



# **Micronas – Most Preferred Partner for Sensing and Control**

2016

## Vision and Principles

Facts & Figures

Quality

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Applications

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Summary

# Micronas – Vision



## Full inhouse Production



## Our Vision

**Most Preferred  
Partner for  
Sensing and Control**

## Social Responsibility



## 900 Employees worldwide

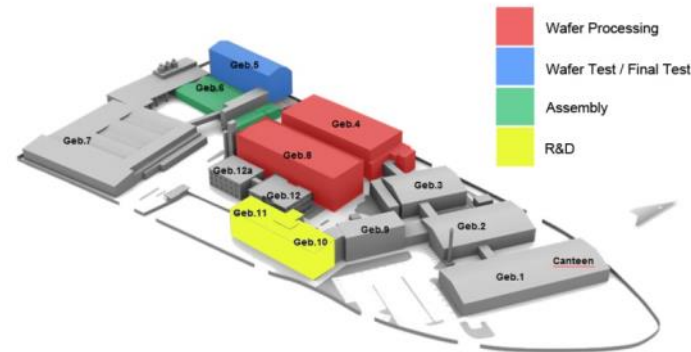


# Micronas – Principles

## All under one roof

More flexibility and fast time-to-market.

## Operational Headquarters Freiburg, Germany



## Quality without compromises

Our products are known for quality, functional safety, and reliability.

## Excellence by experience

Innovative key solutions and excellent support, based on deep market and system know-how.

## Our success proves us right

More than 3 billion ICs sold from the world market leader of linear Hall-effect sensors.

# All under one Roof



## In-house

Micronas handles all of the different stages in development and in production under one roof, enabling Micronas to provide its customers with a high level of flexibility and a fast time to market.

## Safe Supply

Micronas maintains a second site in Scotland for final test to guarantee its customers the safe supply of its products.

### Operational Headquarters Freiburg, Germany



### Micronas Ltd. Glenrothes, Scotland



## Overall Excellence

Based on deep market and system know-how and together with its best-in-class technical support, Micronas offers its customers new and innovative solutions for their ever more demanding applications.

Micronas benefits from extensive production experience know-how achieved in more than 40 years of automotive business.





# Commitment to Quality



## Quality

Rigorous commitment to quality and functional safety, excellent logistics and safe supply represent core attributes making Micronas a reliable partner in its markets. Using products from Micronas means to incorporate robust sensor solutions, meeting the customers' product reliability demands.

## Mission

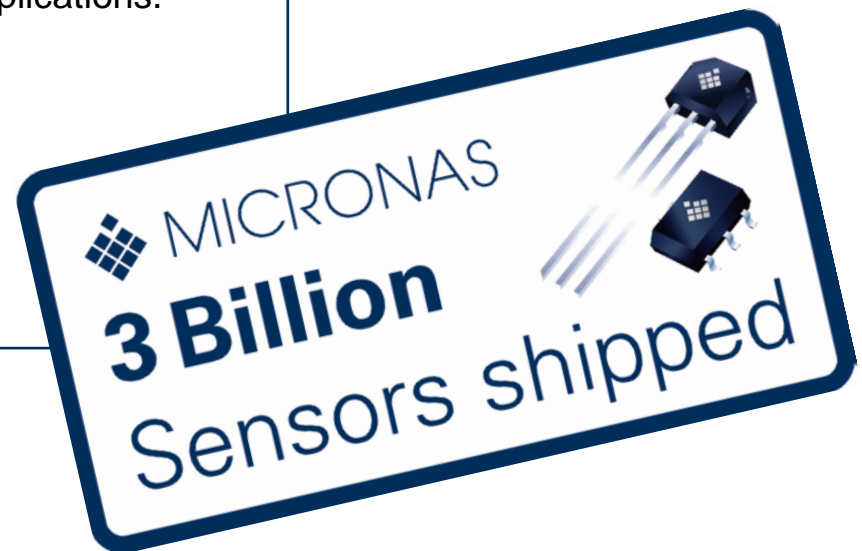


# More than 3 billion ICs sold



## Success

Micronas as the market leader for linear sensors in automotive applications offers the world's largest Hall sensor portfolio for the automotive and industrial markets and has already supplied more than 3 billion Hall sensors for highly demanding applications.





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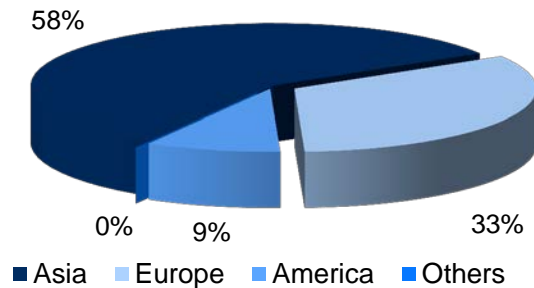
# Micronas – Group Sales



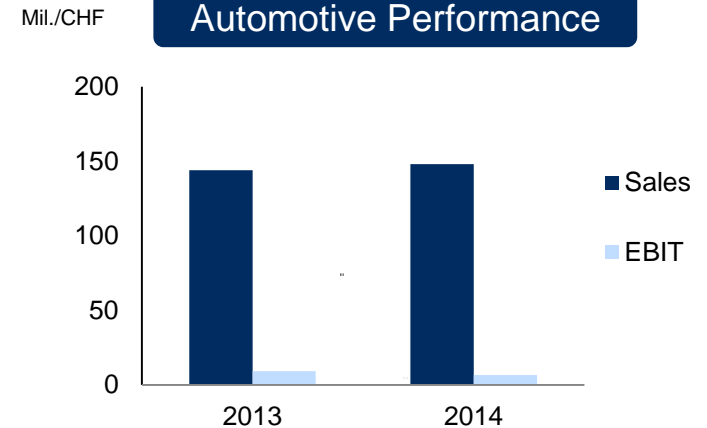
## Total Sales

Mil./CHF	31.12.2014
Europe	51.6
Asia	92.9
America	13.8
Others	0.2
<b>Total sales</b>	<b>158.5</b>

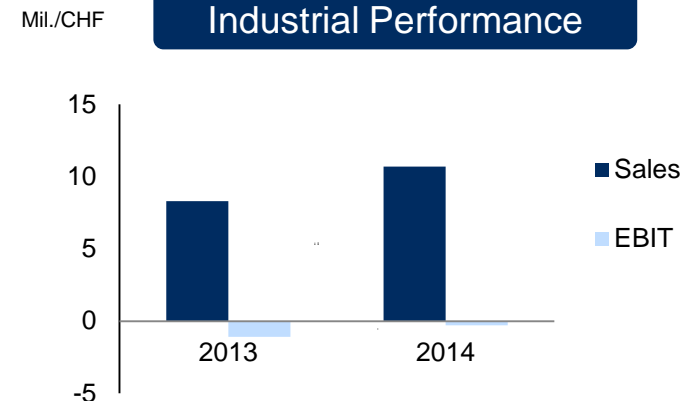
## Regional Information



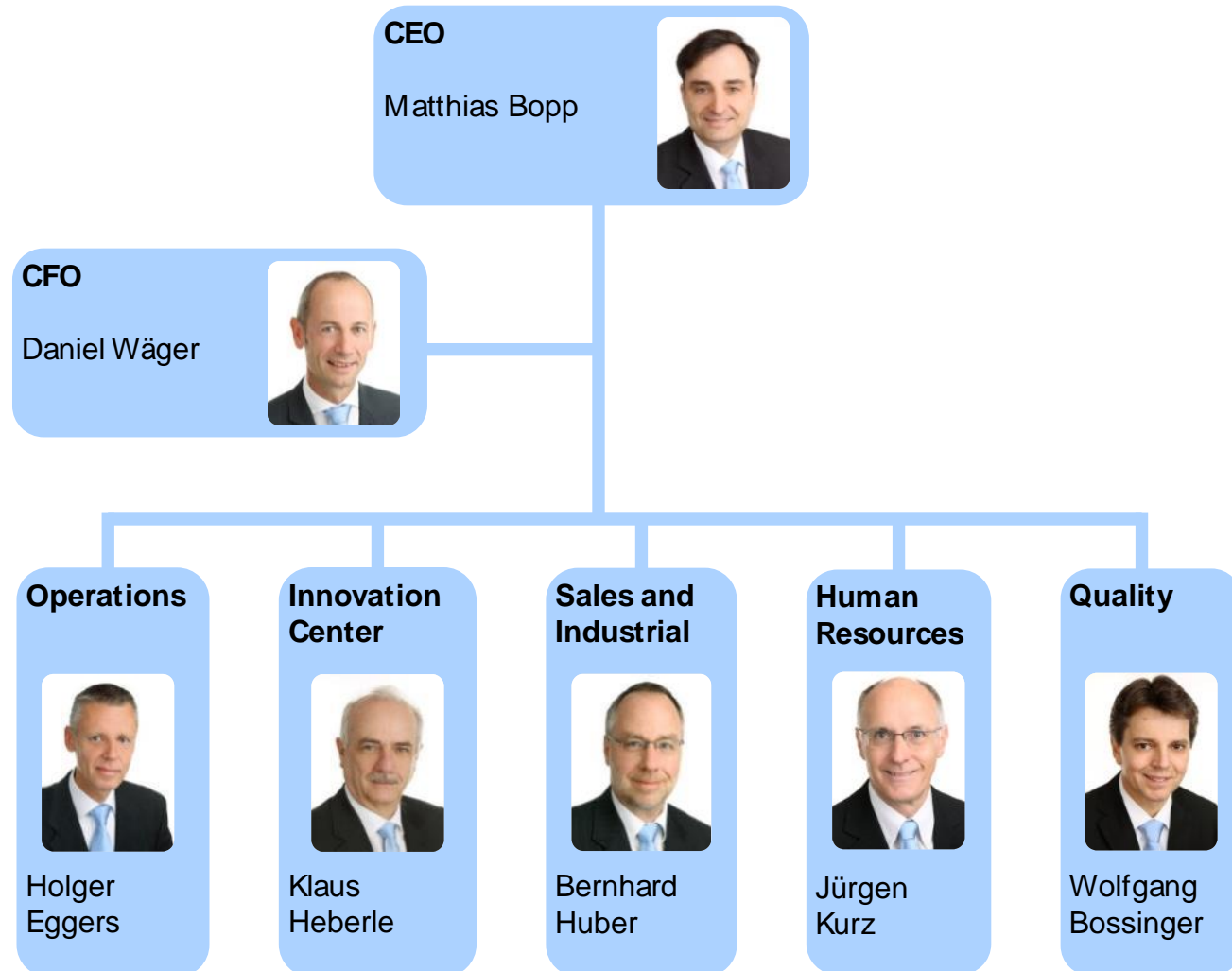
## Automotive Performance



## Industrial Performance



# Micronas Management Team



# Micronas – Group Structure and Locations



Micronas Semiconductor Holding AG, Zurich, Switzerland  
Headquarters

Micronas GmbH  
Freiburg, Germany  
Research & Development  
Marketing & Sales  
Production



Micronas Ltd.  
Glenrothes, Scotland  
Test center, Production

Micronas Japan K.K.  
Tokyo, Japan  
Sales office

Sales offices  
across Europe

Sales office  
Shanghai, China

Sales office  
Seoul, Korea

Sales offices  
around the US

Micronas New Technologies  
GmbH  
Munich, Germany  
Research & Development  
Sales

Distributor base all around the world

# Customer and distributor base



**DENSO**

**Continental**

**BOSCH**

**Valeo**

**AISIN**  
Geared up for the future

**PM·DM**  
Minebea Group of Companies

**CTS**

**DELPHI**

**IKUNI**

**Nidec**  
All for dreams

**BorgWarner**

**KOLBENSCHMIDT  
PIEBURG**

**KOSTAL**

**B/S/H/**

**LG Innotek**

**Efi**  
AUTOMOTIVE

**pretema**

**brose**  
Technik für Automobile

**TOKAI RIKAI**

**Autoliv**

**FTE**  
automotive

**YAZAKI**



**LEM**

**MARQUARDT**

**ebmpapst**

**TE**  
connectivity

**MAGNETI  
MARELLI**

**TRW**  
Automotive

**Johnson  
Controls**

**owell**  
FINE RELATIONS FOR NEXT

**2KS**

**Excelpoint™**

**TOMEN  
ELECTRONICS**

**endrich**  
components of life

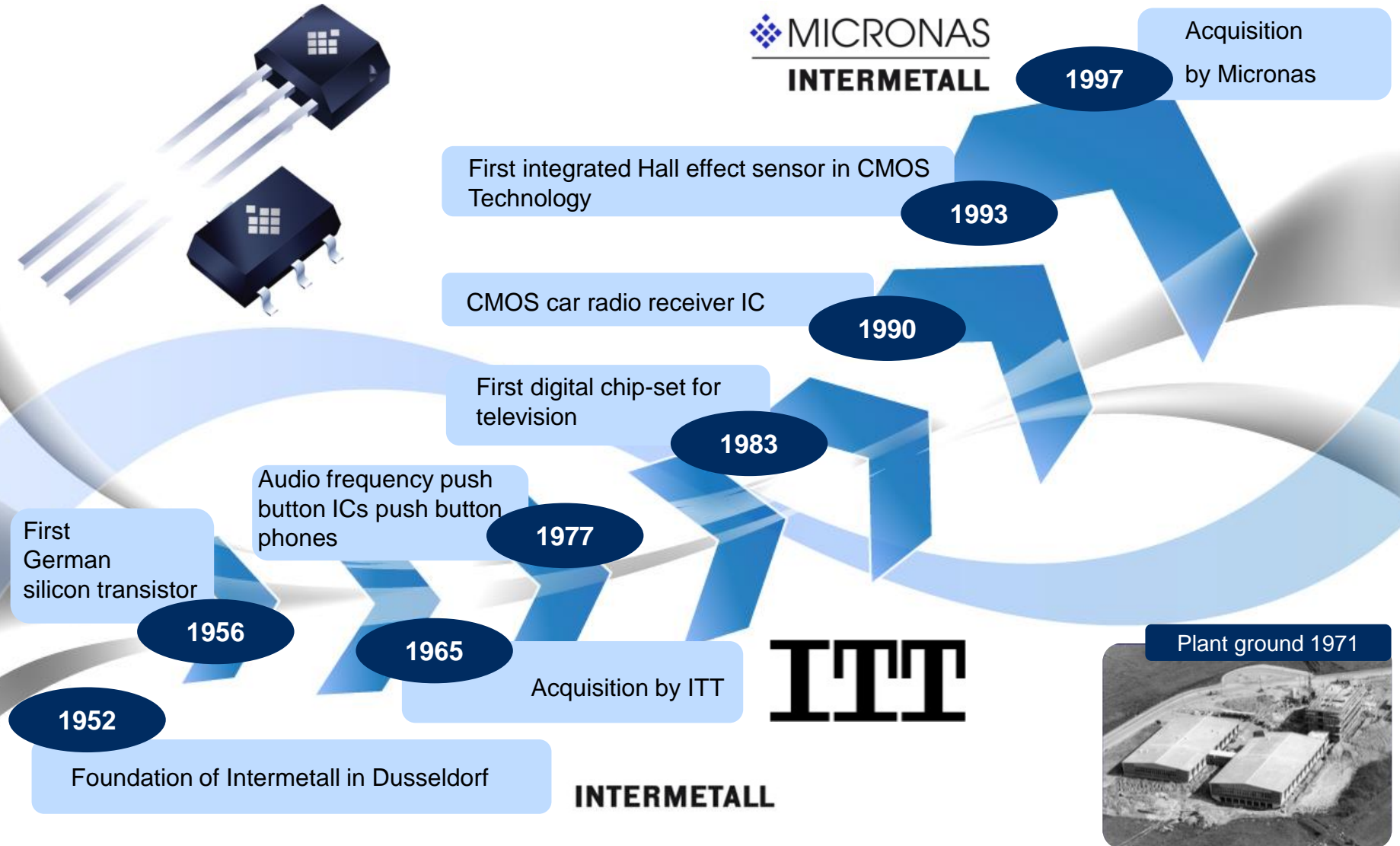
**GLYN**

**RUTRONIK**  
ELECTRONICS WORLDWIDE

**SYMMETRY**  
ELECTRONICS CORPORATION

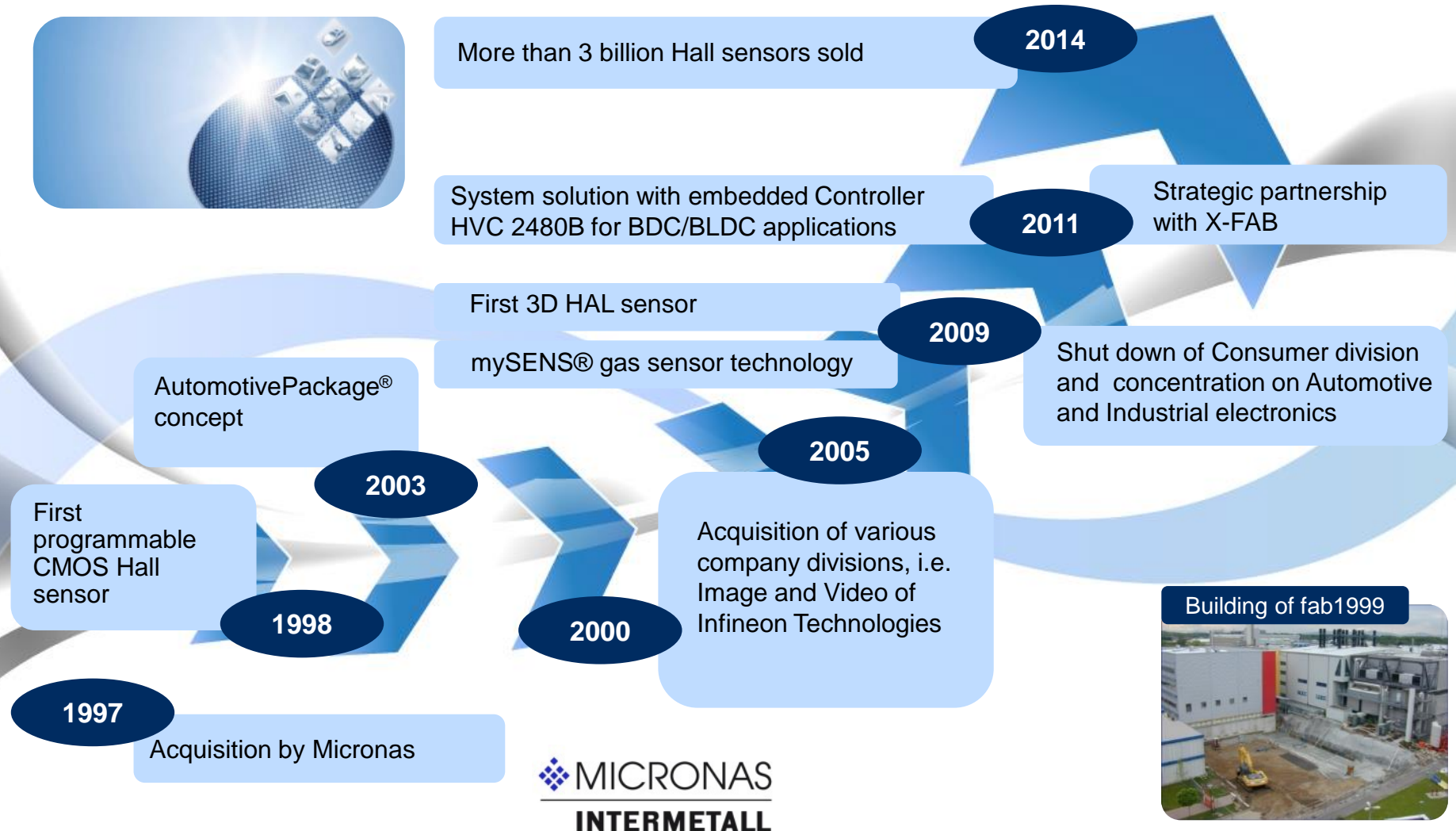
**Phoenixics**  
The Future of Distribution

# Micronas – Corporate History 1952 - 1997





# Micronas – Corporate History 1997 - today



# Technology Milestones



**2014** First ISO 26262 compliant Hall switch family for stringent functional safety requirements

**ASIL**ready

- ◆ Redundancy
- ◆ Higher Accuracy
- ◆ Higher Integration

**2009** First vertical integration of Hall-plates in a sensor enables multidimensional magnetic field measurement

**3D HAL**  
Technology  
by Micronas

**2009** in-house package development for gas sensors with integrated Teflon® particle filter

**mySENS**  
Technology  
by Micronas

**TO92UP**  
4-pin leaded

**1993** First microcontroller with integrated LIN interface

**easyLIN**  
Technology  
by Micronas

**Open Cavity QFN**

Hall Sensor with integrated microcontroller for flexible sensor output (SENT, LIN, PWM)

**vario HAL**  
Technology  
by Micronas

**Leadless QFN**

**Pioneering 1993** First semiconductor company manufacturing Hall-effect sensors in CMOS technology

**SOIC8**

**TO92UA**  
**SOPT89B**



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**Quality**

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# Quality at Micronas – More Than Just a Policy



## We embrace Quality

- ◆ Our customers' success and satisfaction are our bench marks
- ◆ Micronas' quality management system has been proven to work at a most elevated level

## Effective Implementation

- ◆ Mature and robust production processes minimizing the probability of the occurrence of defects
- ◆ State-of-the art analysis techniques are deployed to detect and remove parts with abnormal characteristics

## Right First Time

- ◆ Perfect products are the result of highest quality right from the beginning and at every step
- ◆ Expert knowledge, qualified and committed personnel are one of Micronas' most important asset



## Continuous Improvement

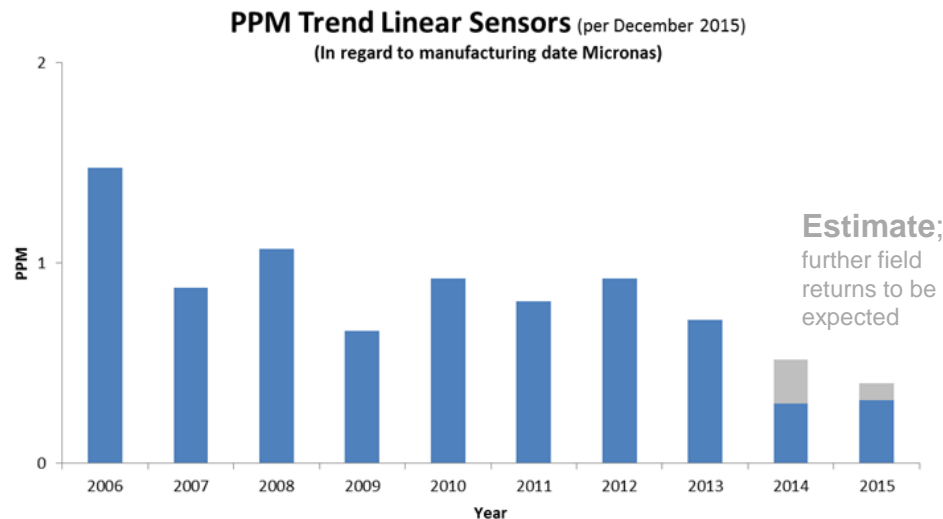
- ◆ We do not merely optimize our proven products, but we strive for their perfection

# Quality at Micronas – We let our results speak for themselves



Micronas remains committed to continuously improving quality towards zero PPM

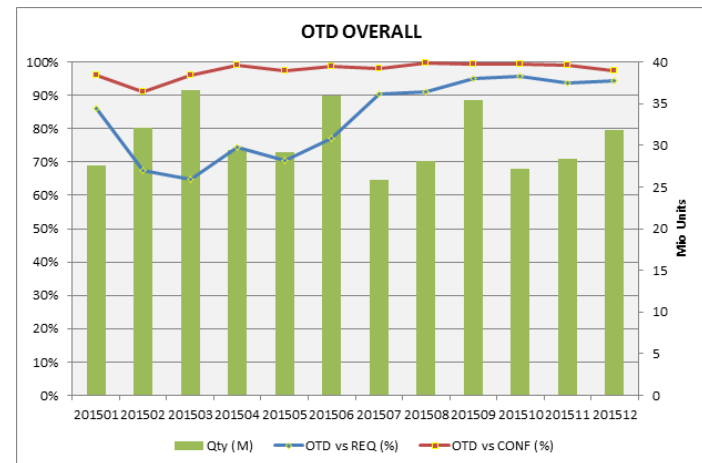
## PPM Trend



## Success Factors

- ◆ High performance online Material Resource Planning System
- ◆ Advanced Manufacturing Execution System
- ◆ Advanced cross-linked Equipment Information System
- ◆ Sophisticated logistic processes in place
- ◆ State of the art documentation and traceability
- ◆ State of the art control of supply chain
- ◆ Systematic Supplier development process

## On Time Delivery





# ESF-Management System – Environment, Safety, Fire Prevention



## Certificates

- ◆ Freiburg
  - ▶ ISO 14001 Certificate since July 2000
  - ▶ EMAS Certificate since August 2002
  - ▶ (acc. to the Regulation (EC) No 1221/2009 on the voluntary participation by organizations in a Community eco-management and audit scheme)
  - ▶ Yearly Environmental Declaration
- ◆ Glenrothes
  - ▶ ISO 14001 Certificate since September 2002
- ◆ Yearly appearing Environmental Declaration

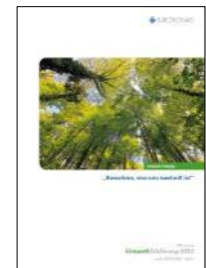
## ISO 14001



## EMAS



## Environmental Declaration



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# Market and technology drivers

## Environmental Protection

Increased demand for high energy efficiency and CO<sub>2</sub> reduction needs optimized sensors and actuator solutions, e.g. for engines, BLDC motors and HVAC systems



## Safety

Increased safety demand drive growth for novel, intelligent and redundant products and system solutions

## Economy

Reduced overall system cost enabled by highly integrated sensors and embedded controllers, e.g. increasing magnet costs can be compensated by higher sensitivity



## Comfort & Lifestyle

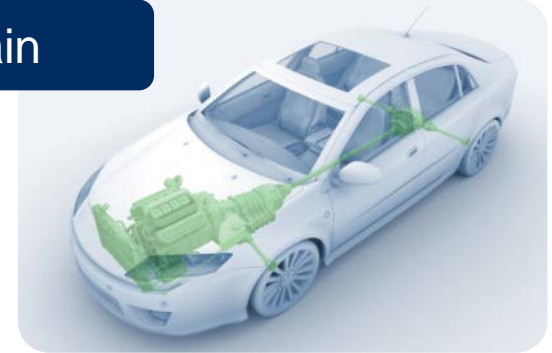
High levels of functionality, low power and small form factor enable new applications and comfort features

# Markets – Automotive

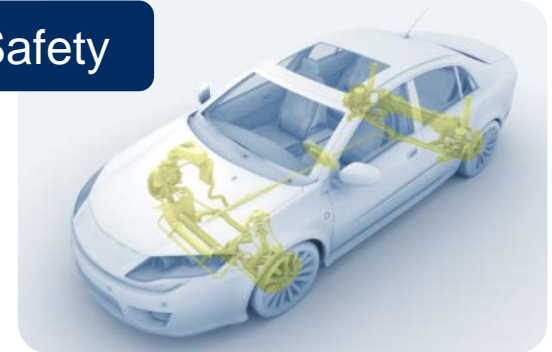
## Automotive

- ◆ Micronas has a long history in Automotive with a very large customer base.
- ◆ Micronas maintains full control of production from wafer fab, assembly and final testing providing highest flexibility to meet automotive quality and to offer unique customization capability.
- ◆ Micronas offers the world's largest Hall sensor portfolio covering all automotive applications. Micronas also provides innovative fully integrated embedded motor controller solutions for motor control applications.

## Powertrain



## Chassis & Safety



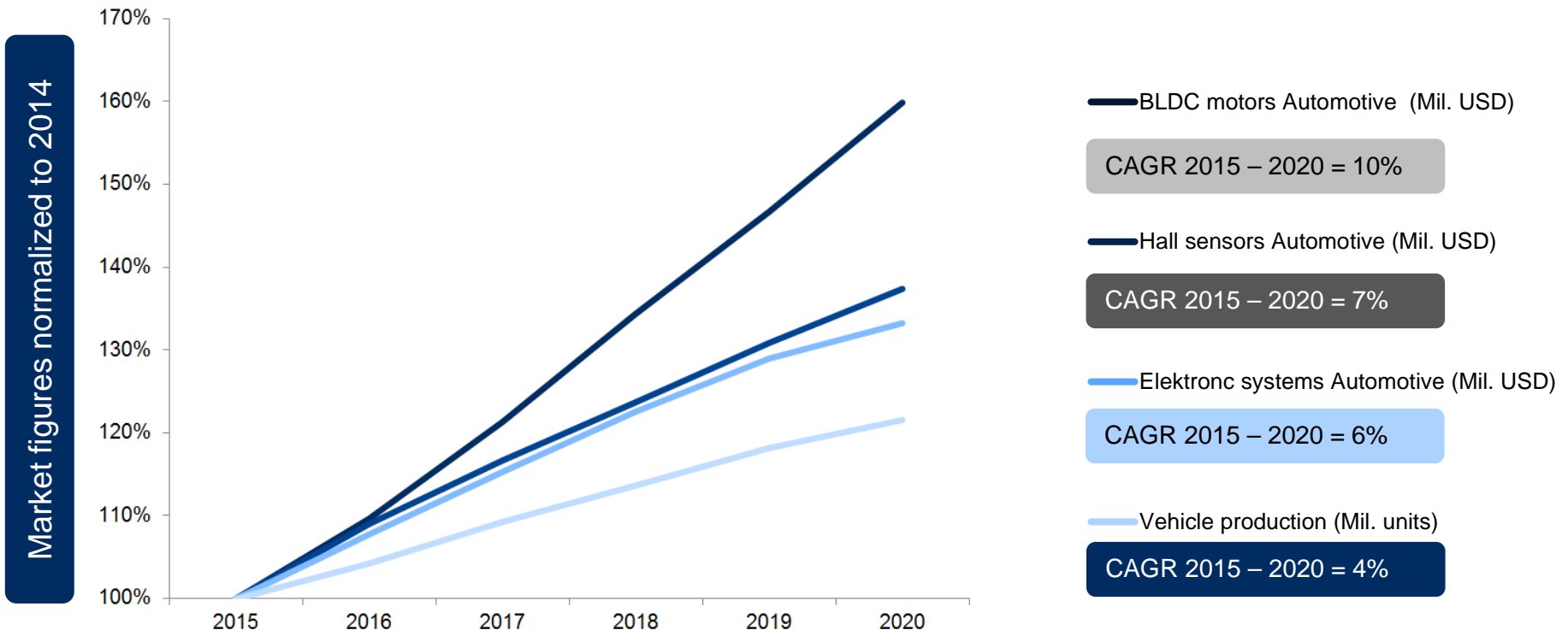
## Body & Comfort



# Automotive Market Development



Hall sensors and BLDC motors will continue to outgrow vehicle production and electronic systems in cars



Source: Strategy Analytics / IHS / WSTS / Micronas, July 2015

Unclassified. "Property of Micronas. All rights reserved."

## Industrial

- ◆ Intelligent sensor and actuator solutions for smart automation networks to enable increased comfort and lifestyle
- ◆ Highly reliable and robust sensors to meet the demands for long lifetime within harsh environments
- ◆ Wide range of cost-effective sensor solutions for eco-friendly home appliances with small form factor



**Building, Home & Office Automation**



**Factory & Process Automation**



**Home Appliance & White Goods**



**Mobility & Robotics**



**Garden & Power Tools**



**Agricultural & Heavy Machinery**



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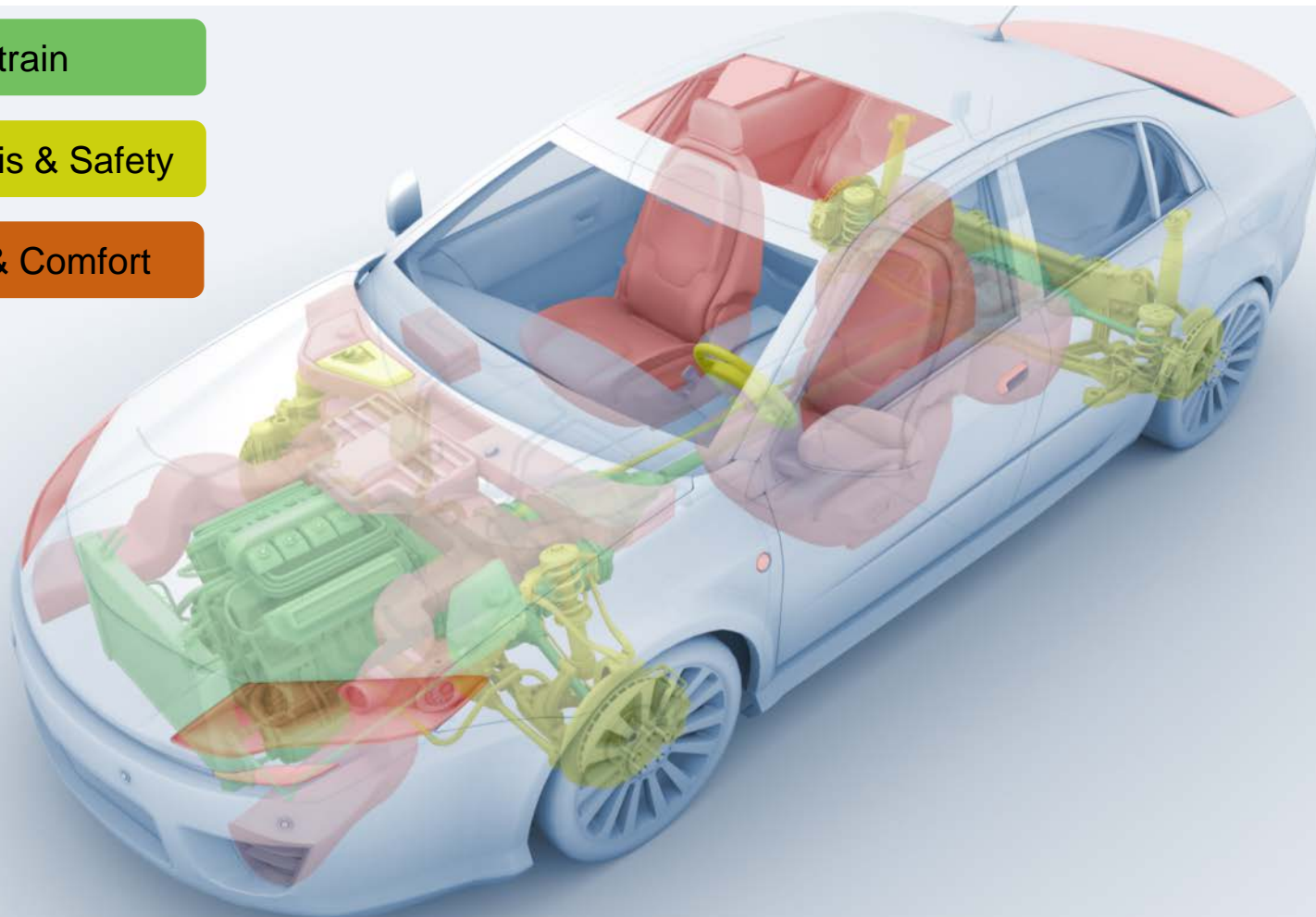
Summary

# Automotive Applications

Powertrain

Chassis & Safety

Body & Comfort

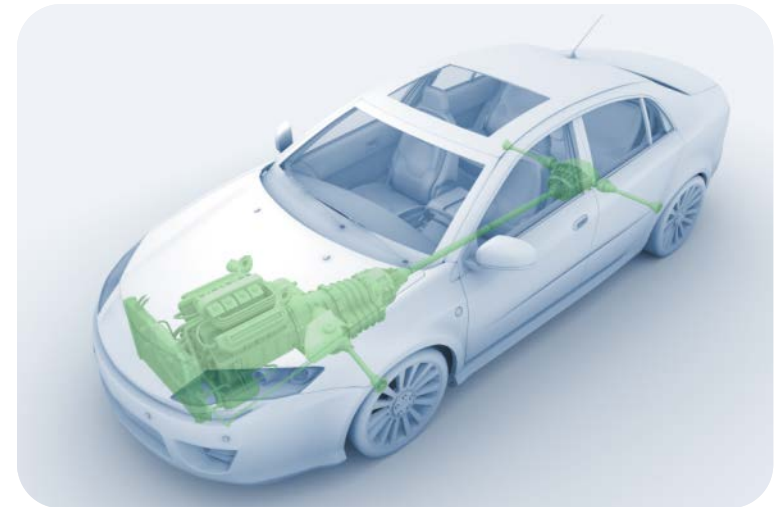


# Automotive Applications – Powertrain



## Powertrain

- ◆ Increased demand for high energy efficiency and CO<sub>2</sub> reduction asks for optimized sensor and actuator solutions.
- ◆ Micronas aims to provide solutions for all powertrain applications from Battery management to exhaust valves through shift lever and pedal position sensors.
- ◆ Micronas develops high accuracy sensors designed to withstand harsh under-the-hood environments: insensitive to vibrations, temperature drift and dirt.



Active Pedal

Water/Oil Pumps

Powertrain Valves

Shift Lever Position

Battery  
Management

Turbo Charger

Gear Position

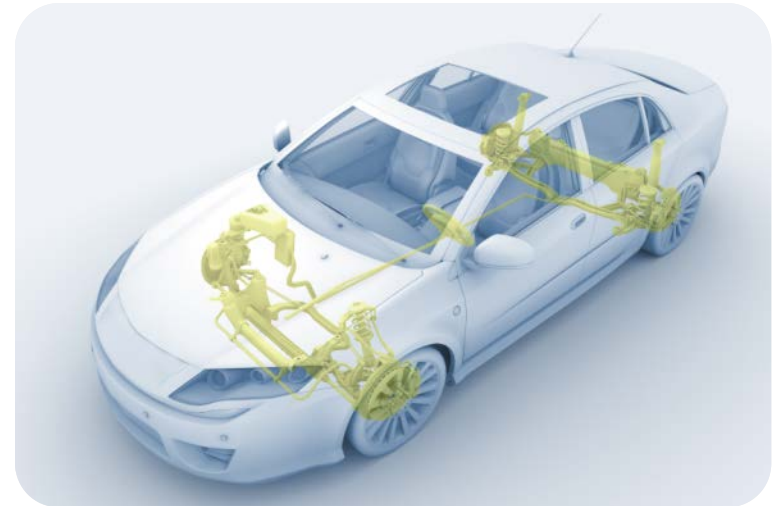
Liquid Level

# Automotive Applications – Chassis and Safety



## Chassis & Safety

- ◆ Both comfort and safety requirements are driving the trends towards higher safety integration and safe exchange of sensor information between braking, suspension and steering modules.
- ◆ Micronas provides highly reliable solutions for those systems and develops next generation components addressing the needs for higher bandwidth and more functional safety.
- ◆ Micronas offers a wide portfolio of switches, linear and direct angle sensors with diversified communication channels and redundancy levels.



Steering Torque

Steering Angle

Steering Motor Position

Chassis Position Sensor

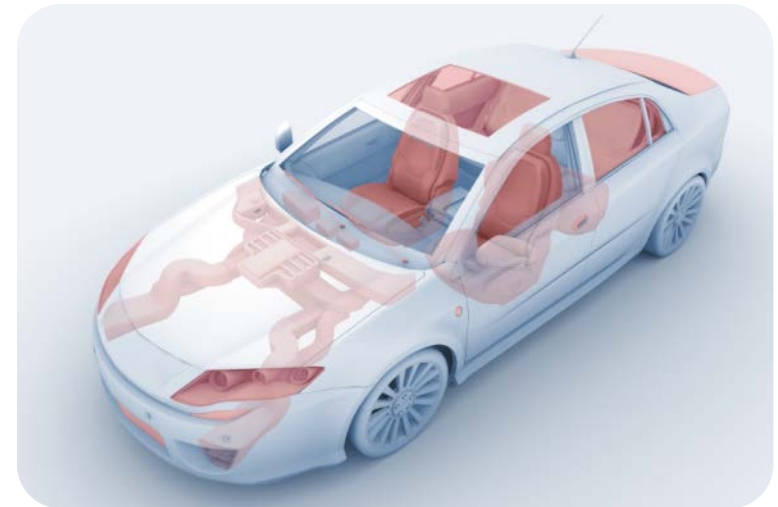
Braking Pedal

# Automotive Applications – Body & Security



## Body & Security

- ◆ Important electrification trend in the vehicle body compartment. Contactless sensors and electric motors are replacing mechanical and hydraulic systems for higher comfort and better reliability.
- ◆ Micronas has the largest Hall effect sensor portfolio to address the wide diversity of requirements in those applications and next generation components addressing the needs for lower power consumption and system cost efficiency.
- ◆ Micronas provides also fully integrated servo-drive controllers for BLDC and stepper motors as well as switches and direct angle sensors for motor position detection.



Window Lift / Sun Roof

Adaptive Headlights

LED Fans

HVAC

Door Lock

Blower and Flap Control

Buckle Switch

Seat Position/Climate

# Industrial Applications



**Building, Home & Office Automation**



**Factory & Process Automation**



**Home Appliance & White Goods**



**Mobility & Robotics**



**Garden & Power Tools**



**Agricultural & Heavy Machinery**



# Industrial Applications – Building & Factory Automation



## Building, Home & Office Automation

- ◆ Micronas aims to provide solutions for Building, Home & Office Automation from HVAC (Heating, Ventilation, and Air Conditioner), Rolling Shutters, Vending Machines to Printers and Metering applications



HVAC

Rolling shutter/blinds

Door /window locks

Copy and fax machine

Water metering

## Factory & Process Automation

- ◆ Micronas aims to provide solutions for Factory & Process Automation applications from Solar energy, Man machine interface, to Process control.



Process equipment

Production equipment

Wind energy

Solar energy

Factory transportation

# Industrial Applications – White Goods & Robotics



## Home Appliance & White Goods

- ◆ Micronas aims to provide solutions for Home Appliance & White goods from Washing machine, Dishwasher, Cook top to Coffee machine.



Washing machine

Dishwasher

Coffee machine

Mixer

Water softener

## Mobility & Robotics

- ◆ Micronas aims to provide solutions for Mobility & Robotics from E-Bike, Wheel chair, Mower, to Robot



E-bike

Wheel chair

Utility tractor

Robot

Golf cart

# Industrial Applications – Tools & Machineries



## Garden & Power Tools

- ◆ Micronas aims to provide solutions for Garden & power tools from Mower, Chain saw, to Cordless drill.



Mower

Chain saw

Trimmer

Blower

Cordless drill

## Agricultural & Heavy Machinery

- ◆ Micronas aims to provide solutions for Agricultural & Heavy Machinery from Harvester, Tractor, Dozer to Excavator.



Harvester

Scraper

Dozer

Loader

Excavator

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## Hall-Effect Sensors



- ◆ Major automotive trends for CO<sub>2</sub> reduction and car electrification are asking for tighter controls, thus increasing the demand for magnetic sensors
- ◆ More than 85% of magnetic sensors in cars are based on the Hall effect
- ◆ Micronas has the broadest portfolio for automotive applications covering switches, linear, direct angle and current sensors

## Embedded Motor Controllers



- ◆ Up to 100 electric motors per vehicle
- ◆ Fully integrated controllers for BLDC, stepper and BDC motors
- ◆ All-inclusive one-chip control solution provide with higher system efficiency to reduce motor size and weight.

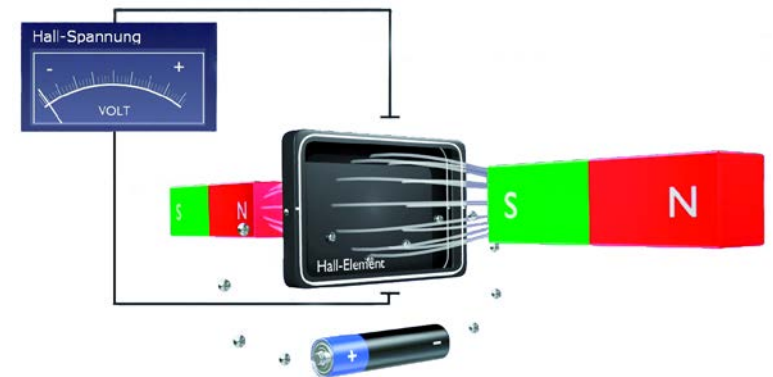
# Hall-Effect Sensors – Technology

Hall-effect sensors are the technology of choice for contactless sensing of magnetic field strength. Micronas, the pioneer of CMOS Hall sensors, continues to innovate in this field.

## Introduction

- ◆ Contactless sensing improves system reliability, especially in harsh environments
- ◆ CMOS technology is the most cost-effective method to realize Hall sensors
- ◆ High levels of integration enable sensors to perfectly fit in a wide range of applications
- ◆ Micronas has a strong track record of supplying sensors which meet the most demanding quality standards

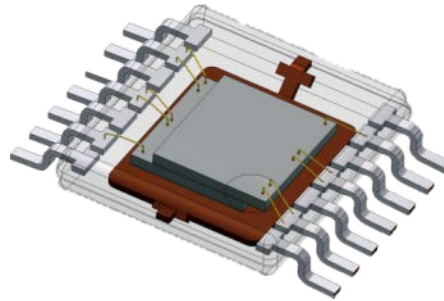
## Hall effect principle



# Hall-Effect Sensors – Trends

## Redundancy

Two silicon dies are integrated into a single package to respond efficiently to redundancy requirements for most critical applications (pedal, throttle, steering)



## Integration

Capacitors are integrated into the sensor package in order to fulfill stringent EMC/ESD requirements and to reduce overall system costs

## Robustness

Micronas has developed a concept for its devices to become insensitive against disturbing magnetic stray fields caused by the increased car electrification (HEV/EV)



## Safety

**ASIL** ready

New product development and documentation are meeting the requirements of ISO26262, the de-facto standard for automotive functional safety



# Hall-Effect Sensors – Products



Micronas offers the broadest portfolio of Hall sensors for automotive and industrial applications

## Switches

- ◆ Position detection
- ◆ Replacement of micro switches

Roller shutter



Buckle switch



## Direct Angle Sensors

- ◆ Magnetic field direction measurement
- ◆ Precise linear measurement up to 40mm and angle up to 360°.

Steering angle



Transmission range



## Linear Sensors

- ◆ Magnetic Field Amplitude Measurement
- ◆ Replacement of conventional potentiometers
- ◆ Highest precision for small position change
- ◆ Small form factor contact-less current transducer

Steering torque



pedal position



Battery management

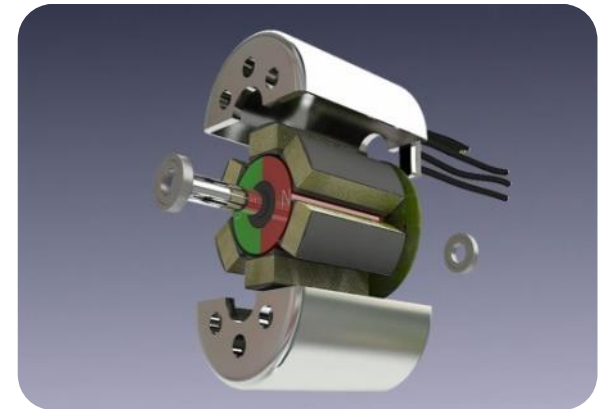


# Embedded Motor Controllers – Technology

Micronas is focusing on highly integrated solutions providing high efficiency and flexibility for driving electric motors

## Technology

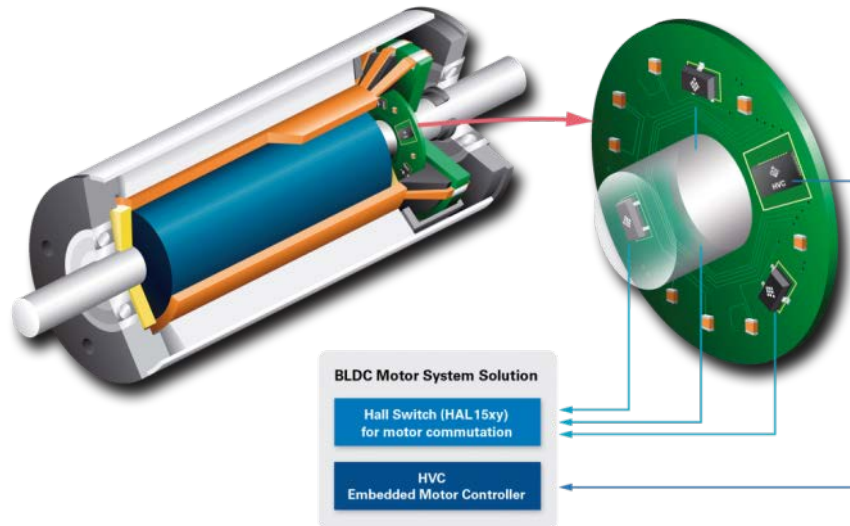
- ◆ High flexibility to directly drive BLDC, stepper and BDC motors through on the spot reconfiguration
- ◆ Greener innovation through weight reduction and power-efficient motor commutation
- ◆ More comfort and connectivity through noise reduction, climate control, driver relaxation
- ◆ Further improved power efficiency and better dynamics when leveraging synergies with our 2D/switch Hall sensor families



# Electric Motor Controllers – Trends

## Transition to BLDC

BLDC motors enables weight, space and noise reduction in interior applications. Micronas products ensure a smooth transition from BDC and stepper motors towards BLDC motors.



## Higher Efficiency

Micronas products are enabling different driving schemes and optimization functions enabling smaller motors to reach higher torque requirements.

## Miniaturization

Micronas is focusing on enabling complex drive to ever smaller motors with small footprint, reducing the number of necessary external components to a minimum.

## Flexibility

Reducing Cost of Ownership and software development time is a major concerns for our customers. Our products are flexible and configurable to drive different type of motors.

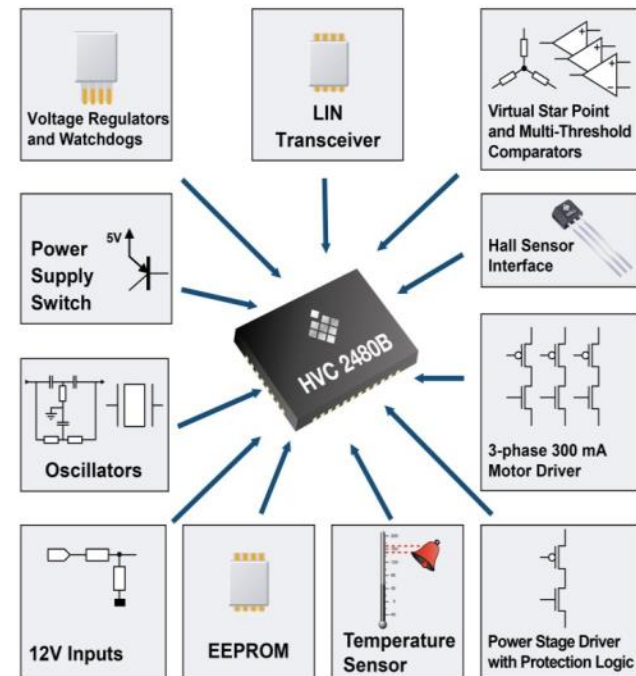
# Embedded Motor Controllers – Products



All-inclusive one-chip control solution with higher system efficiency to reduce motor size and weight

## Products

- ◆ Flexibility for direct stepper/brushless DC motor control (sensored/sensorless)
- ◆ Very few external components necessary
- ◆ Various host interfaces
- ◆ Short development time
  - ◆ Modular software package, development tools and app notes
  - ◆ Complete working demos



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- ◆ ***Quality without compromises.*** Our products are known for quality, functional safety, and reliability.
- ◆ ***All under one roof.*** More flexibility and fast time-to-market.
- ◆ ***Excellence by experience.*** Innovative key solutions and excellent support, based on deep market and system know-how.

Most Preferred Partner for Sensing and Control