLED displays
  - Automotive: Ambient lighting, UV-C disinfection
  - Industrial: Horticulture, UV-C disinfection, LED & laser projection
  - Medical: UV-C disinfection
Addressed market growth projected above semiconductor market

Projected growth at 8-10% CAGR compared to expected semiconductor market growth of 5-7% CAGR

Addressed market (SAM) by end market (in B€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Auto Semi</th>
<th>Consumer</th>
<th>Industrial &amp; Medical</th>
<th>Lamps &amp; Systems</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>~16</td>
<td>~16</td>
<td>~16</td>
<td>~16</td>
<td>~25</td>
</tr>
<tr>
<td>2024</td>
<td>~20</td>
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<tr>
<td>2026</td>
<td>~25</td>
<td>~25</td>
<td>~25</td>
<td>~25</td>
<td>~25</td>
</tr>
</tbody>
</table>

CAGR 2021-26

- Total: 8-10%
- Auto Semi: 7-11%
- Consumer: 15-20%
- Industrial & Medical: 10-14%
- Lamps & Systems: ~0%

Addressed market (SAM) by application (in B€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sensing</th>
<th>Illumination</th>
<th>Visualization</th>
<th>Lamps &amp; Systems</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>~16</td>
<td>~16</td>
<td>~16</td>
<td>~16</td>
<td>~25</td>
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<tr>
<td>2024</td>
<td>~20</td>
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<td>2026</td>
<td>~25</td>
<td>~25</td>
<td>~25</td>
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</tbody>
</table>

CAGR 2021-26

- Total: 8-10%
- Sensing: 12-16%
- Illumination: 5-10%
- Visualization: 16-20%
- Lamps & Systems: ~0%

Source: ams OSRAM internal market model (based on market research data)
Pursuing market leadership across key components for optical solutions …

<table>
<thead>
<tr>
<th>Light source</th>
</tr>
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<tbody>
<tr>
<td>- LED</td>
</tr>
<tr>
<td>- MicroLED</td>
</tr>
<tr>
<td>- VCSEL / EEL</td>
</tr>
<tr>
<td>- Emitter driver IC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light detectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Light sensor</td>
</tr>
<tr>
<td>- Image sensor</td>
</tr>
<tr>
<td>- Sensor interface IC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light path optics</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Lenses</td>
</tr>
<tr>
<td>- Wave guides</td>
</tr>
<tr>
<td>- Spatial filters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light path optics</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Lenses</td>
</tr>
<tr>
<td>- Wave guides</td>
</tr>
<tr>
<td>- Band pass filters</td>
</tr>
</tbody>
</table>

Achieve best-in-class application performance through cross-optimized key components
… and offer micro-modules and solutions for key growth applications

<table>
<thead>
<tr>
<th>Optical Components</th>
<th>Integrated circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emitters</strong></td>
<td>• LED</td>
</tr>
<tr>
<td></td>
<td>• MicroLED</td>
</tr>
<tr>
<td></td>
<td>• VCSEL</td>
</tr>
<tr>
<td></td>
<td>• EEL</td>
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<tr>
<td><strong>Optics</strong></td>
<td>• DOE</td>
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<td></td>
<td>• Optics</td>
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<td></td>
<td>• WLO</td>
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<tr>
<td></td>
<td>• Wave guides</td>
</tr>
<tr>
<td><strong>Detectors</strong></td>
<td>• ALS/Spectral</td>
</tr>
<tr>
<td></td>
<td>• Imaging</td>
</tr>
<tr>
<td></td>
<td>• NIR / IR / UV</td>
</tr>
<tr>
<td></td>
<td>• Bio / SPAD</td>
</tr>
<tr>
<td><strong>Micro-modules</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Light / bio sensors</strong></td>
<td>• Integrated ALS module</td>
</tr>
<tr>
<td></td>
<td>• VSM module</td>
</tr>
<tr>
<td><strong>3D sensing</strong></td>
<td>• TOF module</td>
</tr>
<tr>
<td></td>
<td>• Flood illuminator</td>
</tr>
<tr>
<td><strong>Smart emitters</strong></td>
<td>• Pixelated headline</td>
</tr>
<tr>
<td></td>
<td>• AR emitters</td>
</tr>
<tr>
<td><strong>Micro-cameras</strong></td>
<td>• Naneye</td>
</tr>
<tr>
<td></td>
<td>• IR cameras</td>
</tr>
</tbody>
</table>

**Solutions**

- Demonstrators
- Reference designs
- Sensor solution SW (algorithms, AI/ML)
- Solution eco-system

1. Develop **best-in-class components** with innovation leaders
2. Offer differentiated **micro-modules** assembly largely with in-house components
3. Develop broader market and cross-optimize own components with system reference solutions

**Examples of solutions**

- Light / bio sensors
- Smart emitters
- Micro-modules
- Optical Components
- Integrated circuits
# ams OSRAM is a top 3 player in optical semiconductors

Only player in industry covering the full optical value chain offering unique value to customers

<table>
<thead>
<tr>
<th>#1</th>
<th>ams OSRAM</th>
<th>#2 (^1)</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
<th>#9</th>
<th>#10</th>
<th>TAM (^2) 2021</th>
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<tbody>
<tr>
<td><strong>Total optical revenues 2021</strong></td>
<td>45B€</td>
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<tr>
<td><strong>Emitters</strong></td>
<td>17B€</td>
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<tr>
<td>LED</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>MicroLED</td>
<td>✔</td>
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<td>✔</td>
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<td>✔</td>
<td>✔</td>
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<tr>
<td>VCSEL</td>
<td>✔</td>
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<tr>
<td><strong>Optical elements</strong></td>
<td>3B€</td>
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<tr>
<td><strong>Detectors</strong></td>
<td>19B€</td>
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<td></td>
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<tr>
<td>Image sensors</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Light sensors</td>
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<tr>
<td><strong>ICs</strong></td>
<td>4B€</td>
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<tr>
<td>Emitter drivers</td>
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<tr>
<td>Analog front-end</td>
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<tr>
<td><strong>Micro-optical assembly</strong></td>
<td>2B€</td>
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</tbody>
</table>

1) ams OSRAM tied for #2 position

2) Total Addressable Market

Source: OMDIA, Yole Development, Thomson Reuters
Delivering double digit revenue growth with diverse portfolio of growth vectors

Alexander Everke (CEO)

Outline

1. Strong growth and integration track record
2. Becoming the leader in optical solutions
3. Delivering double digit revenue growth
4. Next steps in the ams OSRAM journey
Key growth areas on top of a steady growing established business

Revenues in B€

<table>
<thead>
<tr>
<th>Year</th>
<th>L&amp;S Lamps</th>
<th>L&amp;S divestments</th>
<th>Semis Growth</th>
<th>Semis Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td></td>
<td>4.2</td>
<td></td>
<td></td>
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<tr>
<td>2024</td>
<td></td>
<td></td>
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<tr>
<td>2026</td>
<td></td>
<td>5.0</td>
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</tbody>
</table>

Note: 2021 figures reflect pro-forma financials, excluding revenues of the divested and to-be-divested businesses of the L&S segment; expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis.
Key growth areas on top of a steady growing established business

**Revenues in €**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (ex divest)</th>
<th>Semis Established</th>
<th>L&amp;S Lamps</th>
<th>CAGR 2021-26</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>4.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Semis Growth**: >50%
- **Total (ex divest)**: >10%
- **CAGR >12%**
- CAGR 3-5%
- CAGR 0-3%

Note: 2021 figures reflect pro-forma financials, excluding revenues of the divested and to-be-divested businesses of the L&S segment; expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or any future geopolitical crisis.
Semis Growth: Diversified growth vectors across markets

CAGR 2021-2026 > 50%

Automotive:
Dynamic Forward/Signal Lighting, LIDAR, In-cabin Sensing, Projection, Smart Surfaces

Consumer:
MicroLED, 3D Sensing & Camera Enhancement, Consumer AR/VR, Vital Signs Monitoring

Industrial & Medical:
Horticulture, UV-C LED, LED & Laser Projection, Digital Health, Micro-cameras

Note: Expected values based on current target model and available information
Expectations and targets are based on ams OSRAM's latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis
Driving a balanced end-market and application mix

Revenues in B€; % of total revenues

<table>
<thead>
<tr>
<th>Segment</th>
<th>ams 2019</th>
<th>ams OSRAM 2021</th>
<th>Long-term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>35-40%</td>
<td>39%</td>
<td>35-45%</td>
</tr>
<tr>
<td>Consumer</td>
<td>28%</td>
<td>32%</td>
<td>25-35%</td>
</tr>
<tr>
<td>Industrial &amp; Medical</td>
<td>31%</td>
<td>22%</td>
<td>15-20%</td>
</tr>
<tr>
<td>Lamps &amp; Systems</td>
<td>13%</td>
<td>7%</td>
<td>15-20%</td>
</tr>
<tr>
<td>Sensing</td>
<td>5%</td>
<td>15-20%</td>
<td>15-20%</td>
</tr>
<tr>
<td>Visualization</td>
<td>82%</td>
<td>35-40%</td>
<td></td>
</tr>
<tr>
<td>Illumination</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 2021 figures reflect pro-forma financials, excluding revenues of the divested and to-be-divested businesses of the L&S segment; expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis.
Successfully engaged with a diversified customer base

**Revenues in B€; % of total revenues**

- **Top 10 customers**
  - ams OSRAM 2021: 29% (71%)
  - ams OSRAM Long-term: 35-40% (60-65%)

- **Other customers**
  - EU large semis players 2021: 65%

Note: 2021 figures reflect pro-forma financials, excluding revenues of the divested and to-be-divested businesses of the L&S segment; expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis.
Delivering double digit revenue growth with diverse portfolio of growth vectors

Alexander Everke (CEO)

Outline

1. Strong growth and integration track record
2. Becoming the leader in optical solutions
3. Delivering double digit revenue growth
4. Next steps in the ams OSRAM journey
## Becoming the uncontested leader in optical solutions as one company

**Create one company**
- Execute business portfolio alignment
- Implement common platforms to run business
- Implement new organizational + culture model
- Drive first year synergies (majority OPEX)
- Define + complete joint solution roadmaps

**Start leveraging strategic portfolio**
- Disposals completed + portfolio in place
- New revenue and growth base established
- Drive second year synergies (OPEX + COGS)
- Drive first gen joint solution developments
- Full leverage of combined IP and resources

**Drive growth + profit targets**
- Mid-term growth drivers kicking in
- Longer-term growth vectors come into sight
- Drive third year synergies (majority manufacturing/COGS)
- Benefit from cross-sell opportunities

---

*Note: Synergies refer to pre-tax run-rate gross synergies against original baseline*
Key takeaways

• Track record of and unchanged commitment to growth

• Successfully executing on OSRAM acquisition and integration commitments, including disposals

• Top 3 optical semiconductor player today, uniquely covering the full optical value chain

• Expected to outgrow our market (8-10% CAGR) with revenue CAGR >10% 2021-26

• Broad and diversified set of growth drivers across all target markets and application segments

• Driving already balanced end-market and application mix with a diversified customer base
Innovation and Technology leadership

Thomas Stockmeier
Chief Technology Officer
Innovation and Technology leadership

Thomas Stockmeier (CTO)

Outline

1. Technology leadership in optical solution platforms for illumination, visualization, sensing
2. Sustainable differentiation and leadership in LED
3. Uniquely positioned to capture microLED opportunity
4. Next generation technologies and solutions
Comprehensive portfolio of optical solution technology platforms for key markets

<table>
<thead>
<tr>
<th>Silicon &amp; Compound Semiconductors</th>
<th>Optical Path</th>
<th>Materials &amp; Packaging Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissors (e.g. VCSEL, EEL, LEDs, microLEDs)</td>
<td>Optical elements (e.g. microlenses, waveguides, metalenses)</td>
<td>Color conversion materials (e.g. Phosphors, Quantum Dots)</td>
</tr>
<tr>
<td>Detectors (e.g. CMOS image sensors, light sensors from IR to UV)</td>
<td>Filters and optical coatings (e.g. bandpass, anti-reflection)</td>
<td>Optical packages and sensor modules (e.g. VIM, TSV, CSP)</td>
</tr>
<tr>
<td>Driver and Analog Front-end ICs (e.g. LED drivers, sensor interfaces)</td>
<td>Integration of passive optics (e.g. diffusors, polarization gratings, lenses)</td>
<td>LED packaging: high power, small pitch (e.g. CSP, SmartVIS)</td>
</tr>
</tbody>
</table>

Integration (Modules, Algorithms, Software)
Integration level tailored to customer needs
Optical path encompasses diversity of functions and components

- Diffractive optics
- Micro-lenses
- Diffusors
- Prisms
- Mirrors
- Waveguides
  - Reflective
  - Diffractive
  - Holographic
- Prisms
- Diffractive optics (e.g. gratings)
- Dielectric filters
- Absorption filters
- Diffractive optics
- Micro-lenses for imaging
- Other non-imaging optics
Core competence in complex very high volume micro-optical modules

Example: Light sensor system integration at package and wafer level

Key technologies in latest generation

- TSV on 8-inch wafer eliminating wire bonding
- Electrostatic shielding with transparent conductive layer (ITO - Indium Tin Oxide)
- High performance interference filters with very wide field-of-view
- Diffuser deposited directly on chip without air-gap
- Ambient Light Sensing (ALS) behind active OLED display, optimized by machine learning algorithms
Core competence in complex very high volume micro-optical modules

Example: Microcamera modules based on in-house imaging, sensing and optics components, realizing smallest high performing sensing module

**Image sensors**
- Global shutter sensors: Leading performance
- Multi-sensor platform development
  - Fusion of global & rolling shutter
  - Event-based image sensors

**Imaging & projection optics**
- Small footprint, low z-height, optimized form factor, re-flowable
- Wafer-level manufacturing & assembly processes
- Meta-surfaces: More functions, further form factor reduction

Complete microcamera module
(2.3 x 2.8 x 2.0 mm)

Microcamera modules for AR/VR or medical endoscopy applications
Innovation and Technology leadership
Thomas Stockmeier (CTO)

Outline

1. Technology leadership in optical solution platforms for illumination, visualization, sensing
2. Sustainable differentiation and leadership in LED
3. Uniquely positioned to capture microLED opportunity
4. Next generation technologies and solutions
Focused on innovation and performance driven segments

- Strategic focus on innovation-driven LED market segments
- Continuously pushing frontier of performance and quality requirements

<table>
<thead>
<tr>
<th>Mass markets</th>
<th>Innovation-driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Indicators for industrial equipment</td>
<td>e.g. Automotive exterior, Automotive interior ambient, UV-C, Horticulture red, LED projection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost dominating factor</th>
<th>Performance / cost in balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater China competition</td>
<td>e.g. Outdoor General Lighting, Infrared vision</td>
</tr>
<tr>
<td>e.g. Consumer display backlighting, Consumer General Lighting, Videowall</td>
<td></td>
</tr>
</tbody>
</table>
# LED technology platforms

<table>
<thead>
<tr>
<th>Material systems</th>
<th>Automotive</th>
<th>Consumer</th>
<th>Industrial &amp; Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlInGaN (UV, blue and green)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InGaAIP (yellow, red and near infrared)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AlGaAs (near infrared)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UX:3 &amp; ThinFilm (Surface emitters)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapphire (Volume emitter)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser (Edge emitter and VCSEL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microLED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion Materials (Phosphors, Quantum dots)</td>
<td>Conversion</td>
<td>Conversion</td>
<td>Conversion</td>
</tr>
<tr>
<td>Matrix Materials (Polymers, Encapsulants)</td>
<td>Materials</td>
<td>Materials</td>
<td>Materials</td>
</tr>
<tr>
<td>Broad portfolio of LED packages</td>
<td>Packages</td>
<td>Packages</td>
<td>Packages</td>
</tr>
</tbody>
</table>

- **EPI wafer**
- **LED Die**
- **Conversion layer**
- **LED package**
Broadest emitter and package portfolio in the industry for perfect application fit

LED Chips across full light spectrum

UV

AllInGaN

Visible

InGaAIP

IR

All technologies in chip sizes from 180µ-2mm

All technologies in chip sizes from 180µ-2mm

Optimized for Biometrics up to Security

Broad and differentiating LED package portfolio

Premold | QFN | Ceramic | Bare Lead frame | PCB | Metal Core Board | Metal Can | Filament | Coherent Optical Sub-assembly
---|---|---|---|---|---|---|---|---

![Premold](image1.png) ![QFN](image2.png) ![Ceramic](image3.png) ![Bare Lead frame](image4.png) ![PCB](image5.png) ![Metal Core Board](image6.png) ![Metal Can](image7.png) ![Filament](image8.png) ![Coherent Optical Sub-assembly](image9.png)
LED technology platform highlights

Epitaxy & Chip

Performance leadership in Hyper-Red devices

- Performance leadership of Hyper-Red device for horticulture lighting
- InGaAlP Epi and chip performance - market benchmark for competitors

Materials & Conversion

Premium lighting redefined: New Quantum Dot LED

- QD-phosphor hybrid solution enabling improved performance at high color quality
- Unique encapsulation – the only QDs in the world suitable for direct on-chip operation
- Award winning technology: High color quality + high efficacy

Packaging

360° SIDELED for Direct Backlighting

- 360° direct backlight optimized side emission enabling highest homogeneity
- Package level conversion w/o remote sheet, no color-over angle effects
- Automotive qualified EMC package providing highest stability & lifetime
Innovation and Technology leadership
Thomas Stockmeier (CTO)

Outline

1. Technology leadership in optical solution platforms for illumination, visualization, sensing
2. Sustainable differentiation and leadership in LED
3. Uniquely positioned to capture microLED opportunity
4. Next generation technologies and solutions
Focusing on smallest microLED dimensions with high volume applications

<table>
<thead>
<tr>
<th>Chip size</th>
<th>Traditional LED</th>
<th>miniLED</th>
<th>microLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;300 µm</td>
<td>&gt;100 µm</td>
<td>50 µm</td>
<td>30 µm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 µm</td>
<td>5 µm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 µm</td>
</tr>
</tbody>
</table>

→ Strongly increasing technological challenge →

Applications

- Streetlighting
- Videowall
- Direct backlight
- Luxury TV
- 4k TV
- 8k TV
- Smartwatch
- Smartphone
- AR/VR microdisplay
- Video wall
- Rear light
- External displays
- Door display
- Dashboard
- Headlamp
- Displays:
- Automotive:

2021 “microLED” products are actually based on miniLED
microLED demo products shown

ams OSRAM microLED focus
MicroLED will revolutionize future display generations

<table>
<thead>
<tr>
<th></th>
<th>LCD</th>
<th>OLED</th>
<th>microLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency</td>
<td></td>
<td></td>
<td>x2</td>
</tr>
<tr>
<td>High pixel density</td>
<td></td>
<td>x6</td>
<td>x9</td>
</tr>
<tr>
<td>Brightness</td>
<td>x2</td>
<td></td>
<td>x50</td>
</tr>
<tr>
<td>Contrast</td>
<td></td>
<td>x10-x100</td>
<td>x100+</td>
</tr>
<tr>
<td>Broad viewing angle</td>
<td>Poor</td>
<td>Good</td>
<td>Best</td>
</tr>
<tr>
<td>Refresh rate</td>
<td>Poor</td>
<td>Good</td>
<td>Best</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>x1.2</td>
<td></td>
<td>x1.9</td>
</tr>
<tr>
<td>Sensors in display</td>
<td>Difficult</td>
<td>Difficult</td>
<td>Easiest</td>
</tr>
</tbody>
</table>

Key challenge for microLED is maturing the technology and driving down cost per display

Market analyst expectation for microLED market starting from 2024

M$

Yole Développement key assumptions:

- Smart watch and mobile penetration largest growth drivers
- AR/VR/MR penetration reaches 33% by 2028 with a broader customer base
- Smart phone adoption will require 8” production to reach required yields and manufacturing cost
- Smart watches and phones will represent ~80% of the market in the 2024-2028 period

Assumptions: (1) Yole Développement’s micro-LED aggressive adoption scenario (units) and 6” wafer volumes & prices per processed wafer  (2) Adapted for 8” production (own estimates)

Focus on providing processed microLED wafers to display assemblers

- EPI wafers
  - MicroLED processed wafers
    - Display assembly, test & repair
      - Mass die transfer to TFT backplane and bonding
      - Post-assembly inspection & testing and repair
      - Optical color converter deposition and patterning
    - Display modules
      - Driver bonding
      - Flat panel/module assembly
      - Additional optical films
      - Display inspection on key features
      - Tiling (for large displays)

- ams OSRAM
  - Driver ICs
    - Driver ICs produced in CMOS foundries
  - Backplanes
    - Thin film transistor circuits on large glass substrates

- Panel suppliers no longer vertically integrated as for LCD/OLED (2B-6B$ capex per fab)

- Different potential setups for microLED display supply chain:
  - Consumer OEMs with microLED makers & OSAT/EMS
  - LCD/OLED panel makers with microLED foundry partners

Source: Based on MicroLED Displays: Market, Industry and Technology Trends report, Yole Développement, 2021
## LEDs size comparison

<table>
<thead>
<tr>
<th>Technology</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Power</td>
<td>1,000 µm</td>
</tr>
<tr>
<td>miniLED</td>
<td>130 µm</td>
</tr>
<tr>
<td>microLED</td>
<td>10 µm</td>
</tr>
</tbody>
</table>

~4 million 10µm microLEDs fit on a 1€ coin
MicroLED technology poses particular challenges that ams OSRAM is solving

Small chip = large perimeter

Large perimeter to surface ratio reduces light generation significantly, solved via optimized chip design

Other challenges

- Environmental protection of chip on nanoscale needed
- Defects and particles are about the same size as a microLED
- Reliability over lifetime
New manufacturing infrastructure need for microLEDs <10-15 µm

Traditional LED fabs cannot be used for producing miniature scale microLEDs

**Traditional LED/miniLED/larger microLED**

"Discretes-like” manufacturing

- 4/6” wafers
- Proximity mask aligners
- Class 10,000+ clean room
- End-of-line metrology & inspection
- Limited advanced process control tools
- Limited automation

**High performance microLED < 10-15 µm**

"Semiconductor-like” manufacturing

- 8” wafers
- Stepper lithography
- Class 100 with class 10 areas
- In-line metrology and testing
- Close, real-time monitoring of tools and process excursions
- Full automation and SMIF boxes

Source: Based on MicroLED Displays: Market, Industry and Technology Trends report, Yole Développement, 2021
### Best positioned to become leading player in microLED market

<table>
<thead>
<tr>
<th>Selection criteria</th>
<th>ams OSRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Die performance</strong></td>
<td></td>
</tr>
<tr>
<td>Blue/green (GaN)</td>
<td>Top 3</td>
</tr>
<tr>
<td>Red (InGaAlP)</td>
<td>Best-in-class</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td></td>
</tr>
<tr>
<td>Wafer size</td>
<td>8”</td>
</tr>
<tr>
<td>Capacity</td>
<td>Scale 8” LED facility</td>
</tr>
<tr>
<td>Location</td>
<td>Malaysia (low cost)</td>
</tr>
<tr>
<td>Quality/reliability</td>
<td>Top 3</td>
</tr>
<tr>
<td><strong>IP</strong></td>
<td></td>
</tr>
<tr>
<td>Know-how</td>
<td>Top 3</td>
</tr>
<tr>
<td>IP</td>
<td>Strong player</td>
</tr>
<tr>
<td><strong>Geopolitical risk</strong></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>EU/Malaysia</td>
</tr>
</tbody>
</table>

- Customers prefer to receive all three colors from one supplier
- Expected to be the only scale 8” LED facility ramping from 2024
- High level of 8” automation drives quality, yield and reliability, and further reduces labor cost
- Know How / IP is key to OEMs

Source: ams OSRAM internal market model and internal research
Innovation and Technology leadership

Thomas Stockmeier (CTO)

Outline

1. Technology leadership in optical solution platforms for illumination, visualization, sensing
2. Sustainable differentiation and leadership in LED
3. Uniquely positioned to capture microLED opportunity
4. Next generation technologies and solutions
**Pixelated Automotive Front Lighting**

- Pixelated LEDs with ~25,000 light points directly mounted on driver IC
- ams OSRAM is uniquely positioned
  - Very small vertical emitting LEDs
  - Direct die attach to driver IC for IC/LED integration
  - System know-how

**AR laser beam scanner visualization module**

- Edge Emitting Lasers with prism, mounted in a ceramic package together with driver IC
- ams OSRAM is uniquely positioned
  - Leading multi-ridge EELs
  - Driver IC design capabilities
  - In-house optical components and module assembly
  - System know-how
Solutions combining light source, optics, detectors and driver ICs

**Integrated Vital Signs Monitoring Module**

- Optical module integrating light source, receiver and driver & signal processing IC in miniaturized module
- ams OSRAM is uniquely positioned
  - Leader in individual components, only player with all in-house
  - High-volume optical module assembly capability
  - Reference designs including system-level algorithm support

**Adaptive UV-C LED disinfection**

- UV-C LED
- UV-C spectral sensor for dose measurements
- 1D-dToF Sensor for Presence Detection
- UV-C disinfetion segments

- UV-C LED illumination
- Stimulated bio-fluorescence

- UV-C based filter contamination testing

- UV-C sensor
- 1D dToF presence detection

OSLON® UV 3636 / 6060

AS7331 UV Sensor

TMF882x Multi-zone
# Self-mixing interferometer (SMI) sensing

<table>
<thead>
<tr>
<th>Concept</th>
<th>Use the VCSEL itself as sensor: measure changes in VCSEL properties induced by reflection of light into the VCSEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capabilities</td>
<td>Expertise in SMI-optimized VCSEL&lt;br&gt;Leading expertise in optics &amp; packaging, signal processing and in-depth application know-how</td>
</tr>
<tr>
<td>Applications</td>
<td><strong>Optical microphones</strong>: high SNR with small form factor, enable directional microphones&lt;br&gt;<strong>Miniature rotary encoders</strong>: higher precision for wider measurement range and faster data processing&lt;br&gt;<strong>SMI imager</strong>: richer data (4D predictive perception), longer range and no background light interference&lt;br&gt;<strong>Vital Signs Monitor</strong>: blood flow measurements for improved PPG, blood pressure, cardiovascular risk analysis</td>
</tr>
</tbody>
</table>

---

**Heart rate proven in steady state (without motion)**

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Signal (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>7.7</td>
<td>0.0</td>
</tr>
<tr>
<td>8.2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**PPG reference**

**SMI fringes**

---

**Self-mixing laser diode**

- $r_1$
- $r_2$
- $r_{Tr}$

**VCSEL**

Junction voltage or power read-out

**Target**
Volume phase holograms for AR device combiners

Concept

- Volume phase holograms (VPHs) increase efficiency of combiners in smart glass displays by 5x to 50x
- Replacing existing grating solutions, solving biggest hurdle on path to consumer devices

Capabilities

- Design and manufacturing expertise of high efficiency, complex VPHs for disruptive combiner solutions: RGB & NIR, transmissive & reflective, multiplexed

Applications

- AR glasses: all-day wearable smart glasses with small form factor and cinematic image quality
- Eye tracking solutions: high-speed, compact & non-obtrusive, low power consuming
Sensor / display integration with lensless imaging

**microLED display with integrated sensing**

- LED and optical sensors integrated on the same plane
- Enabling displays with integrated functionalities
  - Display management (ALS, proximity)
  - Gesture / HMI
  - Face recognition / 3D sensing
  - Speed and distance measurements

**Potential functionality: finger tracking**

Thin plate optics for coded aperture sensing (computational imaging)

- Raw data
- AI/neural network computing
- Optical *encoding* and *decoding* of the information

- Tracking
- Zoom
- Rotation
- Depth
Key takeaways

Thomas Stockmeier (CTO)

• Wide and deep technology portfolio from light source, optical path and package to IC and software/algorithms, enabling differentiated products and integrated solutions across the value chain

• Market-leading LED technology focused on highest performance in epi, chip, light conversion and package enables products for most demanding applications

• ams OSRAM is best positioned to capture the microLED opportunity
  – MicroLED as the next disruption in display technology
  – Technological challenges for highly performing LEDs <10µm being solved
  – Clear industrialization path for volume applications

• Combination of both companies’ capabilities and IP provides unique source for disruptive innovation to serve the megatrends of our markets
Integration, synergies, manufacturing and portfolio management

Mark Hamersma
Chief Business Development Officer

Mike Lusk
Executive Vice President Semiconductor Operations
Integration, synergies, manufacturing and portfolio management

Mark Hamersma (CBO), Mike Lusk (EVP Semi Operations)

Outline

1. Update on integration & synergy creation
2. Manufacturing strategy & footprint optimization
3. Portfolio management approach, M&A strategy and current divestments
### High-level post-merger integration timeline 2020-2024

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
</tr>
<tr>
<td>Synergy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>realization</td>
<td></td>
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<td>Q1</td>
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<td>Q4</td>
<td>Q1</td>
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<tr>
<td>Joint</td>
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<td>organization</td>
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<td>&amp; infrastructure</td>
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<td>Joint</td>
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<tr>
<td>business</td>
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<tr>
<td>operation</td>
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</tbody>
</table>

#### Synergy realization
- Baselining
- Target setting
- Implementation planning
- Pre DPLTA synergy realization (e.g. procurement)

#### Joint organization & infrastructure
- Definition post Day2 org, governance, corporate values and leadership principles
- Implementation of joint organization & E2E business processes (Finance, HR, …)
- Global culture & change program
- ERP & CRM integration, IT Infra consolidation, legal entity simplification

#### Joint business operation
- Operational implementation planning (as allowed pre DPLTA)
- Semi operating model
- Company processes
- Divestments

#### Timeline:
- **Q1 2020**: Baselining, Target setting, Implementation planning, Pre DPLTA synergy realization (e.g. procurement)
- **Q2 2020**: Synergy execution towards ~350M€
- **Q3 2020**: SG&A streamlining, Sales channel optimization
- **Q4 2020**: Real estate consolidation
- **Q1 2021**: Semi production footprint consolidation
- **Q2 2021**: New product synergies
- **Q3 2021**: DPLTA
- **Q4 2021**: Today
- **Q1 2022**: Definition post Day2 org, governance, corporate values and leadership principles
- **Q2 2022**: Implementation of joint organization & E2E business processes (Finance, HR, …)
- **Q3 2022**: Global culture & change program
- **Q4 2022**: ERP & CRM integration, IT Infra consolidation, legal entity simplification
- **Q1 2023**: Operational implementation planning (as allowed pre DPLTA)
- **Q2 2023**: Semi operating model
- **Q3 2023**: Company processes
- **Q4 2023**: Divestments
- **Q1 2024**: Strategy definition
- **Q2 2024**: Cross-divisional development projects

#### Key Milestones:
- Tracking >2,000 initiatives in state-of-the-art workflow tool
- All essential business operation integration completed, large-scale IT infrastructure and legal entity consolidation on track
- Increased focused on synergy / savings execution towards ~350M€ target

Note: Synergies refer to pre-tax run-rate gross synergies against original baseline
Synergy realization at lower cost

M€

~350M€ total synergies and cost savings

Key aspects

- Synergy run-rate in 1Q22 increased to 150M€ + 50M€ (pre-DPLTA cost savings) = 200M€
- Initial synergies more OPEX, procurement and manufacturing overhead-related
- Key drivers
  - Headcount measures
  - Joint procurement initiatives
  - Reduction of SG&A costs
- >70% of total integration synergies expected within first two years of control
- Latest view estimate of cost to realize synergies is ~270M€

All figures in M€; synergy values approximate figures
Graphic representation of expected annual pre-tax run-rate gross synergies of 300M€ p.a. against original baseline gradually ramping up over approx. three years after DPLTA effective date.
## Synergy measures implemented as of Q1 2022

<table>
<thead>
<tr>
<th>Synergy measures implemented</th>
<th>Synergy measures still to come</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R&amp;D (pre-DPLTA)</strong></td>
<td></td>
</tr>
<tr>
<td>• Discontinued centralized innovation spend</td>
<td>• ERP consolidation (7→2) and IT application &amp; infrastructure rationalization</td>
</tr>
<tr>
<td>• Stopped low margin General Lighting</td>
<td>• Billing consolation, legal entity reduction (-50%)</td>
</tr>
<tr>
<td></td>
<td>• Related F&amp;A and IT synergies (remaining ~60% and ~50%, respectively)</td>
</tr>
<tr>
<td></td>
<td>• Office space consolidation</td>
</tr>
<tr>
<td><strong>SG&amp;A</strong></td>
<td></td>
</tr>
<tr>
<td>• &gt;80% of FTE reductions being realized for most overhead functions</td>
<td></td>
</tr>
<tr>
<td>• Sales force overlaps addressed</td>
<td></td>
</tr>
<tr>
<td>• MarCom spend streamlined</td>
<td></td>
</tr>
<tr>
<td><strong>COGS</strong></td>
<td></td>
</tr>
<tr>
<td>• ~75% of materials procurement synergies and fab overhead &amp; efficiency</td>
<td>• Semis footprint consolidated and related indirect and direct labor productivity improvements</td>
</tr>
<tr>
<td>• Synergies in Quality</td>
<td>• Asset utilization driven by new products</td>
</tr>
<tr>
<td>• ~50% of IP synergies</td>
<td>• Remaining procurement, fab overhead &amp; efficiency and IP synergies</td>
</tr>
<tr>
<td>• Stopped low margin General Lighting</td>
<td></td>
</tr>
<tr>
<td><strong>Revenues</strong></td>
<td></td>
</tr>
<tr>
<td>• Leverage in distribution set-up (pricing, consolidation, channel optimization)</td>
<td>• Synergies from new product developments</td>
</tr>
<tr>
<td>• Cross selling of existing products</td>
<td></td>
</tr>
</tbody>
</table>

Note: Synergies refer to pre-tax run-rate gross synergies against original baseline
Integration, synergies, manufacturing and portfolio management
Mark Hamersma (CBO), Mike Lusk (EVP Semi Operations)

Outline

1. Update on integration & synergy creation
2. Manufacturing strategy & footprint optimization
3. Portfolio management approach, M&A strategy and current divestments
Summary semiconductor operations

- Focus in-house manufacturing on differentiating processes and supply flexibility
- Continuous improvement programs to compensate ASP erosion, manufacturing cost increases, and provide capacity for additional business
- Key initiatives defined to address and improve pockets of underutilization
- Pursuing ~190M€ COGS savings from synergies and further footprint optimization
  - ~120M€ COGS synergies from combining ams OSRAM semis operations: eliminating manufacturing footprint and overhead overlaps, portfolio focusing, efficiency improvements, best practice sharing and purchasing synergies
  - ~70M€ from further Semis manufacturing footprint optimization on top of synergies
- Investing across 2022/2023 to establish a scale 8” LED production capability in Kulim that is expected to start ramping in 2024 and able to produce both high-power LEDs and microLEDs
Focus in-house manufacturing on differentiating processes

**Wafer manufacturing**
- III-V EPI and wafer production on 4/6/8” (InGaAlP/ AlInGaN/ AlGaAs)
- High-power visible and IR & UV-C invisible light LEDs and lasers
- Blue, green and red microLEDs
- Application-specific ICs in specialty CMOS processes ≥180nm

**Wafer post-processing**
- Phosphors and quantum dots
- Wafer Level Optics
- Color / Interference filters
- Optical coatings
- Open tube Through Silicon Via (TSV)

**Assembly, calibration and test**
- LED & Laser packaging
- Wafer-level sensor module manufacturing
- Micro-optical module assembly
- Optical testing
- Sensor calibration and testing

- Differentiating process technologies
- Lack of viable commercial sources
- Avoidance of uncompetitive margin stacking
Different types of manufacturing capacity with differing needs and focus areas

<table>
<thead>
<tr>
<th>ams OSRAM business split</th>
<th>Key sites Frontend</th>
<th>Key sites Assembly &amp; test</th>
<th>Investment &amp; Operational Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optical Comp. &amp; Modules</strong></td>
<td>• Singapore</td>
<td>• Singapore</td>
<td>• Increase utilization</td>
</tr>
<tr>
<td><strong>ICs</strong></td>
<td>• Premstaetten</td>
<td>• Calamba</td>
<td>• New products &amp; technology invest</td>
</tr>
<tr>
<td><strong>Emitters</strong> (LED, microLED, lasers)</td>
<td>• Regensburg</td>
<td>• Penang</td>
<td>• Increase make-or-buy flexibility</td>
</tr>
<tr>
<td><strong>Lamps &amp; Systems</strong></td>
<td>• Kulim</td>
<td>• Wuxi</td>
<td>• Expand for future growth needs (8&quot; LED, microLED, etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• OSATs (external)</td>
<td>• Load and site optimization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Various in-house</td>
<td>• Maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Cost efficiency</td>
</tr>
</tbody>
</table>

Capex commitments typically up to 24 months ahead of volume growth
Continuous improvement to mitigate ASP erosion and material cost increases

Example programs and achievements last 2-3 years

**Regensburg, Malaysia, Wuxi**
- Yield/Non-Conformance-Costs reduction of >25% in 2020/21
- Reduced front-end headcount by 7% while increasing fab moves by >65%
- Flat back-end headcount while increasing value output by >35%
- Significant cycle time improvements of up to 50% in the last 3 years in BE/FE
- Annual purchasing cost reductions of 4.9%

**Singapore**
- Yield/Non-Conformance-Costs reduction of >20% per year in 2020/21
- Improved front-end moves per facility by 50-60% per year in 2020/21
- Increased front-end direct labor productivity by >80%
- Increased back-end direct labor productivity by >55%
- Annual purchasing cost reductions of 5.7%

**Premstaetten**
- Yield/Non-Conformance-Costs reduction of >20% in 2020/21
- Reduced front-end direct labor by 10% while increasing fab output by >30%
- Reduction of indirect labor cost by 8% while increasing fab moves by 35%
- Increase of fab capacity by >10% with existing tool park
- Cycle-time improvement by >25% and increasing CLIP to >95%
Key initiatives to address pockets of underutilization

**Singapore**
- Move Woodlands production to AMK and close site
- Transfer VCSEL production to Regensburg
- Consolidate optical filter production in Premstaetten
- Win additional large optical module and component programs
  - Re-uses existing excess capacity
  - Requires additional process steps that use the higher grade Tampines clean rooms

**Premstaetten**
- Product mix and Covid-19 effects drove temporary underutilization
- Growing Industrial & Medical business fills existing capacity in 2022
- Expansion (+10%) for c18 processes drives better cost and loading balance with outsourced foundries

**Test**
- Continue to consolidate test in Calamba moving Foundry test from Singapore and bulk of CMOS test from Austria

**Other semi**
- Regensburg, Kulim and Penang well loaded and expanding capacity by addressing bottlenecks
Well underway to capture COGS synergies and further OPS footprint optimization

- COGS synergies 40% of total 300M€ synergy target = 120M€
- Actions implemented by 1Q22 expected to enable ~70% run-rate of total COGS synergies
- Semis manufacturing footprint strategy identified further footprint optimization opportunities with targeted annual savings of 70M€ to be realized after 1Q24

190M€ total COGS savings targeted

- COGS synergies
- Further footprint optimization
- Portfolio focusing
- Manufacturing overhead
- Purchasing
- Efficiencies

COGS synergies 40% of total 300M€ synergy target = 120M€
Semis manufacturing footprint consolidation and optimization

**Key footprint changes**

- Close 2 complete sites (Woodlands, Penang) and add 1 new low-cost site (Batu Kawan)
  - Consolidate Singapore manufacturing in two sites by closing Woodlands
  - Consolidate dispersed, aged Malaysia LED assembly (12 buildings) into new Batu Kawan facility (1 building) with optimized layout

- Move VCSEL production to Regensburg and consolidate Optical Filters in Premstaetten to capture manufacturing economies

- Consolidate OSAT landscape by 35%

- Add new 8" front-end capacity/facility in Kulim to support future LED and microLED demand

- Add c18 CMOS capability in Austria to increase make-or-buy flexibility

---

**Our key FE/BE manufacturing sites* after implementation (2026)**

- **Regensburg, Germany**
  - LED/Laser chip production

- **Premstaetten, Austria**
  - CMOS ICs, TSV, Optical Filters, Test

- **Wuxi, China**
  - LED Assembly & Test

- **Ang Mo Kio/Tampines Singapore**
  - Wafer Level Optics & Packaging, Optical Processing

- **Batu Kawan, Malaysia**
  - LED Assembly & Test

- **Calamba, Philippines**
  - Test & Sensor Calibration

- **Kulim, Malaysia**
  - LED/microLED chip production

---

* Excludes small materials production sites for phosphors, platelets, etc.
Expected impact of the manufacturing footprint changes

### Productivity and margin improvements

- Supports expected >2x volume growth for 2026 horizon
- Productivity per capita increase in indirect labor of >30%
- ~100M€ expected annual cost savings (~30M€ footprint synergies, ~70M€ further footprint optimization)
- Gross margin expansion
  - At-scale facilities with optimized production flows
  - Shift from 4/6” to mainly 6/8” LED production
  - Significant mix shift to low-cost countries while maintaining strong Europe presence

### First 8” LED front-end facility

- First company to ramp a scale 8” LED front-end facility in 2024 (expected) that can produce both high-power LEDs as well as microLEDs
- High degree of automation in Kulim 8” front-end capacity further improves quality performance and reduces product cost
- New facility will also allow to incorporate energy and water saving measures supporting our ESG goals

---

1) Including treasury shares held by OSRAM Licht AG

Note: Synergies refer to pre-tax run-rate gross synergies against original baseline
Kulim development

<table>
<thead>
<tr>
<th>Looking back</th>
<th>Looking forward</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mid-2019, when ams made its offer to acquire OSRAM, OSRAM’s business plan would not sufficiently load Kulim with profitable business</td>
<td>• Continued substantial volume growth in the diverse “Semis Growth” areas presented will require capacity expansion in Kulim while supporting continued full loading in Regensburg</td>
</tr>
<tr>
<td>• In 2020, OSRAM changed its Kulim strategy</td>
<td>• Existing front-end space in Kulim and Regensburg is expected to be fully utilized in the mid-term</td>
</tr>
<tr>
<td>– Discontinued mid-power general lighting that would largely load Kulim</td>
<td>• Further volume growth to be supported by the 8” LED and microLED platform to be located in Kulim</td>
</tr>
<tr>
<td>– Accelerated transfer of high-volume auto LEDs from 4/6” in Regensburg to 6” Kulim</td>
<td>• Building construction started recently to allow for extended lead times</td>
</tr>
<tr>
<td>• Capacity in Kulim and the transfers from Regensburg allowed to support the surge in demand for high-power LEDs in 2021</td>
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</tbody>
</table>

Looking back

- Mid-2019, when ams made its offer to acquire OSRAM, OSRAM’s business plan would not sufficiently load Kulim with profitable business.

- In 2020, OSRAM changed its Kulim strategy:
  - Discontinued mid-power general lighting that would largely load Kulim.
  - Accelerated transfer of high-volume auto LEDs from 4/6” in Regensburg to 6” Kulim.

- Capacity in Kulim and the transfers from Regensburg allowed to support the surge in demand for high-power LEDs in 2021.

Looking forward

- Continued substantial volume growth in the diverse “Semis Growth” areas presented will require capacity expansion in Kulim while supporting continued full loading in Regensburg.

- Existing front-end space in Kulim and Regensburg is expected to be fully utilized in the mid-term.

- Further volume growth to be supported by the 8” LED and microLED platform to be located in Kulim.

- Building construction started recently to allow for extended lead times.
Summary semiconductor operations

- In-house manufacturing focused on differentiating processes and supply flexibility
- Clear plans to address pockets of underutilization and realize continuous improvement
- Pursuing ~190M€ COGS savings from synergies and further footprint optimization

Preparing for future growth needs
- Consolidate select product areas into single sites to drive manufacturing economies
- Transition multiple older locations into larger sites for higher efficiency
- First to ramp a scale 8” LED front-end facility in 2024 (expected) supporting both high-power LEDs as well as microLEDs

New manufacturing footprint more environmentally positioned to support our long term ESG goals
Integration, synergies, manufacturing and portfolio management

Mark Hamersma (CBO), Mike Lusk (EVP Semi Operations)

Outline

1. Update on integration & synergy creation
2. Manufacturing strategy & footprint optimization
3. Portfolio management approach, M&A strategy and current divestments
Portfolio framework for driving long-term growth and market leadership

Semis

<table>
<thead>
<tr>
<th>Category</th>
<th>&quot;Emerging&quot; (5Y Market CAGR &gt;= 25%)</th>
<th>&quot;Growth&quot; (8% &lt; 5Y Market CAGR &lt; 25%)</th>
<th>&quot;Mature&quot; (0% &lt;= 5Y Market CAGR &lt;= 8%)</th>
<th>&quot;Decline&quot; (5Y Market CAGR &lt; 0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market &amp; technology leadership</td>
<td>Select portfolio of opportunities within the R&amp;D envelope with best risk/reward</td>
<td>Invest to become market leader (MS/MS#2 &gt;2)</td>
<td>Invest to be true market leader</td>
<td>Right-size investment for 4-8Y EBIT maximization</td>
</tr>
<tr>
<td>Market leadership</td>
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<td></td>
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<tr>
<td>Technology leadership</td>
<td></td>
<td></td>
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<tr>
<td>Follower</td>
<td>Stop/milk unless technology discontinuity offers market leadership potential</td>
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</tbody>
</table>

Note: Percentage figures of R&D spend and revenues refer to 2021 actual financials
Accelerate implementation of our strategy through M&A

<table>
<thead>
<tr>
<th>M&amp;A principles</th>
<th>Example prior transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Build optical leadership positions by strengthening our strategic technologies &amp; capabilities and not buying revenues</td>
<td><img src="image1" alt="HEPTAGON™" /> <img src="image2" alt="CMOSIS" /> <img src="image3" alt="OSRAM" /> <img src="image4" alt="PRINCETON OTOPTRONICS" /> <img src="image5" alt="MAZeT" /></td>
</tr>
<tr>
<td>2. Enable full application solutions to increase differentiation</td>
<td><img src="image6" alt="sensing" /> <img src="image7" alt="KeyLemon" /> <img src="image8" alt="ixellence" /></td>
</tr>
</tbody>
</table>
| 3. Divest/spin-off non-strategic businesses to eliminate distractions and free up capital | • NFC and RFID readers  
• LED display drivers  
• MEMS microphone ASICs  
• Environmental/flow sensors  
• OSRAM DI divestitures  
• OSRAM-Continental JV |
Scope and status of divestments & portfolio alignment of Lamps & Systems

**Retained L&S**
- Automotive Lamps (OEM, Aftermarket)
- Entertainment & Industry Lamps

**Sold / Announced**
- Digital Systems North America
  - Closed
- Connected Building App. (a.o. Digital Lumen)
  - Closed
- Fluence
  - Close 1H 22E
- Automotive Lighting Systems (Retained OSRAM-Conti JV business)
  - Close 2H 22E

**To-be-divested**
- Digital Systems Eurasia
  - Lighting electronics / LED drivers
    - Close late 22E
- Traxon
  - City/building/street lighting systems
    - Close late 22E
- Clay Paky
  - Entertainment lighting fixtures
    - Close late 22E

~0.9B€ 2021 revenues
Double digit adj. EBIT margin

~0.8B€ 2021 reported revenues (~0.95B€ 2021 annualized run-rate est.)
Negative adj. EBIT contribution
Expected total proceeds: >500M€

---

1) To-be-divested closings reflect an expected potential date, no signing or agreement in place at this point in time. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
Financial model and path to financial targets

Ingo Bank
Chief Financial Officer
First twelve months: significant achievements

### OSRAM acquisition & group financing

- DPLTA in place since March 2021
- De-listed OSRAM Licht AG; ownership >80%\(^1\)
- Bridge facility cancelled and 3-year RCF in place (800M€, undrawn), established core set of top-tier relationship banks
- Strong operational cash flow in 2021 (~16% of revenues)
- Leverage consistently below 2x and first steps in gross debt reduction

### OSRAM integration

- Current synergy / savings run-rate of 200M€ (gross, ~57% of overall target) also helping to offset headwinds (Consumer share reduction, supply chain headwinds, inflation)
- Portfolio divestment process on track with 4 deals announced or closed
- Harmonized accounting principles, calendars, reporting segments and performance management approach
- Harmonized key policies for ESG focus areas
- IT integration and rationalization fully on track (HR-IS / CRM 2021, ERP 2022)

\(^1\) Including treasury shares held by OSRAM Licht AG

Note: Synergies refer to pre-tax run-rate gross synergies against original baseline
Financial model and investor value proposition

Ingo Bank (CFO)

Outline

1. **Company target financial model**

2. **Path to value creation: Margin expansion**

3. **Capital allocation priorities**

4. **Investor value proposition**
Company and segment target financial model

<table>
<thead>
<tr>
<th>ams OSRAM Group</th>
<th>Semiconductors Economic Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue CAGR (%)</strong></td>
<td>• Revenue CAGR (%): &gt;12%; Adj. EBIT ~20-25%</td>
</tr>
<tr>
<td>&gt;10%</td>
<td>• Growth driven by R&amp;D and Capex investments</td>
</tr>
<tr>
<td><strong>Adj. Gross Margin (%)</strong></td>
<td>• Improved asset utilization &amp; optimized industrial footprint</td>
</tr>
<tr>
<td>~40%+</td>
<td>• Synergy realization and lean SG&amp;A</td>
</tr>
<tr>
<td><strong>Adj. R&amp;D (%)</strong></td>
<td>• Divesting low margin businesses</td>
</tr>
<tr>
<td>11-14%</td>
<td>• Market consolidation winner in Lamps, grow share in aftermarket business</td>
</tr>
<tr>
<td><strong>Adj. SG&amp;A (%)</strong></td>
<td>• Increase SG&amp;A productivity</td>
</tr>
<tr>
<td>7-9%</td>
<td>• Low R&amp;D and investment needs</td>
</tr>
<tr>
<td><strong>Adj. EBIT (%)</strong></td>
<td></td>
</tr>
<tr>
<td>~20%+</td>
<td></td>
</tr>
</tbody>
</table>

Note: Expected values based on current target model and available information
Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis
Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business
Financial model and path to financial targets

Ingo Bank (CFO)

Outline

1. Company target financial model
2. Path to value creation: Margin expansion
3. Capital allocation priorities
4. Investor value proposition
Our path to gross margin expansion

Adjusted numbers

<table>
<thead>
<tr>
<th>Component</th>
<th>2020 Gross Margin</th>
<th>2021 Gross Margin</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted Gross</td>
<td>33%</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>Long-term adj.</td>
<td></td>
<td>&gt;40%</td>
<td></td>
</tr>
<tr>
<td>Gross margin target</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Price/Inflation/Oper. Excellence**: ~ (5)%
- **Business mix**: ~15%
- **Asset utilization**: ~15%
- **Semis footprint**: ~20%
- **COGS Synergies**: ~20%
- **Divestments**: ~35%

**Note**: Expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
EBIT margin improvement path

Adjusted numbers

### Long-term adj. EBIT margin target

- **>20%**

### Adjusted numbers

<table>
<thead>
<tr>
<th></th>
<th>Adj. EBIT margin 2020</th>
<th>Adj. EBIT Margin 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adj. EBIT</strong></td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Margin improvement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gross margin expansion</strong></td>
<td></td>
<td>~50%</td>
</tr>
<tr>
<td><strong>OPEX leverage</strong></td>
<td>~30%</td>
<td></td>
</tr>
<tr>
<td><strong>SG&amp;A synergies</strong></td>
<td>~15%</td>
<td></td>
</tr>
<tr>
<td><strong>Divestments impact OPEX</strong></td>
<td></td>
<td>~5%</td>
</tr>
<tr>
<td><strong>Divestments impact GM</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
On track to deliver on margin improvement levers

<table>
<thead>
<tr>
<th></th>
<th>2022-2023</th>
<th>2024+</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Divestments</td>
<td>✓</td>
<td></td>
<td>▪ Expect to complete in 2022, full year effect in 2023</td>
</tr>
<tr>
<td>2. Synergies/savings of ~350M€E</td>
<td>✓</td>
<td>✓</td>
<td>▪ &gt;70% by 1Q23 and 100% by 1Q24</td>
</tr>
<tr>
<td>a. Revenue synergies</td>
<td>✓</td>
<td>✓</td>
<td>▪ 2022/23 channel &amp; cross-selling, 2024+ new products</td>
</tr>
<tr>
<td>b. COGS synergies</td>
<td>✓</td>
<td></td>
<td>▪ Realized synergies masked by SGP asset utilization</td>
</tr>
<tr>
<td>c. SG&amp;A synergies</td>
<td>✓</td>
<td></td>
<td>▪ SG&amp;A reduction expected in 2022/2023; ongoing lean activities after that</td>
</tr>
<tr>
<td>3. Semis footprint</td>
<td>✓</td>
<td>✓</td>
<td>▪ Moves in 2022/2023 expected to deliver savings 2024+</td>
</tr>
<tr>
<td>4. Asset utilization</td>
<td>✓</td>
<td>✓</td>
<td>▪ Project funnel; further optimization measures</td>
</tr>
<tr>
<td>5. OPEX leverage</td>
<td>✓</td>
<td>✓</td>
<td>▪ Accelerating growth in 2024+</td>
</tr>
</tbody>
</table>

Note: Synergies values are based on current expectations and available information; Synergies refer to pre-tax run-rate gross synergies against original baseline.
Mid-term (2024) ams OSRAM target financial model

<table>
<thead>
<tr>
<th>2024 target band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues total</td>
</tr>
<tr>
<td>Revenue growth run-rate year-on-year</td>
</tr>
<tr>
<td>Adj. EBIT margin</td>
</tr>
</tbody>
</table>

Note: Expected bandwidth and values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
Financial model and path to financial targets

Ingo Bank (CFO)

Outline

1. Company target financial model
2. Path to value creation: Margin expansion
3. Capital allocation priorities
4. Investor value proposition
Capital allocation priorities

Deliver >10% organic annual revenue growth

Targeted technology spend
- R&D target spend between 11-14%
- Bolt-on technology M&A and buying/licensing strategic IP

Capex
- Production volume growth & maintenance Capex
- New manufacturing platforms (e.g. 8” LED); new technologies
- Balancing strategic in-house capacity and capability with flexibility of outsourcing

Realize synergies

One-time costs
- Invest into integration: Expected ‘One-Time-Expense-to-Synergies’ ratio <0.7x
- Footprint, infrastructure & systems rationalization

Balance Sheet

Debt management
- Expect to retire 320M$ CB in Sep 2022 and revisit HYB in 2023/24
- Maintain strong Operational Cash Flow focus
- Target investment grade rating and leverage <2x

Shareholder capital returns
- Focus on structurally establishing investment grade rating
- Increase of OSRAM stake currently not a priority
Investment-to-revenue ratio expected ~10% on average through cycle

Next 18-24 months expected to be markedly higher to support growth and consolidation

Focus areas

- Establish first of its kind 8” front-end capacity in Kulim to support expected LED and microLED demand (step-up in asset base for emitters)
- Add c18 CMOS capability in Austria (make-or-buy CMOS)
- Consolidate back-end and remove duplicative settings (efficiency)

Capex in 2022 and 2023 expected to be markedly higher

Note: Conceptual representation; Normalized over a full cycle, i.e. an average value. Typically oscillates especially when footprint extensions are done
Stable and solid leverage coupled with layered maturity profile

- Stable leverage situation throughout 2021 and solid Balance Sheet in place
- ~320M$ CB due in Sep 2022, expected to be repaid from existing cash
- ~450M€ CB due in 2025
- HY bonds (850M€ + 450M$) to be revisited in 2023/2024 timeframe; due in 2025
- 800M€ RCF in place (undrawn)
- Limited exposure to interest rate increase with 95% of debt at fixed rates today
- Targeting investment grade rating and sustained leverage <2x

Note: Leverage defined as Net Debt / Adj. EBITDA (excluding M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business)
Minority situation OSRAM shareholders

- ams OSRAM owns 80.5% of OSRAM shares (including treasury shares held by OSRAM)
- Domination agreement (DPLTA) gives ams OSRAM full operational control over OSRAM since March 2021
- Under the DPLTA, remaining shareholders have a put option at 45.54€ per share
- Total liability for DPLTA put option recognized in balance sheet as Other Liability at 862M€
- In addition, under the DPLTA, outstanding shares receive annual fixed payment of 2.24€ net per share, totaling a cash out of ~49M€ p.a.* settled after AGM in following year; first payment due this year
- Given full management control, prevailing economics (cost of capital vs dividend yield) do not create an economic incentive to acquire further OSRAM shares at this point
- Select groups of remaining shareholders have started an appraisal proceeding to examine the put option pricing and resulting annual payment, typical for takeover transactions in Germany. Based on historical precedents, situation may take up to 5 years to be processed by the relevant courts

* Based on current amount of outstanding shares
Financial model and path to financial targets

Ingo Bank (CFO)

Outline

1. Company target financial model
2. Path to value creation: Margin expansion
3. Capital allocation priorities
4. Investor value proposition
### Clear investor value proposition

<table>
<thead>
<tr>
<th>Commitment to growth</th>
<th>Path to strong sustainable profitability</th>
<th>Balanced and diversified business mix</th>
<th>Prudent financial policy</th>
<th>Focus on long-term value generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader in optical solutions driven by secular growth trends in Automotive, Consumer and Industrial &amp; Medical</td>
<td>Doubling of EBIT margin driven by portfolio optimization, manufacturing footprint consolidation, synergy realization and revenue growth</td>
<td>Balanced application end-market exposure and diversified global customer base creates broadly supported earnings streams</td>
<td>De-lever based on strong operational cash flows and proceeds from divestments, while maintaining investment for growth</td>
<td>Re-invest in differentiating technology &amp; innovation and related organic growth opportunities, in alignment with ESG focus</td>
</tr>
</tbody>
</table>

### Clear long-term targets

- Revenue CAGR >10%, outgrowing our SAM
- Synergies / savings ~350M€
- Adj. EBIT margin 20%+
- Automotive 35-40%, Consumer 35-40%, I&M 25-30%
- Top 10 global customers 35-40%
- Divestment proceeds >500M€
- Targeting investment grade with net debt/adj. EBITDA <2x
- Carbon neutrality in 2030
- Gender diversity in leadership 25% in 2026

---

**Note:** Expected values based on current target model and available information. Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
Ukraine situation for ams OSRAM

• Safety and security of our very small number of employees and their families in the Ukraine is our top priority. Full support in place.

• We have halted all shipments to and business activities in Russia and Belarus for the time being. Sanctions are fully observed and complied with.

• At this point in time we evaluate the direct economic impact to ams OSRAM as immaterial (less than 1% of revenue p.a.). No production sites in Ukraine and Russia, indirect impacts are outweighing direct impacts. Situation remains in flux also due to extensions of sanction regimes.

• Possible supply chain consequences are understood, corrective measures defined and being implemented - where necessary.

• Task forces in place to support our customers and suppliers as required.

• If the geopolitical situation remains tense or even worsens, this could result in lasting consequences for production, supply chains and demand with a potentially negative financial and operational impact on ams OSRAM.
Key Automotive growth drivers

Robert Feurle
GM Opto Semiconductors
Automotive trends driving significant new opportunities

<table>
<thead>
<tr>
<th>Automotive Trends</th>
<th>Illumination</th>
<th>Visualization</th>
<th>Sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrification</td>
<td>• LEDification</td>
<td>• Smart surfaces replace buttons/displays</td>
<td>• Sensor ubiquity (interior &amp; exterior)</td>
</tr>
<tr>
<td>Digitalization</td>
<td>• Intelligent lighting</td>
<td>• Increasing number and size of displays</td>
<td>• Increasing complexity human-machine interface</td>
</tr>
<tr>
<td>Autonomous driving</td>
<td>• Light color indicates driving mode</td>
<td>• Car as 3rd living room: Entertainment, productivity, comfort</td>
<td>• LiDAR adoption (EEL and VCSEL-based)</td>
</tr>
<tr>
<td>Comfort and Safety</td>
<td>• Adaptive beam steering</td>
<td>• Advanced head-up displays</td>
<td>• Expanding 2D/3D driver monitoring use cases</td>
</tr>
</tbody>
</table>
Ambient Light Sensing
Light sensor

In Cabin Sensing
IR Emitter, Light sensor, Optics

Ambient Light Sensing
Light sensor

Position Sensing
Sensors

Exterior Sensing
EEL, VCSEL

Rain, light- and tunnel sensing
Sensors, LED

Smart Surface
LED, Driver IC, Sensor

Functional Illumination
LED

Dynamic forward lighting
LED, Trad. Lamps

Dynamic signaling
LED, Multi-lens array

Static forward lighting
LED, Driver IC

Static signaling
LED, LED lamps (XLS), Trad. Lamps

Static Forward Lighting
LED, LED lamps

Functional Illumination
LED

Illumination / Visualization

Projection
R/G/B LED, Laser, Multi-lens array

Static Forward Lighting
LED, Trad. Lamps

Exterior Sensing
EEL, VCSEL

Broad offering of illumination, visualization and sensing components
Broad offering of illumination, visualization and sensing components

- **Ambient lighting**: LED, RGBi LED
- **Static forward lighting**: LED, Trad. Lamps
- **Static signaling**: LED, LED lamps (XLS), Trad. Lamps
- **Functional illumination**: LED
- **Dynamic forward lighting**: LED, Driver IC
- **Dynamic signaling**: LED, Multi-lens array
- **Smart Surface**: LED, Driver IC, Sensor
- **Rain, light, and tunnel sensing**: Sensors, LED
- **Position Sensing**: Sensors
- **Ambient Light Sensing**: Light sensor
- **In Cabin Sensing**: IR Emitter, Light sensor, Optics
- **Application**: Sensing
  - **LCD Backlighting**: LED
  - **Dynamic forward lighting**: LED, Driver IC
  - **Exterior Sensing**: EEL, VCSEL
  - **Position Sensing**: Sensors
  - **Rain, light, and tunnel sensing**: Sensors, LED
  - **Smart Surface**: LED, Driver IC, Sensor
  - **Functional illumination**: LED
  - **Ambient Light Sensing**: Light sensor
  - **In Cabin Sensing**: IR Emitter, Light sensor, Optics
Leadership positions in key markets

Market position and relative market share (RMS = MS / MS#2)

<table>
<thead>
<tr>
<th>Forward lighting</th>
<th>Signaling</th>
<th>Interior functional</th>
<th>LiDAR Emitters²</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>#1</td>
<td>#1</td>
<td>#1</td>
</tr>
<tr>
<td>RMS &gt;1-1.5</td>
<td>RMS &gt;2</td>
<td>RMS &gt;2</td>
<td>RMS &gt;2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display backlighting</th>
<th>Rain sensors</th>
<th>In-cabin sensing</th>
<th>Interior ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3</td>
<td>#1</td>
<td>#1</td>
<td>#1 for RGB</td>
</tr>
<tr>
<td>RMS &gt;0.1</td>
<td>RMS &gt;1-1.5</td>
<td>RMS &gt;1-1.5</td>
<td>RMS &gt;1</td>
</tr>
</tbody>
</table>

1) Based on latest available market data  
2) Automotive and Industrial markets combined
Broad range of Automotive growth drivers

<table>
<thead>
<tr>
<th>Growth in established areas</th>
<th>Present growth drivers</th>
<th>Emerging growth drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward lighting static</td>
<td>Forward lighting dynamic</td>
<td>Exterior sensing ADAS/AD (LiDAR)</td>
</tr>
<tr>
<td>Interior functional</td>
<td>Backlighting</td>
<td>microLED Displays</td>
</tr>
<tr>
<td>Ambient Light Sensors</td>
<td>Signaling dynamic</td>
<td></td>
</tr>
<tr>
<td>Signaling static</td>
<td>In-cabin sensing</td>
<td>Smart surfaces</td>
</tr>
<tr>
<td></td>
<td>Interior ambient</td>
<td>Projection</td>
</tr>
</tbody>
</table>
Automotive addressed semiconductor market grows by 7-11% CAGR

Key driver is vehicle production volume trend

Key growth driver is feature and LED penetration in high- and mid-end cars

Source: ams OSRAM Automotive market model; SAM incl. LED lighting, optical sensing, non-optical position sensing

*incl. ~350M€ extraordinary supply chain effects due to Covid-19 and semiconductor shortage
Significant content growth opportunities in particular for high-end vehicles

### Light Vehicle Production (M units)

<table>
<thead>
<tr>
<th>Year</th>
<th>High-end</th>
<th>Mid-end</th>
<th>Low-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>77</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>2024</td>
<td>93</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>2026</td>
<td>95</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

**Light Vehicle Unit CAGR 2021-26**

<table>
<thead>
<tr>
<th>Type</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-end</td>
<td>5%</td>
</tr>
<tr>
<td>Mid-end</td>
<td>6%</td>
</tr>
<tr>
<td>Low-end</td>
<td>2%</td>
</tr>
</tbody>
</table>

### Average SAM / car

<table>
<thead>
<tr>
<th>Year</th>
<th>High-end</th>
<th>Mid-end</th>
<th>Low-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>~52 €</td>
<td>~28 €</td>
<td>~15 €</td>
</tr>
<tr>
<td>2026</td>
<td>65-75 €</td>
<td>35-40 €</td>
<td>20-25 €</td>
</tr>
</tbody>
</table>

Source: IHS Light Vehicle Production Forecast 03/2022; SAM incl. LED lighting, optical sensing, non-optical position sensing
Feature and LED penetration driving growth segments

**Illumination**
(penetration in % of light vehicle production)

<table>
<thead>
<tr>
<th>LED Forward Lighting</th>
<th>LED Signaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>53%</td>
<td>55%</td>
</tr>
<tr>
<td>78%</td>
<td>72%</td>
</tr>
<tr>
<td>+25pp</td>
<td>+17pp</td>
</tr>
</tbody>
</table>

**Sensing**
(penetration in % of light vehicle production)

<table>
<thead>
<tr>
<th>In-Cabin Sensing</th>
<th>LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td>48%</td>
<td>3%</td>
</tr>
<tr>
<td>+35pp</td>
<td>+3pp</td>
</tr>
</tbody>
</table>

- Significant growth on top of light vehicle production
- Penetration still increasing significantly even in established applications
- Government regulation driving strong adoption in in-cabin sensing
- New technology adoption on different timelines

Source: IHS 2021, ams OSRAM Automotive Market Model 2021
Headlamp evolution: from light source to micro-pixelated intelligent device

Evolution of headlamp functionality over time

- **On/off functionality only**
- **Multiple discrete LEDs for pixelated headlamps**
- **Dynamic high-resolution**
  - Integrated and high # of pixels

Brightness race

Innovation drive
Key growth drivers – (1) Dynamic Forward Lighting (EVIYOS)

Well positioned to profit from being the innovation leader

- As next big step in dynamic forward lighting, EVIYOS enables adaptive driving beam and projection capabilities (e.g. construction lighting, traffic signs)
- Integrated intelligent light source based on a monolithic structured LED chip with >25k individually addressable pixels
- Very positive market traction: on the road from 2023 onwards
- Only player with all required capabilities in-house including driver IC; very limited number of capable competitors
- EVIYOS leading vs. competing technologies on key performance criteria: energy efficiency, system size, system cost
EVIYOS video

Spot unit – Narrow field of view
Key growth drivers – (2) In-Cabin Sensing

Regulatory push drives adoption

**Driver Monitoring (DMS)**
Driver safety & assistance
- Distraction & drowsiness monitoring
- Driver identification & authentication
- HuD / Augmented Reality support

**Gesture Sensing**
Intuitive Human-Machine Interface (HMI)
- Infotainment control
- Body controls (sunroof, lights, windows...)
- HVAC controls

**Interior Monitoring (IMS)**
Cabin & occupant safety
- Wide-FoV driver & occupant monitoring
- Child & pet presence / object detection
- Airbag control (adaptive restraint)

Market boost driven by regulatory push for driver and occupant monitoring

---

1) Examples: DMS mandatory in Europe for new cars from 2024 onwards, China expected to follow. DMS on 10-year roadmap for US. For SAE autonomous driving L2+, driver presence and attentiveness of driver need to be monitored.
Key growth drivers – (2) In-Cabin Sensing

Innovation and market leadership with IR LEDs and VCSEL for ICS

Only player covering full portfolio spanning LED and VCSEL for 2D and 3D

- Market leading position in each region
- Revenues and design wins with leading OEMs worldwide

Differentiation in IR LED-based solutions

- #1 position based on broad portfolio with leading performance
- Enabling all types of 2D ICS application in every region
- Various lens options based on same package platform, enabling flexibility for customer designs

Differentiation in VCSEL-based solutions

- Industry’s first automotive AECQ-102 qualified VCSEL flood illuminator
- Best-in-class optical performance, enabling 3D iToF-based gesture sensing + 2D cabin and driver monitoring systems at European and Asian OEMs
- Fully in-house developed solutions (Laser, micro-lens array, complete module)
Key growth drivers – (3) LiDAR emitters

Million LiDAR units; EEL and VCSEL expected to capture 80% of market

- OEMs defining technology/architectures and key suppliers now
- Confidence in market development higher than during "hype cycle"
- Well prepared for both EEL and VCSEL architecture deployment
- Expect ~2 LiDARs per equipped vehicle on average in 2026

Source: LiDAR for Automotive and Industrial Applications report, Yole Développement (Yole), 2021
Key growth drivers – (3) LiDAR emitters

Innovation and market leadership position with full LiDAR emitter portfolio

Only player able to offer full portfolio spanning EEL and VCSEL

**Edge Emitting Lasers (EEL)**

- Market leader for IR LIDAR EEL with over 30 design wins
- Outstanding track record: already delivered >20M lasers to auto OEMs with >300B km driven without chip failures
- Highly efficient laser chip portfolio with highest peak power & reliability, and strong roadmap in place
- Automotive-qualified SMT package platform

**Superior peak optical output power**

**VCSEL arrays**

- First to market with multi-junction addressable arrays
- Over 20 years experience in Epi and VCSEL design
- Leading VCSEL portfolio following automotive trend of higher performance at lower cost of ownership
- In-house manufacturing leverages automotive footprint

Single and multi-channel dies
1-4 channel SMT packages

<table>
<thead>
<tr>
<th></th>
<th>Best competitor</th>
<th>ams OSRAM</th>
<th>+40%</th>
</tr>
</thead>
</table>

100 emitters up to >1,600 emitters
### Key growth drivers – (4) Smart Surfaces

**Full offering for Smart Surfaces (multifunctional user interfaces)**

<table>
<thead>
<tr>
<th>Smart Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Console</td>
</tr>
<tr>
<td>Center Stack</td>
</tr>
<tr>
<td>Door Panels</td>
</tr>
<tr>
<td>Dashboard</td>
</tr>
<tr>
<td>Steering Wheel</td>
</tr>
</tbody>
</table>

#### Uniquely positioned with full offering

**Emitters**
- LEDs
- Integrated products (RGBi)

**Sensors**
- Drivers
- Proximity / gesture
- Capacitive / optical touch
- Ambient Light Sensing

- Complete offering of light emitters (full capabilities in in-house chip and package in all colors), drivers and sensors
- Development of open eco-system for all required functionalities
- First mover with novel system concepts
Key takeaways

- Clear #1 in majority of served automotive segments creating an attractive business and margin profile

- SAM growth for 2021-26 of 7-11% CAGR fueled by automotive megatrends which ams OSRAM expects to outgrow

- Attractive mix of shorter and longer term growth drivers
  - Key growth drivers dynamic forward & signaling lighting, interior ambient lighting, LCD backlighting, in-cabin sensing and LIDAR
  - Longer-term growth from smart surfaces and long-term from microLED display and advanced head-up display opportunities

- Innovation leader with differentiated offering in each key growth driver
Key Consumer growth drivers

Jennifer Zhao
GM Advanced Optical Sensors
## Consumer trends driving significant new opportunities

### Consumer Trends

| Digitalization | Smart devices | Energy efficiency |

#### Sensing
- 3D camera enhancement
- Emerging AR/VR use cases
- 3D authentication in select applications
- Vital Signs Monitoring
- High SNR audio sensing for context awareness
- MicroLED sensor integration
- On-skin detection for wearables
- Advanced BOLED sensing for low transmissivity displays

#### Illumination
- Smart LED flash
- Infrared eye, hand, and body posture tracking

#### Visualization
- Size/number of displays
- Color temperature correction
- Near-to-Eye projection for AR/VR glasses
- MicroLED display adoption
- Low power Near-to-Eye projection for AR/VR glasses
Significant content opportunities in phones, wearables, other devices

**Camera enhancement**
- Flicker, Spectral Color Sensors
- Folded path optics
- Single/Multi-zone 3D/1D ToF

**3D AR sensing**
- Optical components
- 3D/1D dToF modules
- NIR imaging

**Display**
- MicroLED

**Display Management / BOLED sensing**
- Ambient Light Sensor
- Spectral Color Sensor
- Proximity

**Authentication**
- 3D sensing components

**User Interaction**
- Sensing applications

**Vital Sign Monitoring**
- Green/Red/IR LED / VCSEL
- Photodiodes
- Temperature sensors
- Analog front-ends and modules

**Body Tracking**
- Proximity
Leadership positions in key markets

Market position and relative market share (RMS = MS / MS#2)\(^1\)

<table>
<thead>
<tr>
<th>Technology</th>
<th>#1 Position</th>
<th>RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Light Sensors</td>
<td>#1</td>
<td>~1-2</td>
</tr>
<tr>
<td>3D Sensing &amp; Camera Enhancements</td>
<td>Top 3</td>
<td>~1</td>
</tr>
<tr>
<td>Vital Signs Monitoring</td>
<td>#2</td>
<td>~0.5-1</td>
</tr>
<tr>
<td>Wearable Optics</td>
<td>#1</td>
<td>&gt;2</td>
</tr>
<tr>
<td>Wearable Proximity</td>
<td>#2</td>
<td>~0.5-1</td>
</tr>
<tr>
<td>Near-to-Eye Projection</td>
<td>#1</td>
<td>&gt;2</td>
</tr>
</tbody>
</table>

1) based on latest available market data
Key Consumer growth drivers

<table>
<thead>
<tr>
<th>Growth in established areas</th>
<th>Present growth drivers</th>
<th>Emerging growth drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOLED display management</td>
<td>3D sensing &amp; camera enhancements</td>
<td>MicroLED displays</td>
</tr>
<tr>
<td>Wearable optics &amp; proximity</td>
<td>Vital Signs Monitoring</td>
<td>AR/VR glasses sensing &amp; visualization</td>
</tr>
</tbody>
</table>
Consumer addressed semiconductor market grows by 15-20% CAGR

Stable core with strong growth

Key drivers are end-product volumes and ASP trends

Key driver is adoption of new features (e.g. camera enhancements), applications (e.g. AR/VR glasses) and technologies (e.g. microLED)

Consumer semiconductor SAM (B€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumer Growth</th>
<th>Consumer Established</th>
<th>Total CAGR 2021-26</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
<td>15-20%</td>
</tr>
</tbody>
</table>

Source: ams OSRAM internal market model
Key growth drivers – (1) 3D sensing & camera enhancements

**Depth Sensing for Auto Focus & Bokeh**
Single and Multi-zone dToF-based depth sensing for depth-of-field effects and sharp images, also in low light situations

**Flicker Detection**
Artificial light modulation band elimination

**Spectral Light Sensing**
Auto White Balancing to improve contrast & low light performance

**AR Support**
Social media (SnapChat, TikTok), room scanning, navigation, gaming, E-Commerce

**Folded Path Optics**
Optical elements to enable optical zoom in thin devices
Key growth drivers – (1) 3D sensing & camera enhancements

Leveraging optical solution leadership

- Premium sensor offering to drive excellent camera performance and picture quality
- Leadership in multi-channel spectral color sensing (highest DXOMARK scores)
- Folded path optics for space-optimized optical zoom (leveraging top class high volume manufacturing capabilities)
- 3D/1D dToF for Auto Focus and Bokeh effects (smallest sensors & longest range with lowest power)

**Addressed market (B€)**

- **2021**
  - User-Facing 3D Sensing: CAGR (15)-(5)%
  - World-Facing 3D Sensing: CAGR 40-45%
  - Camera Enhancements: CAGR 13-17%
  - Total: CAGR 9-13%

- **2024**
- **2026**

Source: OMDIA, ams OSRAM internal market model
Key growth drivers – (2) Vital Signs Monitoring

The partner of choice for optical Vital Sign Monitoring solutions

- Emitters (LED, VCSEL)
- Analog Front End (AFE) - High performance & low power logic
- Module solution - With or without embedded AFE
- Optical simulation capability
- Receivers (Photodiode)
- Reference design portfolio
- Algorithms - Heart Rate, Heart Rate Variability, SpO2, Blood Pressure, ...

Able to fit anywhere on the body
Key growth drivers – (2) Vital Signs Monitoring

Uniquely positioned in both component and module markets

**Integrated Module**

- LED
- Optical Front End (OFE)
- Receiver
- Analog Front End (AFE)
- AS7050

**Algorithms**

- Components
- Optical modules
- Integrated modules

**Uniquely positioned to win**

- Cover all elements of vital sign monitoring solutions
- Offer integrated modules on top of individual components
  - Optical Front-End modules (LED + Receiver)
  - Integrated modules (LED + Receiver + Analog Front-End)
- Algorithm development in-house and with medical-certified partners
- Innovation leader in blood pressure, body temperature and hydration, and looking at additional vital signs
- Addressing new devices such as earbuds and glasses
Key growth drivers – (3) AR/VR smart glasses

**Display**
- LED/Laser projection
- MicroLED
- Optical components (e.g. waveguides)

**Display Management**
- Ambient Light Sensing

**2D/3D sensing**
- Optical components
- 3D / dToF modules
- NIR imaging

**Eye Tracking / Authentication**
- Optical components
- NIR illumination & imaging

**Hand/Body Tracking**
- Optical components
- 3D / dToF modules
- NIR illumination & imaging
- On-skin detection

**Vital Sign Monitoring**
- Green/Red/IR LED / VCSEL
- Photodiodes
- Temperature sensors
- Analog front-ends and modules
Key growth drivers – (3) AR/VR Smart Glasses

Roadmap for technologies addressing new generations of Smart Glasses

Developing multiple proprietary technologies to enable Smart Glasses for consumer adoption

- **Near-to-Eye projection**
  Integrating RGB lasers or LEDs, driver ICs and optical path components in miniaturized package/form factor for projection solutions, and future microLED displays

- **Optical combiners / waveguides**
  Excellent optical performance with 5x-50x higher relative efficiency

- **Eye tracking systems**
  Based on NIR LED and laser technology, offering high speed and high accuracy at low power

Source: ams OSRAM market research and estimates
Key growth drivers – (3) AR/VR smart glasses

Uniquely positioned in both component and module markets

AR/VR glasses addressable market (M units)

<table>
<thead>
<tr>
<th>Year</th>
<th>Augmented Reality glasses</th>
<th>Virtual Reality headsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>CAGR 85-95%</td>
<td>CAGR 10-20%</td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CAGR 2021-26
Total
CAGR 30-40%

Uniquely positioned to win

• Leading application know-how and support
• Strong traction in emitters based on excellent product performance, roadmap and reliability
• NIR image sensor offers optimal footprint & resolution for AR/VR today, unique roadmap with integrated wafer level optics
• In-house high-volume manufacturing capability for optics/waveguide components
• Broadest portfolio of products optimized for AR/VR glasses
• Customer traction with key Tier-1 OEMs

Volume Source: Yole Développement: 3D Imaging and Sensing – Technology and Market Trends, 2021
AR/VR video
Key takeaways

- Leading in majority of consumer segments served despite previously communicated headwinds in consumer business

- SAM growth for 2021-26 of 15-20% CAGR fueled by adoption of new features (e.g. camera enhancements, Vital Signs Monitoring), applications (e.g. AR/VR glasses) and technologies (e.g. microLED)

- Attractive mix of shorter and longer term growth drivers
  - Key growth drivers 3D Sensing & Camera Enhancement, BOLED ALS & Proximity Display Management, and Vital Signs Monitoring
  - Longer-term growth drivers AR/VR glasses and microLED displays

- Innovation leader with differentiated offering in each key growth driver
Key Industrial & Medical growth drivers

Jens Milnikel
GM Image Sensor Solutions
Industrial & Medical trends driving significant new opportunities

<table>
<thead>
<tr>
<th>I&amp;M Trends</th>
<th>Illumination</th>
<th>Visualization</th>
<th>Sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart health</td>
<td>• UV-C disinfection acceleration</td>
<td></td>
<td>• Digital X-ray</td>
</tr>
<tr>
<td>Industry 5.0</td>
<td>• Smart industry lighting</td>
<td>• Smart surfaces</td>
<td>• CT photon counting</td>
</tr>
<tr>
<td>Urbanization</td>
<td>• Smart outdoor lighting</td>
<td>• Outdoor displays</td>
<td>• Point-of-care diagnostics</td>
</tr>
<tr>
<td>Energy efficiency &amp; sustainability</td>
<td>• Horticulture</td>
<td>• LED &amp; laser projection</td>
<td>• Industrial automation</td>
</tr>
<tr>
<td></td>
<td>• Vertical farming</td>
<td></td>
<td>• Drones &amp; Robotics</td>
</tr>
<tr>
<td></td>
<td>• Human-centric lighting</td>
<td></td>
<td>• Machine vision</td>
</tr>
<tr>
<td></td>
<td>• Disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Human-centric lighting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• LED &amp; laser projection</td>
<td></td>
<td>• Home &amp; Building Automation</td>
</tr>
<tr>
<td></td>
<td>• UV-C disinfection acceleration</td>
<td></td>
<td>• Security</td>
</tr>
<tr>
<td></td>
<td>• CT photon counting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Point-of-care diagnostics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Key applications enabled by illumination, visualization and sensing components

Outdoor / Industry Lighting
- LED, presence detection sensor

UV-C LED Disinfection
- LED, spectral sensor

Horticulture & Smart Farming
- LED, spectral sensor

LED & Laser Projection
- LED, laser

Home & Building Automation (HABA)
- Image sensor, spectral sensor, illuminator, LED

Robotics & Drones
- Image sensor, spectral sensor, illuminator, laser, LED, full ToF module

Medical Imaging
- CT sensor modules, CMOS X-ray modules, ICs
Key applications enabled by illumination, visualization and sensing components

- **Outdoor / Industry Lighting**: LED, presence detection sensor
- **UV-C LED Disinfection**: LED, spectral sensor
- **Horticulture & Smart Farming**: LED, spectral sensor
- **LED & Laser projection**: LED, laser
- **Home & Building Automation (HABA)**: Image sensor, spectral sensor, illuminator, LED
- **Robotics & Drones**: Image sensor, spectral sensor, illuminator, laser, LED, full ToF module
- **Medical Imaging**: CT sensor modules, CMOS X-ray modules, Sensor Interface ICs
- **Point-of-care Diagnostics**: Spectral sensor, LED
- **Sensing**
Leadership positions in key markets

Market position and relative market share (RMS = MS / MS#2)\(^1\)

<table>
<thead>
<tr>
<th>Market</th>
<th>#1</th>
<th>#1/2</th>
<th>#4</th>
<th>#1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horticulture (red)</td>
<td>RMS 1.5-2</td>
<td>RMS ~1.5</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>LED Projection</td>
<td>RMS ~1.5</td>
<td>RMS 1-1.5</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>Medical Imaging</td>
<td>RMS ~1.5</td>
<td>RMS 1-1.5</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>Outdoor/Industry Lighting</td>
<td>RMS 0.8-1.2</td>
<td>RMS 0.8-1.2</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>IR Vision LED</td>
<td>RMS ~1.5</td>
<td>RMS ~1.5</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>Material Processing</td>
<td>RMS ~1</td>
<td>RMS ~1</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>Industrial Imaging</td>
<td>RMS ~1.5</td>
<td>RMS 1-1.5</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
<tr>
<td>LiDAR emitters(^2)</td>
<td>RMS 0.8-1.2</td>
<td>RMS 0.8-1.2</td>
<td>RMS &lt;0.5</td>
<td>RMS &gt;2</td>
</tr>
</tbody>
</table>

\(^1\) Based on latest available market data
\(^2\) Automotive and Industrial markets combined
Broad range of Industrial & Medical growth drivers

- **Growth in established areas**
  - Outdoor/Industry Lighting
  - Industrial Automation
  - HABA
  - Robotics & drones
  - Medical Imaging

- **Present growth drivers**
  - Horticulture & Smart Farming
  - LED & Laser Projection

- **Emerging growth drivers**
  - UV-C LED
  - Micro-cameras
  - Point-of-care diagnostics
Industrial & Medical addressed semiconductor market grows by 10-14% CAGR

B€

<table>
<thead>
<tr>
<th>Year</th>
<th>Total CAGR 2021-26</th>
<th>I&amp;M Growth CAGR 2021-26</th>
<th>I&amp;M Established CAGR 2021-26</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>10-14%</td>
<td>14-18%</td>
<td>9-13%</td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mainly driven by smart applications and IoT

Strongly driven by LED adoption rate and smart health applications

Source: ams OSRAM internal market model
Key growth drivers – (1) Horticulture

Drivers of fast-growing horticulture market

- **Increasing LED Adoption**
  … significantly higher energy efficiency for lower CO₂ footprint

- **Private investors and Government**
  … funding growth to reduce dependency on imports

- **Increase in automation**
  … to reduce labor costs in vertical farms to improve ROI

- **Broadening range of crops**
  … on top of continued strong growth in cannabis
Key growth drivers – (1) Horticulture

Significant growth potential as vast majority of green house area is not illuminated by artificial light

Artificial lighting in greenhouses globally

- Not illuminated
- Trad. luminaires
- LED luminaires

Global greenhouse illumination

- Only a very small share of the worldwide greenhouse area is illuminated today
- Of the illuminated area only ~10% are illuminated by LED luminaires
- Two growth drivers:
  - Further illumination of green houses
  - Conversion of traditionally illuminated area into LED

Source: Horti Daily and Produce Growers interviewed in Oct 20
Key growth drivers – (1) Horticulture

True market and technology leader in faster growing red LED segment

Horticulture LED market (value in M€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Value (M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>336</td>
</tr>
<tr>
<td>2024</td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
</tr>
</tbody>
</table>

Red LED
CAGR 2021-26 = 19-23%

White LED
CAGR 2021-26 = 10-14%

Our key differentiators in red LED

- 15 years experience in red process technology
- Full solution in-house (Epi, chip & packaging), while LED competitors need to buy chips
- Around 3 ppt better wall-plug efficiency vs. next best competitor across generations → significant competitive advantage as this can drive 20-40% higher crop yield
- New batwing lens design delivers better light distribution in selected plant setups
- #1 in lifetime and reliability data
- Best-in-class application support

Source: ams OSRAM internal market model
Horticulture video

Reducing CO$_2$

460 nm  Sensor-controlled spectrum automation
Key growth drivers – (2) UV-C LED

Strong long-term potential, accelerated by Covid-19

UV-C disinfection using LEDs

- UV-C LEDs enable novel applications and replace traditional mercury lamps
  - Smaller footprint
  - Increased energy efficiency
  - Lower system cost

- Growth potential across various application areas:
  - Air: Air conditioning in cars, planes, offices
  - Surfaces: Hospitals, transportation, food
  - Water: Point of use and larger facilities

- Accelerating market growth driven by Covid-19, especially for air and surfaces applications

Note: Graphical representation as UV-C is not visible
Key growth drivers – (2) UV-C LED

Focus on high power applications in increasingly demanding application segments

Sub-segments:

- Wave 1: Consumer products
- Wave 2: Household goods & lighting
- Wave 3: Medical and Auto products
- Wave 4: Professional water treatment

Increasingly demanding application segments with higher power requirements

Note: Graphical representation as UV-C is not visible
Key growth drivers – (2) UV-C LED

Penetrating High Power market with differentiated offering

Our key differentiators in High Power

- Best in class wall plug efficiency (EQE) – targeting 20% for professional application – enabling lower system cost and longer lifetime
- Covering whole value chain (Epi, chip, LED, packaging), including high power ceramic package with tailored thermal management
- Full in-house manufacturing enables becoming a leader in €/mW
- Strong quality reputation for industry and medical segment

UV-C LED market (M€)

<table>
<thead>
<tr>
<th>Year</th>
<th>Low Power CAGR 2021-26 = 10-20%</th>
<th>High Power CAGR 2021-26 = 100-120%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>133</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ams OSRAM internal market model
UV-C LED video

MOST EFFECTIVE

265nm

UV-C LED
**Key growth drivers – (3) LED / Laser Projection**

Both LEDs and Lasers are used as a light source for projection

---

**Only player able to offer full portfolio spanning LED and Laser + complementing sensors**

<table>
<thead>
<tr>
<th>Projected lumen</th>
<th>2,000</th>
<th>4,000</th>
<th>10k+</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LED</strong> (e.g. projectors for entry-level consumer)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LED + Laser</strong> (e.g. projectors for home cinema)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Laser</strong> (e.g. projectors for enterprise &amp; education)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Red, green and blue LEDs**
- **DLP**
- **Blue semi-conductor laser**
- **Folding mirrors**
- **Phosphor wheel**
- **Color wheel**

**Red LED**

**Blue LED**

**Collimation optics**

**Dichroic mirrors**

**High power blue lasers**
Key growth drivers – (3) LED / Laser Projection

Entering Laser segment to further accelerate growth as one-stop shop for LED + Laser

**LED & Laser Projection market**¹ (in M€)

- **Laser (new entrant)**
  - CAGR 2021-26 = 15-20%

- **LED (#1 position)**
  - CAGR 2021-26 = 25-30%

**Our key differentiators in LED**

- Best-in-class luminance in Red and Green LEDs, and on par in Blue
- Best-in-class application fit for larger DLP-imager sizes
- Best-in-class quality, automotive qualified

**Why we will win share in Laser**

- Customers want alternative supply to one major supplier
- Set to achieve best-in-class wall-plug efficiency
- Packaging synergies with broader laser portfolio

---

¹ does not include Automotive applications  
Source: ams OSRAM internal market model
Key takeaways

- Targeting specific markets where challenging requirements allow for differentiation through innovation, resulting in #1/2 positions in majority of addressed markets

- SAM growth for 2021-26 of 10-14% CAGR fueled by global megatrends which we expect to outgrow

- Attractive mix of shorter and longer term growth drivers
  - Significant growth opportunities in established areas
  - Key growth drivers in components for Horticulture and LED/Laser Projection
  - Longer-term growth from UV-C LED, micro-cameras and point-of-care diagnostics opportunities

- Innovation leader with differentiated offering in each key growth driver
Key Takeaways

Alexander Everke
Chief Executive Officer
# Clear investor value proposition for ams OSRAM

## Commitment to growth
- Leader in optical solutions driven by secular growth trends in Automotive, Consumer and Industrial & Medical

## Path to strong sustainable profitability
- Doubling of EBIT margin driven by portfolio optimization, manufacturing footprint consolidation, synergy realization and revenue growth

## Balanced and diversified business mix
- Balanced application end-market exposure and diversified global customer base creates broadly supported earnings streams

## Prudent financial policy
- De-lever based on strong operational cash flows and proceeds from divestments, while maintaining investment for growth

## Focus on long-term value generation
- Re-invest in differentiating technology & innovation and related organic growth opportunities, in alignment with ESG focus

### Clear long-term targets
- **Revenue CAGR >10%, outgrowing our SAM**
- **Synergies / savings ~350M€**
- **Adj. EBIT margin 20%+**
- **Automotive 35-40%, Consumer 35-40%, I&M 25-30%**
- **Top 10 global customers 35-40%**
- **Divestment proceeds >500M€**
- **Targeting investment grade with net debt/adj. EBITDA <2x**
- **Carbon neutrality in 2030**
- **Gender diversity in leadership 25% in 2026**

---

147 Note: Expected values based on current target model and available information

Expectations and targets are based on ams OSRAM’s latest reasonable assumptions and do not include potentially material effects related to the further development of the current or to any future geopolitical crisis. Adjusted figures exclude M&A-related, transformation and share-based compensation costs as well as results from investments in associates and sale of a business.
Become the uncontested leader in optical solutions
Sensing is life
<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFE</td>
<td>Analog Front-End</td>
</tr>
<tr>
<td>AGM</td>
<td>Annual General Meeting</td>
</tr>
<tr>
<td>ALS</td>
<td>Ambient Light Sensor</td>
</tr>
<tr>
<td>AM</td>
<td>Automotive</td>
</tr>
<tr>
<td>ASIC</td>
<td>Application Specific Integrated Circuit</td>
</tr>
<tr>
<td>BOLED</td>
<td>Behind OLED (screen)</td>
</tr>
<tr>
<td>CB</td>
<td>Convertible Bond</td>
</tr>
<tr>
<td>CMOS</td>
<td>Complementary Metal-Oxide-Semiconductor</td>
</tr>
<tr>
<td>CSP</td>
<td>Chip Scale Package</td>
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<tr>
<td>CT</td>
<td>Computer Tomography</td>
</tr>
<tr>
<td>DLP</td>
<td>Digital Light Processing</td>
</tr>
<tr>
<td>DMS</td>
<td>Driver Monitoring System</td>
</tr>
<tr>
<td>DOE</td>
<td>Diffractive Optical Element</td>
</tr>
<tr>
<td>DPLTA</td>
<td>Domination and Profit and Loss Transfer Agreement</td>
</tr>
<tr>
<td>dToF</td>
<td>Direct Time of Flight</td>
</tr>
<tr>
<td>EEL</td>
<td>Edge Emitting Laser</td>
</tr>
<tr>
<td>EMC</td>
<td>Epoxy Mold Compound</td>
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</table>

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS</td>
<td>Electronics Manufacturing Services</td>
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<tr>
<td>EPI</td>
<td>Epitaxy</td>
</tr>
<tr>
<td>EQE</td>
<td>External Quantum Efficiency</td>
</tr>
<tr>
<td>EVIYOS</td>
<td>Product for pixelated matrix LED forward lighting</td>
</tr>
<tr>
<td>FoV</td>
<td>Field of View</td>
</tr>
<tr>
<td>HABA</td>
<td>Home Automation &amp; Building Automation</td>
</tr>
<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
</tr>
<tr>
<td>HuD</td>
<td>Head Up Display</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation und Air Conditioning</td>
</tr>
<tr>
<td>I&amp;M</td>
<td>Industrial &amp; Medical</td>
</tr>
<tr>
<td>IC</td>
<td>Integrated Circuit</td>
</tr>
<tr>
<td>ICS</td>
<td>In-Cabin Sensing</td>
</tr>
<tr>
<td>IMS</td>
<td>Interior Monitoring</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>L&amp;S</td>
<td>Lamps &amp; Systems</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>Abbr.</td>
<td>Explanation</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>LiDAR</td>
<td>Light Detection and Ranging or Laser Imaging Detection And Ranging</td>
</tr>
<tr>
<td>MEMS</td>
<td>Micro Electrical Mechanical Systems</td>
</tr>
<tr>
<td>ML</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>MS</td>
<td>Market Share</td>
</tr>
<tr>
<td>NIR</td>
<td>Near Infra-Red</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OFE</td>
<td>Optical Front End</td>
</tr>
<tr>
<td>OLED</td>
<td>Organic Light Emitting Display</td>
</tr>
<tr>
<td>OSAT</td>
<td>Outsourced Assembly and Test</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
</tr>
<tr>
<td>PPG</td>
<td>Photoplethysmogram</td>
</tr>
<tr>
<td>QD</td>
<td>Quantum Dot</td>
</tr>
<tr>
<td>QFN</td>
<td>Quad Flat No Leads Package</td>
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<tr>
<td>RCF</td>
<td>Revolving Credit Facility</td>
</tr>
<tr>
<td>RGB</td>
<td>Red, Green, Blue</td>
</tr>
<tr>
<td>RGGB</td>
<td>Red, Green, Green, Blue</td>
</tr>
<tr>
<td>RGBi</td>
<td>Intelligent Red, Green, Blue</td>
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<tr>
<td>RMS</td>
<td>Relative Market Share</td>
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<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>ROI</td>
<td>Return On Investment</td>
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<tr>
<td>SAM</td>
<td>Serviceable Available Market</td>
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<td>SMI</td>
<td>Self-Mixing Interferometry</td>
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<tr>
<td>SMIF</td>
<td>Standard Mechanical Interface</td>
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<tr>
<td>SNR</td>
<td>Signal to Noise Ratio</td>
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<tr>
<td>SPAD</td>
<td>Single Photon Avalanche Diode</td>
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<tr>
<td>SW</td>
<td>Software</td>
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<td>ToF</td>
<td>Time of Flight</td>
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<td>TSV</td>
<td>Through Silicon Vias</td>
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<tr>
<td>UV</td>
<td>Ultra Violet</td>
</tr>
<tr>
<td>UV-C</td>
<td>Short-wave Ultra Violet light (C-Band)</td>
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<tr>
<td>UX:3</td>
<td>Property High power chip technology</td>
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<tr>
<td>VCSEL</td>
<td>Vertical Cavity Surface Emitting Laser</td>
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<tr>
<td>VIM</td>
<td>Versatile Interface Module</td>
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<td>VPH</td>
<td>Volume Phase Holograms</td>
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<td>VSM</td>
<td>Vital Signs Monitoring</td>
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<td>WLO</td>
<td>Wafer Level Optics</td>
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<tr>
<td>WLO</td>
<td>Wafer Level Optics</td>
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<td>XLS</td>
<td>Exchangeable Light Source</td>
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