ams Full Service Foundry

CMP User Group Meeting 2015, Paris

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February 5, 2015
World of Sensors
Providing a seamless human-machine interface for a richer and more intuitive user experience

Communications & Consumer
- Ambient light, color & proximity sensing
- Gesture recognition
- NFC based contactless payment solutions
- Active noise cancellation
- Power management solutions

Automotive
- Safety systems
- Battery management
- Position sensing
- Comfort & chassis sensors
- Advanced driver assistance

Industrial
- Industrial/building automation
- Motion control
- Heat, Ventilation & Air conditioning (HVAC)
- Position sensing

Medical
- Digital x-ray
- Computer tomography
- Surgical Robots
- Diagnostic equipment

Environment
- Lightning sensors
- Gas sensors
- Seismic analysis
- Temperature sensors
- Day light harvesting

Health/Fitness
- Diabetes management
- Heart rate monitors
- Medication tracking
- Activity trackers
## Our focus

<table>
<thead>
<tr>
<th>Target markets</th>
<th>Consumer and Communications</th>
<th>Industrial, Medical, &amp; Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59% of revenues 2013</td>
<td>41% of revenues 2013</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Core expertise</th>
<th>Sensor and sensor interfaces</th>
<th>Power management</th>
<th>Wireless</th>
</tr>
</thead>
</table>
Financial overview
EUR millions

Revenue 2013: 377,8 M€
Revenue 2014: 464,4 M€
In-house capacity + partnerships: a scalable and robust growth model

Wafer manufacturing
- Specialty analog processes
- 200mm in-house fab (over 155 kwafer p.a.)
- Technology nodes: 0.18µm – 0.35µm – 0.8µm
- Best-in-class efficiency
- Multi-source security: TSMC, UMC, IBM
- Zero-defect program

Assembly and test
- In-house test in Austria and Philippines
- Multi-source assembly locations
- End-to-end fully integrated supply chain
Capacity expansion

**Annual Wafer start capacity**
- Several capacity expansions since Q2-2013
- 2013 capacity: 120k WSPA
- First expansion: +15k WSPA completed
- Second expansion: +20k WSPA (total 155k) completed
- Third expansion: +25k WSPA (total 180k) ongoing
- Fourth expansion: Approval pending

**Test facility expansion**
- Philippines test center fully loaded
- Philippines test center expansion Phase II started
Full service foundry
Your one-stop-shop for turn-key high performance analog IC solutions

Specialty processes
- 0.18µm, 0.35µm, 0.8µm
- CMOS, HV, SiGe
- AUT & MED certified
- Extended temp range

Foundry services
- MPW service
- Benchmark PDK: hitkit
- Highly accurate models
- Digital & analog base IP

Turn-key solutions
- One-stop-shop
- Mixed-signal test
- Qualification services
- 2nd source capabilities

More than silicon
- 3D IC using TSVs
- RGB & IR color coating
- Extended IP portfolio
- Advanced packages
## Specialty analog processes
### ams process overview & roadmap

<table>
<thead>
<tr>
<th>Technology details</th>
<th>0.8µm</th>
<th>0.35µm</th>
<th>0.18µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. number of metal layers</td>
<td>2</td>
<td>3 - 4</td>
<td>4 - 7</td>
</tr>
<tr>
<td>Gates per mm²</td>
<td></td>
<td>23k</td>
<td>118k</td>
</tr>
<tr>
<td>Embedded EEPROM / Flash</td>
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<td></td>
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</table>

### Mixed-Signal / RF
- Max. operating frequency
  - 0.8µm: ~1 GHz
  - 0.35µm: ~4 GHz

### High Voltage CMOS
- Scalable voltage modules
  - 0.8µm: 50V
  - 0.35µm: 120V
  - 0.18µm: 50V

### SiGe BiCMOS
- Max. operating frequency
  - ~7 GHz

### Qualified for Automotive & Medical
- Scalable and robust model for growth through partnerships
- [Logo] am, TSMC, ams
Advantages

- Low cost alternative to prototype designs
- Mask costs are shared by MPW participants
- Frequent schedules for all offered process technologies

CMP (cmp.imag.fr)

- Long term partner
- Very reliable
- Experienced in using ams technologies
- Supporting small and mid size projects
- Supporting academic and start ups
<table>
<thead>
<tr>
<th>Process Options</th>
<th>C18</th>
<th>H18</th>
<th>aC18</th>
<th>aH18</th>
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<tbody>
<tr>
<td>Metal</td>
<td>3-8</td>
<td>3-7</td>
<td>3-6</td>
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<td>High Res</td>
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<td>✓</td>
<td>✓</td>
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<tr>
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<tr>
<td>TaN Res</td>
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<tr>
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<td>LL*</td>
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<tr>
<td>5V</td>
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<tr>
<td>PI</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20V GOX</td>
<td>✓</td>
<td>✓</td>
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<td>10/2016</td>
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<tr>
<td>MIM</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
<td>DUALMIM</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
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<tr>
<td>DUAL HD MIM</td>
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<tr>
<td>120V</td>
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<td>5/2016</td>
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</table>
## 0.18µm HV-CMOS process implementation status

<table>
<thead>
<tr>
<th>Activity</th>
<th>50V</th>
<th>120V</th>
<th>20V GOX</th>
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<tbody>
<tr>
<td>Project start</td>
<td>✔ 02.2014</td>
<td>✔ 06.2014</td>
<td>04.2015</td>
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<td>Alpha hitkit to selected customers</td>
<td>✔ 01.2015</td>
<td>10.2015</td>
<td>10.2015</td>
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<tr>
<td>Risk MPW participation possible</td>
<td>✔ 12.2014</td>
<td>04.2015</td>
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0.18µm HV-CMOS process implementation status
Digital libraries & Memories

**Digital Library:**

- High density digital core library Q1/2015

**Memory overview:**

- **OTP**: Polyfuse. IP block available from ams ✓ Q4/2014
- **SRAM/ROM**: ams Memory compilers Q2/2015
- **EEPROM**: Synopsys 0-Mask EEPROM available (8 kBit) Q4/2015
ams‘ prototyping portfolio, I.

Multi project wafer (MPW)
+ Lowest costs
- Limited number of devices
- Fixed schedule

Multi layer reticle wafer (MLR)
+ Tape out at any time
+ Manufacture as many samples as required
+ Moderate NRE due to reduced # of masks
- Mask set cannot be used for mass production

Single die tooling (SDT)
+ Tape out at any time
+ Manufacture as many samples as required
+ Mask set can be immediately used for mass production
ams' prototyping portfolio, II.

Multi project wafer (MPW)
- New option: WLCSP
- Including RDL (Cu)
- 250μm bump diameter
- 400μm bump pitch

New option!
MPW with WLCSP
Example 1: Active Interposer
TSV + Backside RDL

- Si (200µm)
- Met1
- Backside RDL
- Solder ball
- Die to wafer bonding
- Top Metal
Example 2: PD Wafer

TSV + Backside RDL

Photo-Diode

p+ N-well p+

p-- substrate

TSV

Solder ball
Example 3: Pad Replacement
TSV + Backside RDL
Full Service Foundry

Your Analog Foundry Partner.

ams AG
Full Service Foundry

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