Think Automotive Dependability.
Think Infineon.

Bill Stewart (Senior Director, Vehicle Automation & Chassis)
December 2020
We shape the future of mobility with microelectronics enabling clean, safe, smart cars

Clean
› Clean combustion engines
› Efficient energy management
› Electrified drivetrain

Safe
› Occupant and pedestrian protection
› Collision avoidance
› Advanced driver assistance

Smart
› Individual convenience
› Secure connectivity, data integrity and privacy
Infineon has industry’s broadest product portfolio covering entire range of auto applications

<table>
<thead>
<tr>
<th>Body</th>
<th>Cluster/Infotainment</th>
<th>Chassis</th>
<th>Powertrain</th>
<th>ADAS/AD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Sensors</strong> (magnetic, pressure, radar, current, 3D ToF, TrueTouch®, CapSense®)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MCU (Embedded Power ICs, PSoC™, Traveo™)</strong></td>
<td></td>
<td><strong>MCU (AURIX™)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Memory</strong> (NOR Flash, SRAM, nvSRAM, F-RAM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Power (MOSFETs, IGBTs, modules, driver ICs, power ICs, LDOs, PMICs, USB Type-C PD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Connectivity (USB)</strong></td>
<td><strong>Connectivity (Wi-Fi, BT, BLE)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Application examples**

- HVAC
- door control
- pumps
- seat adjustment
- instrument cluster
- in-cabin entertainment
- touch control
- in-cabin charging
- braking
- steering
- stability program
- suspension
- engine management
- transmission
- main inverter
- auxiliaries
- speed control
- emergency braking
- blind spot detection
- sensor fusion
Increased sensor requirements drive the content in the next five years and beyond

### More sensors required for any next level of automation

<table>
<thead>
<tr>
<th>Application</th>
<th>NCAP 5 Star, AD L2</th>
<th>AD L2+/L3</th>
<th>AD L4/L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic emergency brake/ forward collision warning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking assist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane keep assist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway assist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway and urban chauffeur</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Radar

<table>
<thead>
<tr>
<th># of modules**</th>
<th>Corner</th>
<th>MRR/LRR</th>
<th>MRR/LRR</th>
<th>Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥ 3</td>
<td>≥ 6</td>
<td>≥ 10</td>
<td></td>
</tr>
<tr>
<td>New: Corner; starting 2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Camera

<table>
<thead>
<tr>
<th># of modules**</th>
<th>≤ 1</th>
<th>≥ 4</th>
<th>≥ 8</th>
</tr>
</thead>
</table>

#### Lidar

<table>
<thead>
<tr>
<th># of modules**</th>
<th>0</th>
<th>≤ 1</th>
<th>≥ 1</th>
</tr>
</thead>
</table>

#### Others

- Ultrasonic
- Interior camera
- V2X

---

* Source: VDA (German Association of the Automotive Industry); Society of Automotive Engineers

** Market assumption
Dependable electronics are the foundation for trust

"Delivering self-driving cars at scale isn’t just about winning the tech race, it’s about winning the tech race and the trust race."
Dan Ammann, CEO, Cruise, July 2019

"Designing automated vehicles that people trust is just as important as the technology required to make them work"
Intel – "A Matter of Trust" Whitepaper

“We’re Building Self-Driving Technology You Can Trust.”
Argo.ai Website Headline
Dependability is the key driver for the megatrend automated driving

**Dependability** definition | n.
The quality of being trustworthy or reliable; trust in safety
Automated driving systems are fueling the need for trust

<table>
<thead>
<tr>
<th>Safety Concept</th>
<th>Degree of Automation</th>
</tr>
</thead>
</table>
| Fail-safe | ADAS  
Human is driving fallback | Level 0: No System  
Driver Only |
| Fail-operational | AD  
Machine is driving fallback | Level 1: Feet-off  
Assisted |
|  |  | Level 2: Hands-off  
Partly Automated |
|  |  | Level 3: Eyes-off  
Highly Automated |
|  |  | Level 4: Brains-off  
Fully Automated |
|  |  | Level 5: No Driver  
Driverless |

Higher level of automated driving require trust; trust requires dependable systems

Source: Barclays Research & Infineon
Dependable systems are highly available and secure systems, increasing the need for more dependable electronics.

**High Availability** | Ensure high availability beyond critical operations; a safe and secure system, that operates in all conditions.

**Fail-Operational** | Mitigate potentially hazardous effects by ensuring critical operations in the event of a failure.

**Fail-Safe** | In the event of a failure, system enters safe state.

- Lower levels (ADAS, <L2)
- System enters safe mode
- Reliable, robust, safe, secure

- Higher levels (AD, ≥L2+)
- System continues safety critical tasks
- Fail safe + available

- Higher levels (AD, ≥L3+)
- High availability in all conditions
- Fail operational + highly available
Dependability is part of Infineon's cultural mindset with system understanding as one of its key ingredients.

Infineon leverages a deeply embedded system thinking.

Environment

Safe Autonomous Vehicle

Dependable systems

Dependable subsystems

ECUs and Modules

Components

Dependable Actuation
Dependable Computing
Dependable Communication
Dependable Sensing
Dependable Power

Technology

Trust

Infineon
Infineon's dependable electronics
We offer technology you can trust

Passion for Innovation
- Partnerships
- Device Performance
- Full R&D value chain

System Understanding
- Functional requirement
- Fail-Operational Systems
- Cybersecurity

Trusted Supplier
- Zero Defect Mentality
- Business Continuity
- Premium Services

Cybersecurity

Functional Safety

Automotive Quality

Copyright © Infineon Technologies AG 2020. All rights reserved.
Part of your life. Part of tomorrow.
For more information on each topic please click on the respective image below.