Infineon
Automotive Dependability

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

"Developing a self-driving system built on trust."

Argo.ai Website Headline with Ford and VW Investors

Dependability is the key driver for the megatrend automated driving

Technology

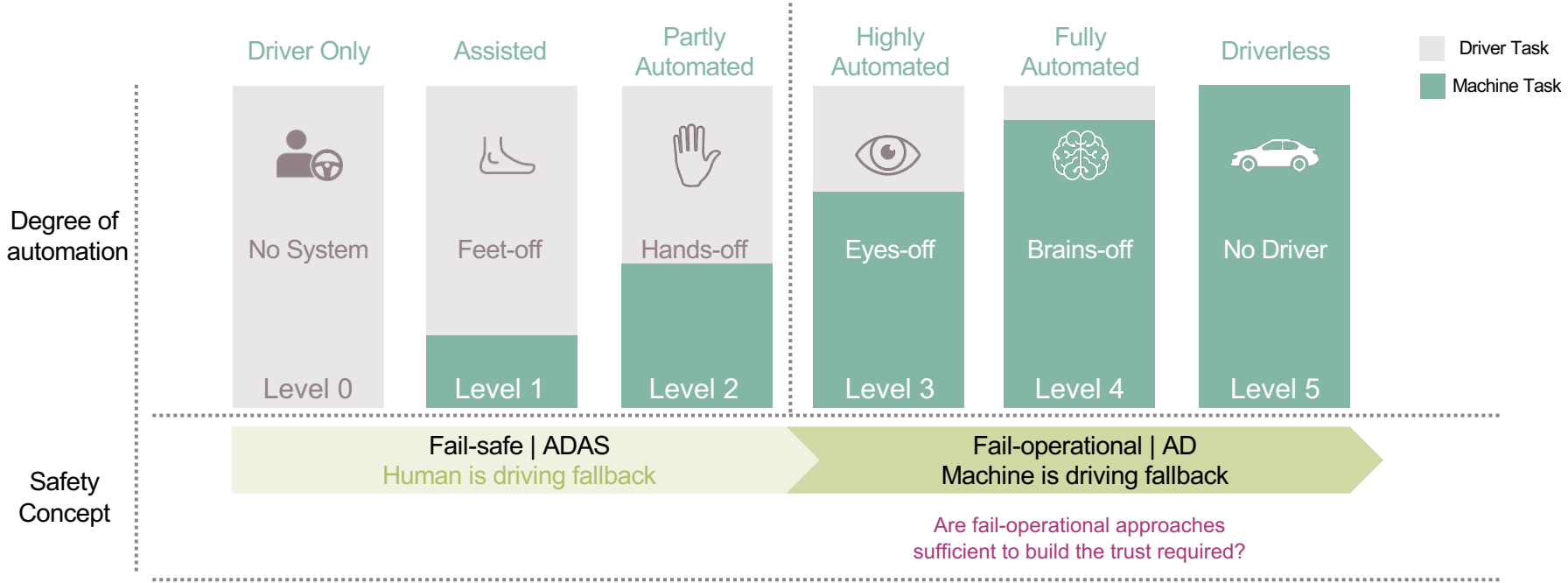
Trust

Autonomous Driving

Dependability definition | n.

The quality of being trustworthy or reliable; trust in safety

Automated driving systems are fueling the need for trust



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

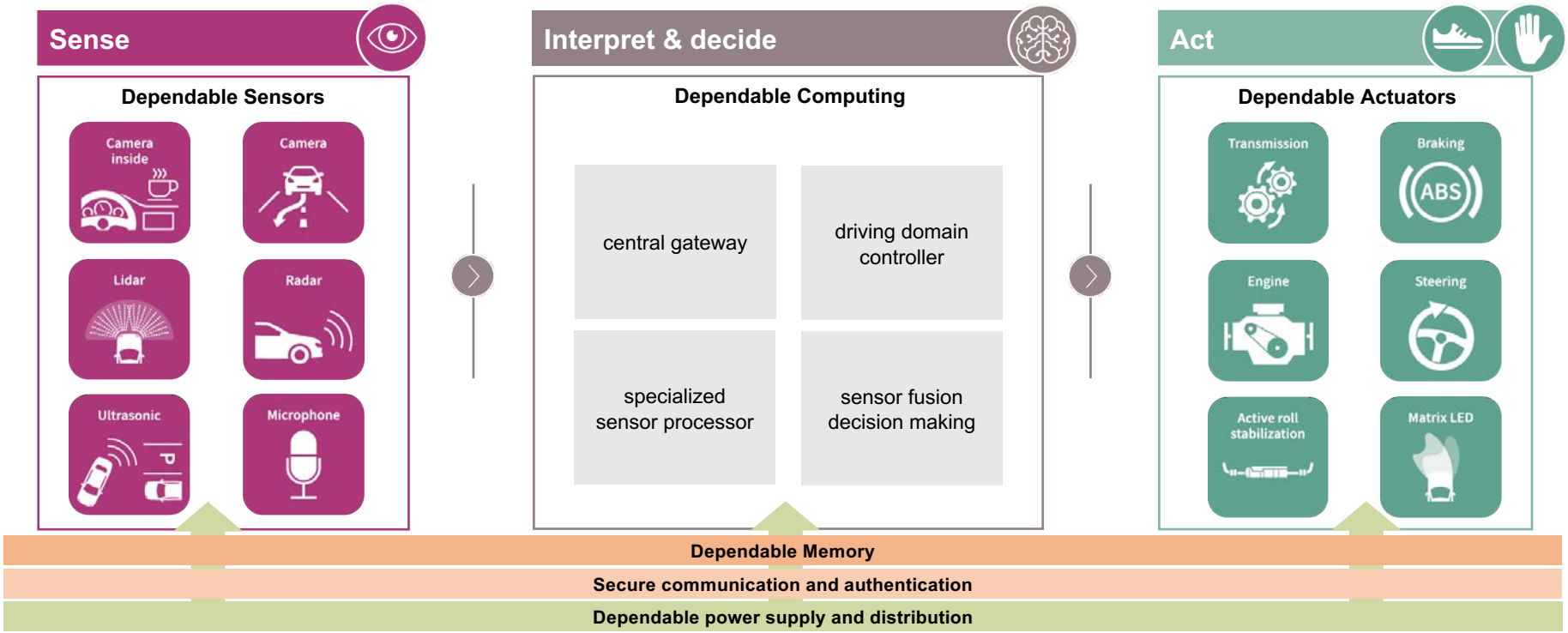
High Availability | Ensure high availability beyond critical operations; a safe and secure system, that operates in all conditions

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

	Fail-Safe	Fail-Operational	High Availability
Automation	Lower levels (ADAS, <L2)	Higher levels (AD, ≥L2+)	Higher levels (AD, ≥L3+)
Failure	System enters safe mode	System continues safety critical tasks	High availability in all conditions
System	Reliable, robust, safe, secure	**Fail safe** + available	**Fail operational** + highly available

Trust requires dependable systems which are always available



Dependable systems require **secure** systems, which
always **sense**! always **compute**! always **act**! are always **connected**! are always **powered**!

But also, the increasing number of functionalities drive the need for dependable electronics

Dependable systems

- …not only avoid and **mitigate** potentially **hazardous effects** (functional safety)
- …but also enable safe & secure autonomous **driving under all conditions** (secure high availability)
- … are **key to overcome** the ever **increasing number** of more functionality in cars

We deliver dependable electronics which enable systems that are the foundation for trust

Secure dependable systems, which always sense, always compute, always act, are always connected, are always powered!

Dependable Actuation

Dependable Computing

Dependable Communication

Dependable Sensing

Dependable Power

Robustness

Degree to which a system continues to function with invalid inputs or in stressful environments

Reliability

Probability that a system performs requested functions under stated conditions when required

Availability

Probability that the system is operating properly when a failure occurs

Safety

Ensures the absence of Unreasonable Risk

Security

Ensures the protection of the system from its environment

Infineon Automotive Quality

Infineon Functional Safety

Infineon Cybersecurity

Operational Excellence

Passion for Innovation

System Understanding

Infineon Automotive Dependability

Infineon is Automotive Dependability

Infineon Automotive Dependability

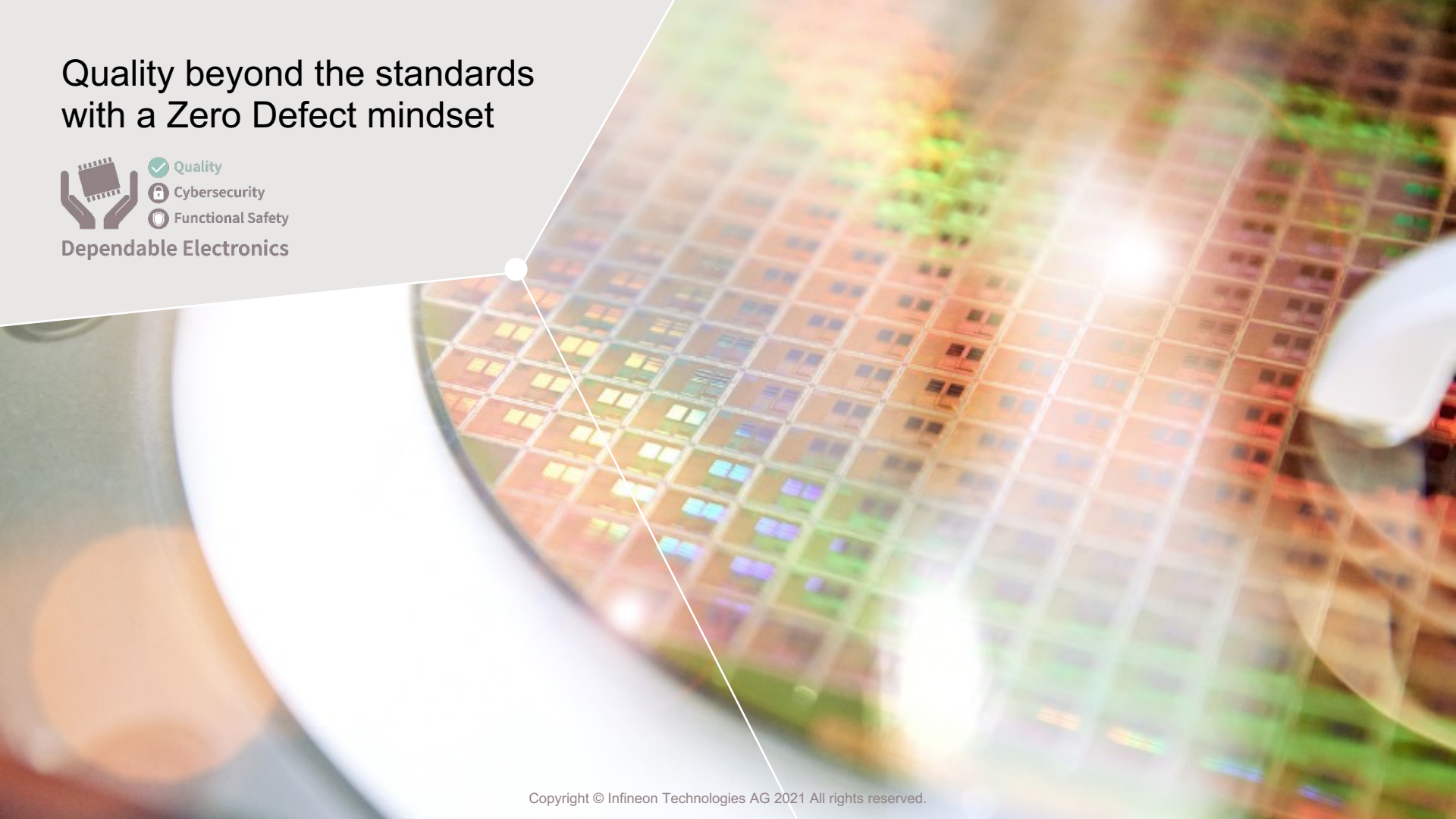
Quality
Cybersecurity
Functional Safety
Dependable Electronics

Dependable Electronics

Dependable Partner through Premium Service

Quality beyond the standards with a Zero Defect mindset

Quality
Cybersecurity
Functional Safety
Dependable Electronics



Our competitive advantage: Differentiating as quality leader

Our path

We do what we promise.
That's quality made by Infineon.

Our aspiration

Zero defect regarding the committed

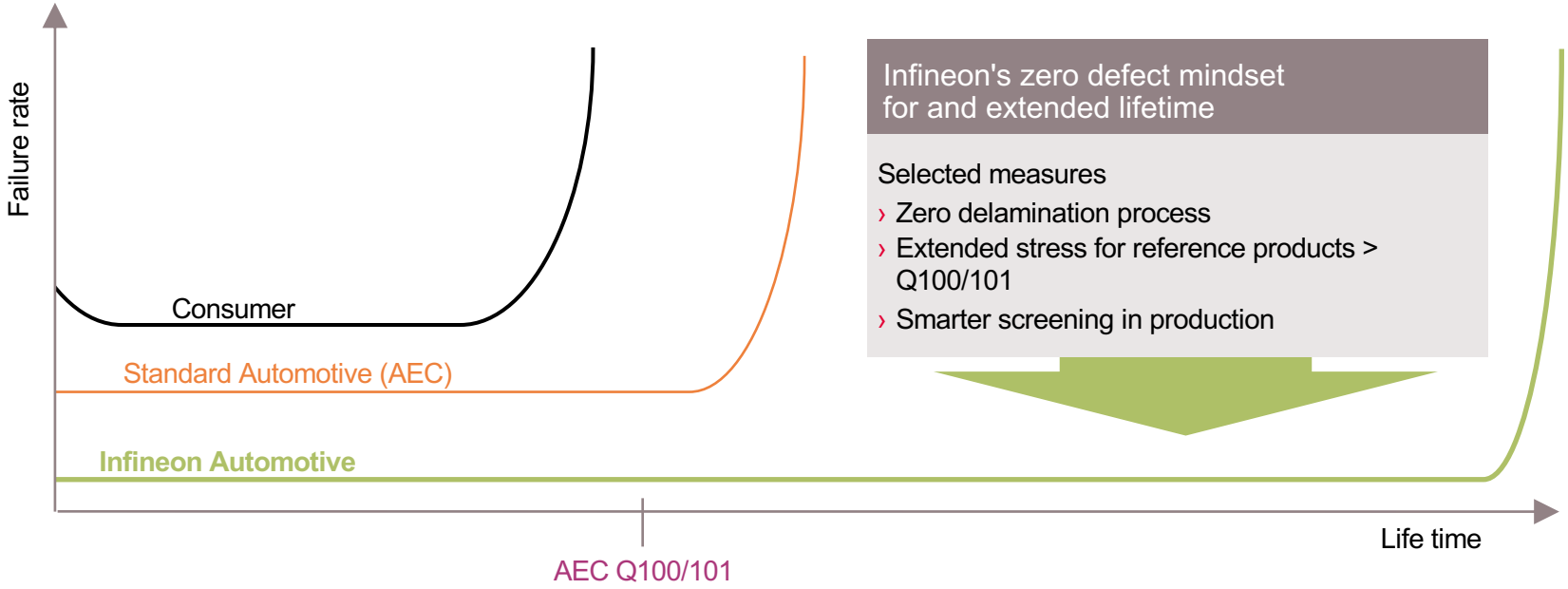
- functionality
- reliability
- time
- volume & cost

Our foundation

International standards such as ISO 9001, IATF 16949, AS 9100, IEC 17025

We go beyond the standards to better fit the real application requirements

Highly engineered products to target Zero Defect over 15+ years of product life time



Infineon Zero Defect mentality

We reduced our ppm rate significantly to sub ppm levels

We produce 24/7/365 and deliver Zero Defect for all but the last 3 seconds of a year

Most of our 8Ds are closed in less than 14 days

Regional network of failure analysis labs and strong localized competencies

Zero delamination approach

90% of our products are already Zero Defect

Infineon is your trusted advisor to make Functional Safety easy

Quality
Cybersecurity
Functional Safety
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With our strong Functional Safety experience we provide building blocks for integrating safety features

ProSIL™ products support a safety use case

Customer use case	System Integration Efforts	System Integration Documentation	Safety Feature Description	Infineon Label
Design with safety product to develop its own safety system	 Use case specific	 Use case specific	Product with diagnostic or safety features	PRO SIL
Hardware integration using products developed with Infineon automotive processes	 Medium	 Safety App. Note	Safety analyses and customer documentation supporting ISO26262 system integrations	PRO SIL ISO 26262 ready
System designed around Infineon components developed specifically for safety relevant applications	 Low	 Safety Manual	Product developed according to ISO26262 process with required documentation	PRO SIL ISO 26262 compliant

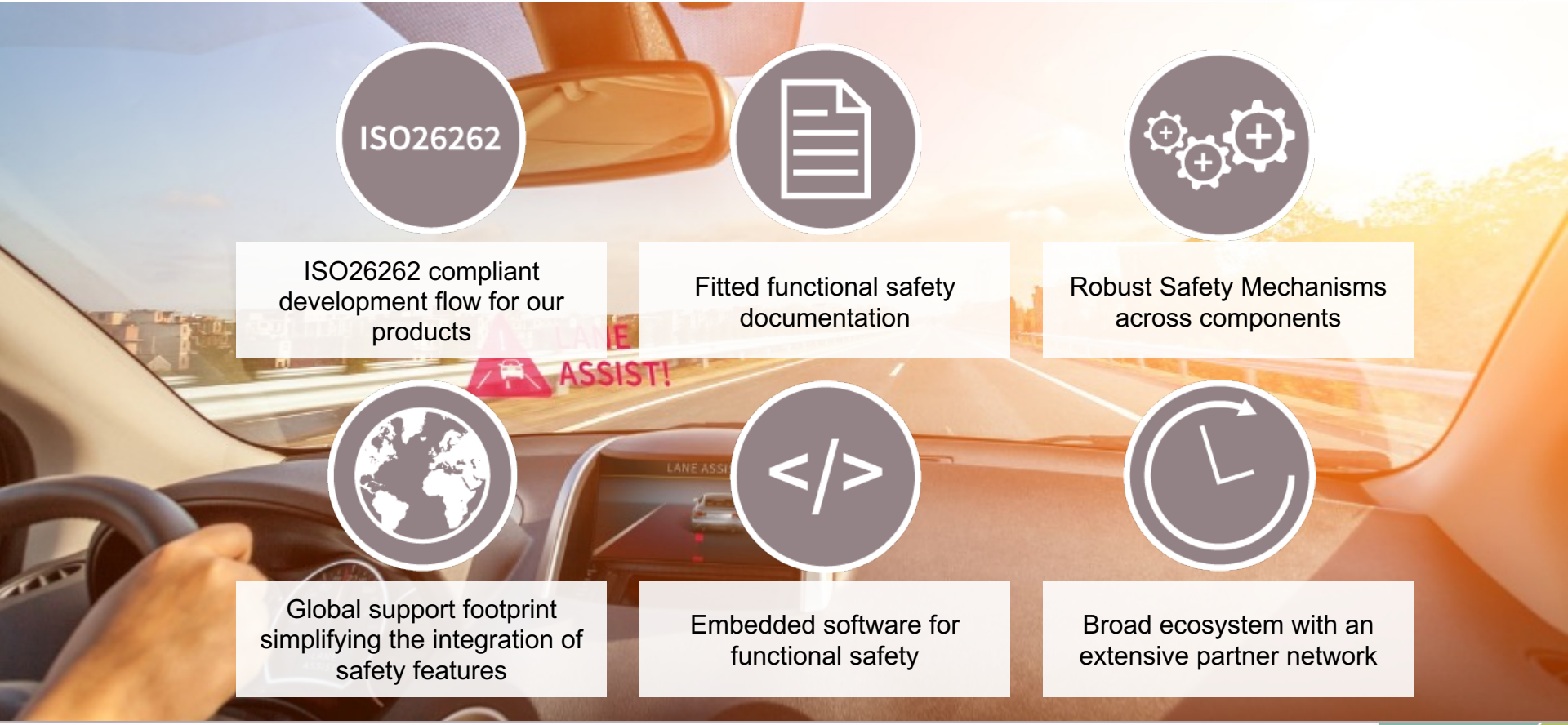
Agile thinking and approach to innovation builds upon trust to adopt new technology

Infineon safety objectives

- **Development** of products in compliance to ISO26262
- **Innovative solutions** for safety critical applications
- Future rising requirements of **ISO26262** compliant components with **increasing complexity**
- **Efficient development processes in place** to design ISO26262 conform products

We have a track record of successful safety solutions, allowing you to focus on your own value-add.

Infineon's Functional Safety approach



ISO26262 compliant development flow for our products

Fitted functional safety documentation

Robust Safety Mechanisms across components

Global support footprint simplifying the integration of safety features

Embedded software for functional safety

Broad ecosystem with an extensive partner network

Next Level of Scalable & Agile Security Beyond the Standards

Quality
Cybersecurity
Functional Safety

Dependable Electronics

A dependable communication in an interconnected system has security as an integral part

No Safety without security

- Security is a mandatory precondition for Safety
- Safety is the most important asset to be protected
- A dependable architecture is secure and safe

Security is an architecture property

- A secure EE-architecture is always built around a certified root-of-trust
- Hardware/Software co-design is key for a strong protection scheme
  - Appropriate security is required on all layers of the EE-architecture

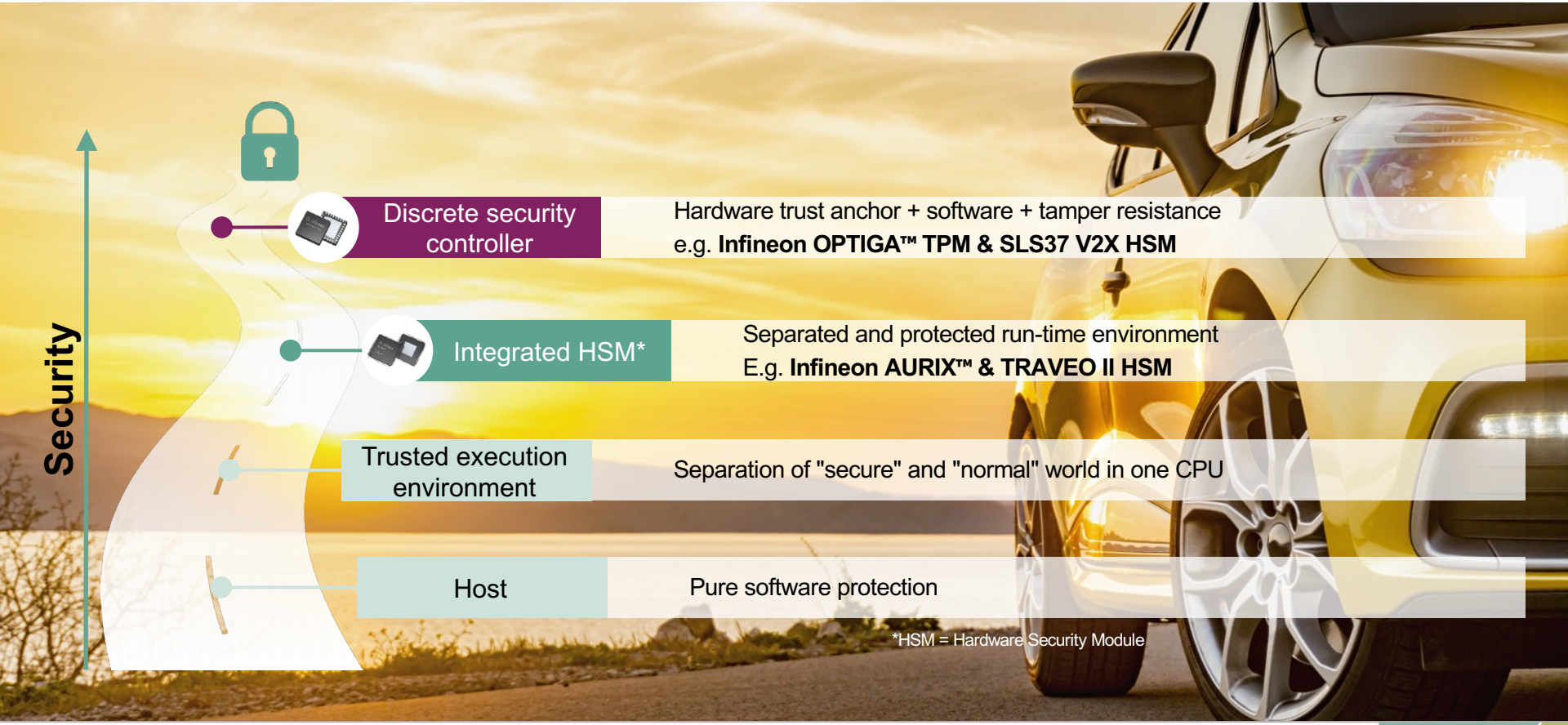
Security is a moving target

- Security erodes over time
- Always be ahead of the attacker's capabilities
- Crypto-agility is a must – the right hardware is an enabler for this

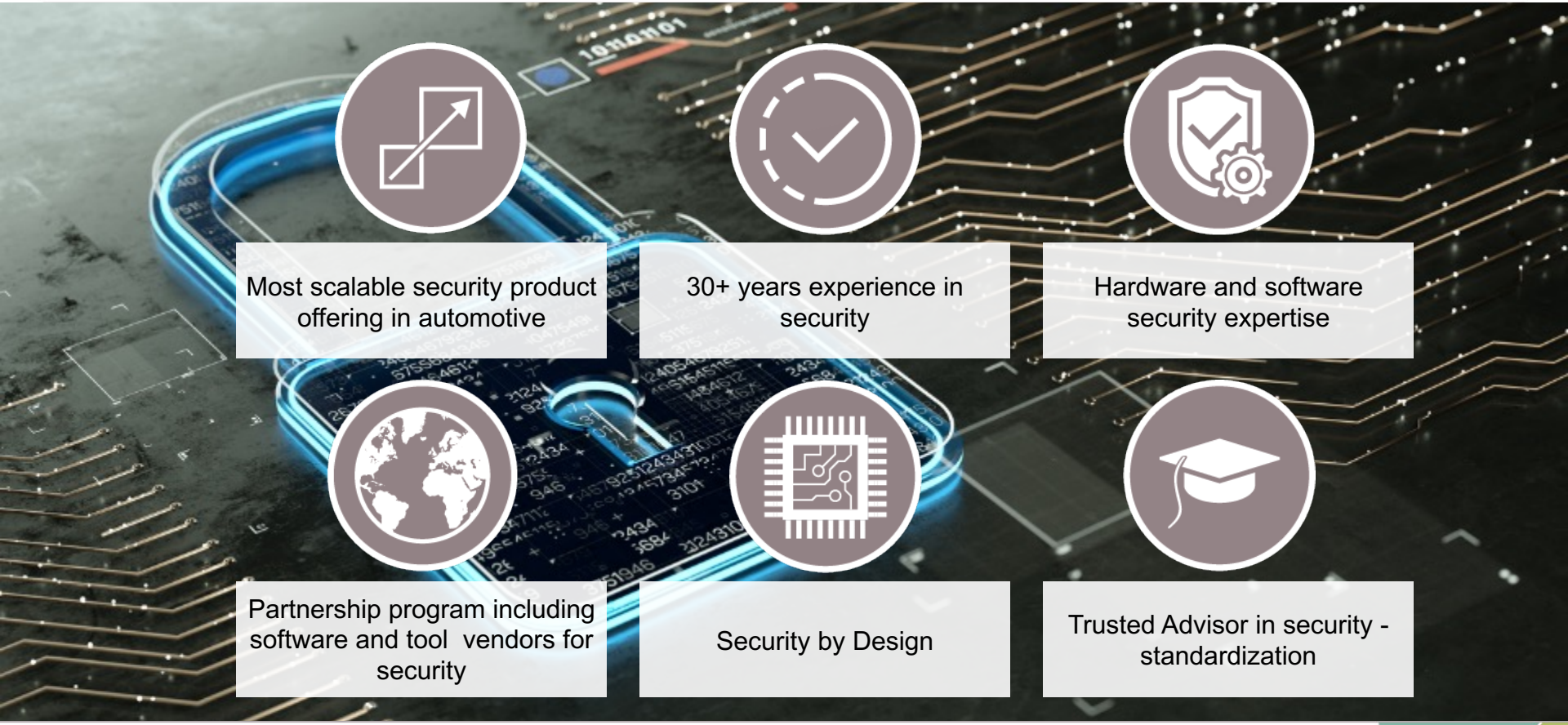
Security needs cooperation

- Security by obscurity is not sustainable
- Security standards allow transparent risk management over the complete lifecycle
- Incident management processes across the whole supply chain have to be established

We offer the most scalable automotive cybersecurity portfolio, meeting the right level of security



Trusted advisor in security



Most scalable security product offering in automotive

30+ years experience in security

Hardware and software security expertise

Partnership program including software and tool vendors for security

Security by Design

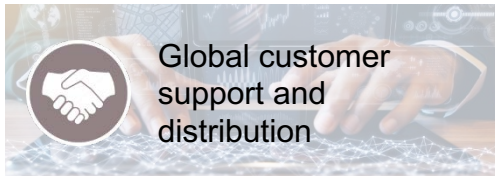
Trusted Advisor in security - standardization

Dependable Partner through Premium Service

Premium Services: operational excellence, quality, sales support, application support, R&D and distribution

We are the number 1 partner in the fast changing automotive world

Premium Services



Expert service local to our customers sites

- We provide expert quality analysis and support close to our customers
- Consultative & trusted advisor product selection support
- System & product technical experts to assist customer R&D teams
- Project management support, safe launch & APQP

Operational excellence and automotive quality covering the full product lifecycle process

Disaster and risk management operations & logistics planning

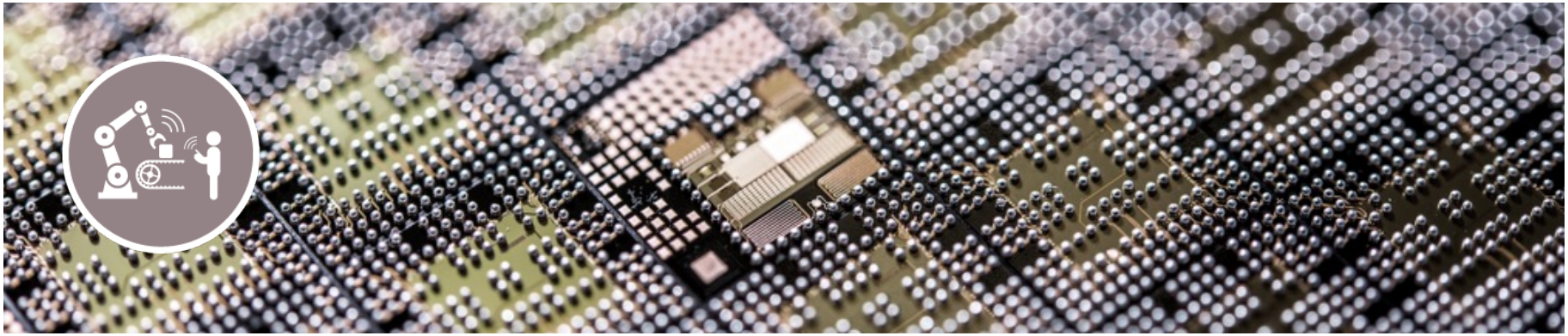
Rigorous capacity planning & tight supply management processes

- Continuously investing for reacting quickly to add future capacity
- Digitized monthly short, mid & long term (5 year horizon) capacity planning
- Standardized tight supply management system (integrated in planning system landscape)
- Dedicated CLM organization

Fast T2M

Distribution is a key for Infineon growth supporting over 35k customers all over the world

Operational excellence
We continuously increase our supply chain robustness



- High volume factories including 300mm and multi-site manufacturing **secures your supply**
- Fully digitized End-to-End planning, short-term and long-term infrastructure preparation including a new 300mm factory in Villach **secures your growth**

- Regional distribution & customer logistic centers offer close **proximity and fast response**
- The tight supply management across all factories is digitized and **seamlessly integrated** into our **order management system**

- Our comprehensive Business Continuity Management ensures **fast and agile response** to potential **threats**
- Our **logistical excellence** is proven and honored by various awards

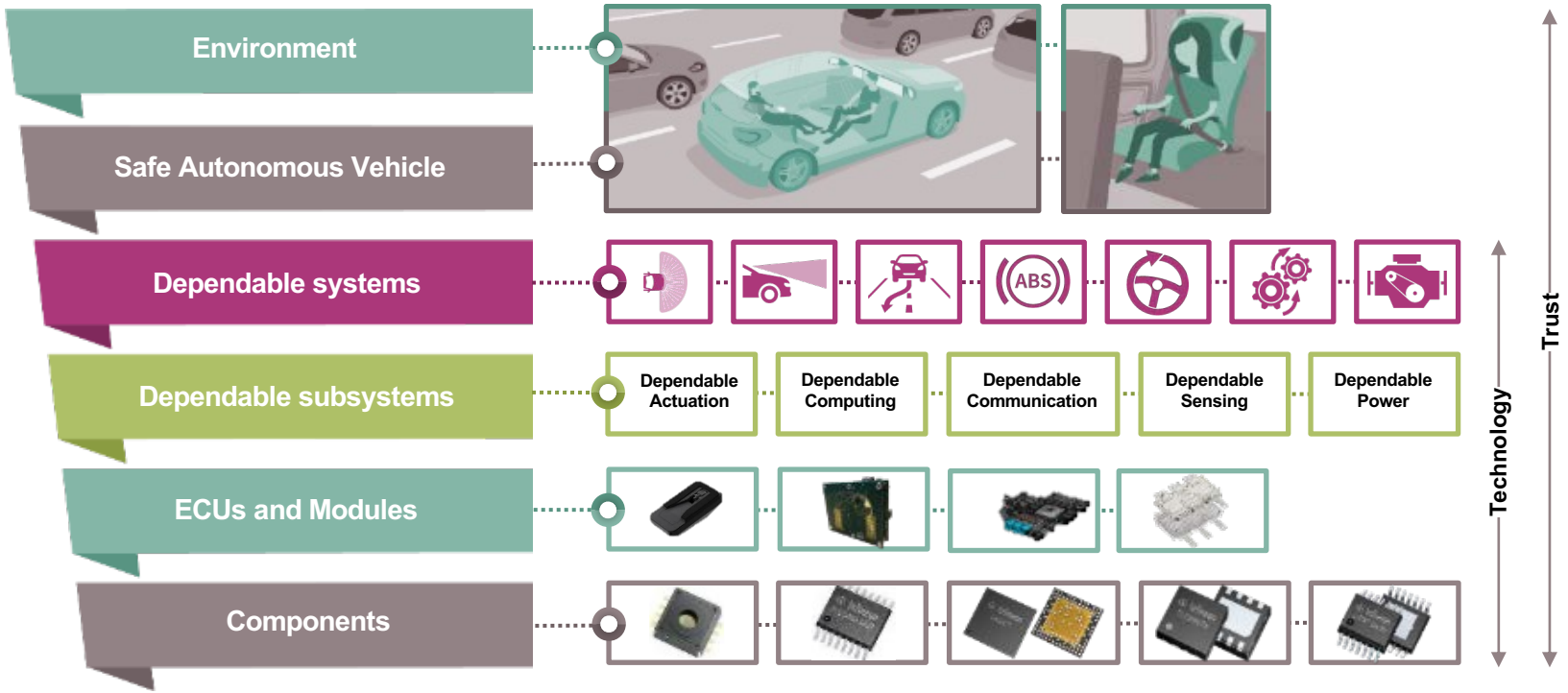
Passion for innovation
Infineon has long track record as innovation leader

- We develop technologies, packages and testing procedures, and processes as well as tooling in R&D for functional safety specifically **for automotive use cases**
- We run a global network of 20+ own development centers providing **access to broad skilled engineering resources**

- We cover the full R&D value chain from chip design, technology development, manufacturing and dedicated design tooling, **enabling full project ownership**

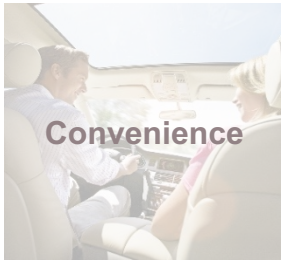
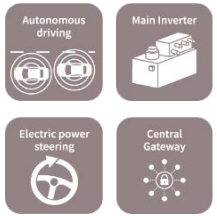
- We are **innovation leader with a track record** of many successful newly introduced product categories
- Worldwide collaborations with leading universities and research institutes **to early identify technical trends and develop competences**

Dependability is part of Infineon's cultural mindset with system understanding as one of its key ingredients



Infineon leverages a deeply embedded system thinking

The interactions of increasing functions require a partner offering premium services in addition to dependable electronics

Application Type	Examples	Application Needs	Quality	Cyber-security	Functional Safety	Innovative Technology	Operational Excellence	Application Understanding
		Superior Customer Experience	✓	✓	○	✓	✓	✓
		Freedom from unacceptable risk	✓	✓	✓	✓	✓	✓
					Dependable Electronics		Dependable Partner	

Two Examples of Infineon's dependable solution: Fail-operational Electric Power Steering and Radar Sensors

Electric power steering

Result:
Robust, redundant system which provides fail-operational functionality

- AURIX Hardware Security Module (HSM) and Access to Infineon Security Ecosystem
- Safety Software including MCAL Drivers and Reference Examples
- ISO26262 Compliant Semiconductors: Microcontroller, Power Supply, Sensors
- Zero Defect Products: MOSFET ppm rate of less than 0.1 for example
- Robust Safety Mechanisms Ensure Interoperability Across Components
- Safety Documentation: At Component and Chipset level
- Integration Support: Access to Experts with in-depth Product and Application Understanding

Radar

Result:
High performance, reliable environmental sensing

Infineon Functional Safety | Infineon Automotive Quality | Infineon Cybersecurity

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		✓	✓	✓

Summary

We deliver dependable electronics which enable systems that are the foundation for trust.

Part of your life. Part of tomorrow.