

IFX Day 2003

Munich – September 22, 2003

Industrial and Horse Power

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Never stop thinking.

Disclaimer

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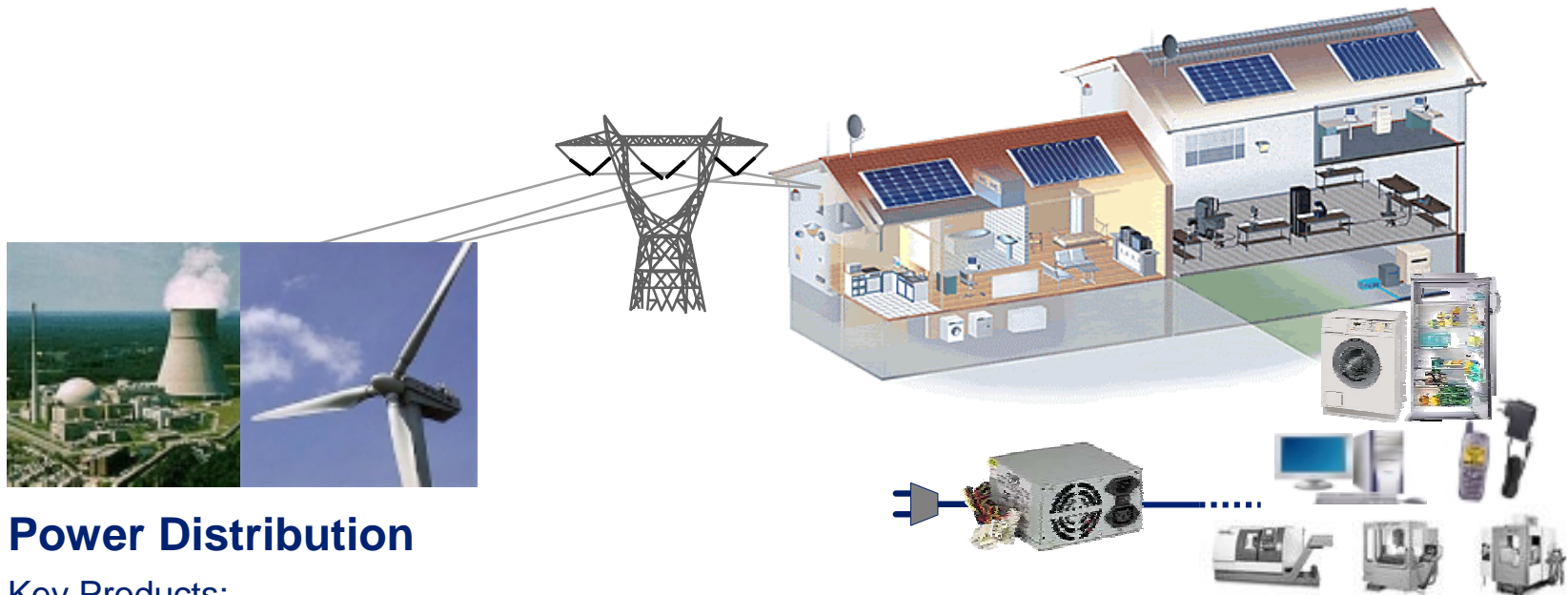
New York

August 14, 2003

London

August 28, 2003

Power Semiconductors, Power Modules and Microcontrollers for the Entire Energy Supply Chain



Power Distribution

Key Products:

- Thyristors and diodes
- IGBT- and bipolar modules
- 8 bit and 16 bit microcontrollers
- 32 bit TriCore® microcontrollers (incl. DSP)

Energy Treatment

Key Products:

- Thyristors and diodes
- IGBT- and bipolar modules

Power Management (Supplies and Drives)

Key Products:

- Discrete Power
- Power Control ICs
- 8 bit and 16 bit microcontrollers
- 32 bit TriCore® microcontrollers (incl. DSP)

Converting & Controlling Power

Defining Automotive Intelligence

Automotive Outlook

Efficiency Losses without intelligent Power Management

Several energy transformations from mains to loads

Standby consumption:
4 nuclear power plants
in the US for efficiency
losses only

DC/DC Conversion,
e.g. on PC motherboard:
20% losses

**AC/DC
Conversion
in power
supply:**
30% losses

Battery Discharge:
20% losses

Battery Standby:
50% losses

Battery Charge:
20% losses



Chris Calwell and Travis Reeder, Ecos Consulting; Carrie Webber, LBNL at Power Supply Workshop PEC hosted by Pacific Gas & Electric (PG&E), the Environmental Protection Agency (EPA), Lawrence Berkeley National Laboratory (LBNL), and the Natural Resources Defense Council (NRDC), San Francisco, CA January 14, 2002.

Energy Savings with intelligent Power Management

Example: Personal Computer



Energy Efficiency and Renewable Energy Federal Energy Management Program

Computer Cost-Effectiveness Example (Desktop PC, 500+ Mhz, 300 W Power Supply)

<i>Performance</i>	<i>Base Model (No Power Management)</i>	<i>Recommended Level (Power Management Enabled)</i>
<i>Annual Energy Use</i>	252 kWh	133 kWh
<i>Annual Energy Cost</i>	\$15	\$8
<i>Lifetime Energy Cost</i>	\$53	\$28
<i>Lifetime Energy Cost Savings^a</i>	–	\$25

a) These savings do not include the benefit from reduced air-conditioning costs, which depend on location and building type.

Source : www.eren.doe.gov/femp/procurement, July 2000

- Based on that you can save for each PC annually 119 kWh equivalent \$7
- With 129 mil. PCs produced worldwide in 2001 (source: Gartner)
the total saving potential is ~ \$900M or ~ 15 GWh or ~ 10 power plants!

Power Distribution and Energy Treatment

Eupec's Development Fields of Applications

Future



Distributed Energy Supply Systems



Domestic Appliances



Automotive



Classics



Energy Systems



Drives



Traction

Power Management & Supplies Applications and Target Markets

PC / Server / Telecom Power Supply

Low on-resistance and low switching losses are critical to this market

Power supplies for

- PCs
- Servers
- Telecom



Lighting Ballasts / ESL

Driven by performance and size considerations & cost

- Electric lamp ballasts for consumer and industrial applications
- High intensity discharge (HID)
- Lighting for industrial and automotive applications

Adapters / Chargers

Reduced system size / weight

- Notebooks
- Printers
- Games
- Handsets



Consumer Electronics

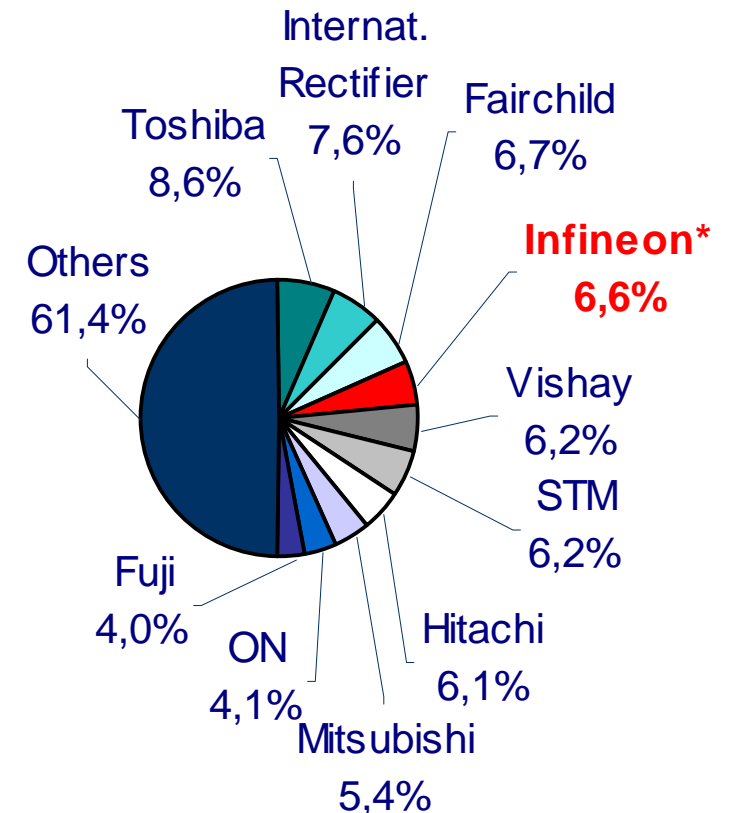
Driven by system cost, size and weight (power supply)

- Color TVs
- Beamers
- Set-top box / DVDs
- White goods

Key Competence in overall Power Semiconductors

Moving up from Position 7/8 to Position 4 in 2001

Rank	Supplier	2000	2001	Change
1.	Toshiba	9.3%	8.6%	-0.7%
2.	International Rectifier	8.1%	7.6%	-0.5%
3.	Fairchild	7.8%	6.7%	-1.1%
4.	Infineon *	5.6%	6.6%	1.0%
5.	Vishay	7.4%	6.2%	-1.2%
6.	STMicroelectronics	5.6%	6.2%	0.6%
7.	Hitachi	5.7%	6.1%	0.4%
8.	Mitsubishi	4.5%	5.4%	0.9%
9.	ON Semiconductor	6.2%	4.1%	-2.1%
10.	Fuji Semiconductor	4.5%	4.0%	-0.5%



Highlights Industrial Power (FY 02/03)

Power Management & Supply:

- Major market share gain with DC/DC converters in motherboard applications
- Completed product offering for Core Supply Chipset Solution (PC / laptop motherboard)
- Expanded AC/DC portfolio to cover lower power applications (e.g. DVD player and Settop-Boxes)
- Improved competitive cost position and achieved technological leadership (Silicon Carbid, CoolMOS™)

High Power Conversion:

- No. 2 worldwide in high power conversion with 21.7% market share*
- Strengthen #1 position in medium / high power drives
- Set new standards for medium power drives and
- Straight on track to solution business with new IGBT stack assemblies

Converting & Controlling Power

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Automotive Outlook

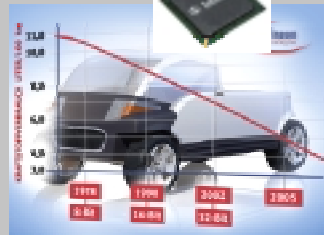
Enabling System Integration of Automotive Electronics Innovative Semiconductor Solutions for ...

... Powertrain, Safety, Comfort and Infotainment

System on Board Level

Powertrain

AUDO-NG 32-bit microcontroller enable new engine concepts and reduce fuel consumption and emission



System on Vehicle Level

Safety Management

Pressure sensors monitoring tire pressure, initiating alert if pressure is too low, to protect passenger's health



System on Traffic Management Level

Infotainment

TCG Telematics Communication Gateway leveraging automotive and wireless know-how



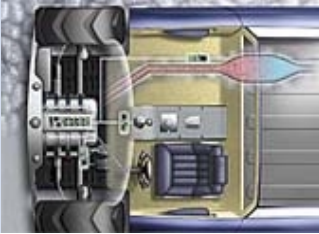



Smart power door module offers up to 9 comfort functions on one chip



Comfort Management

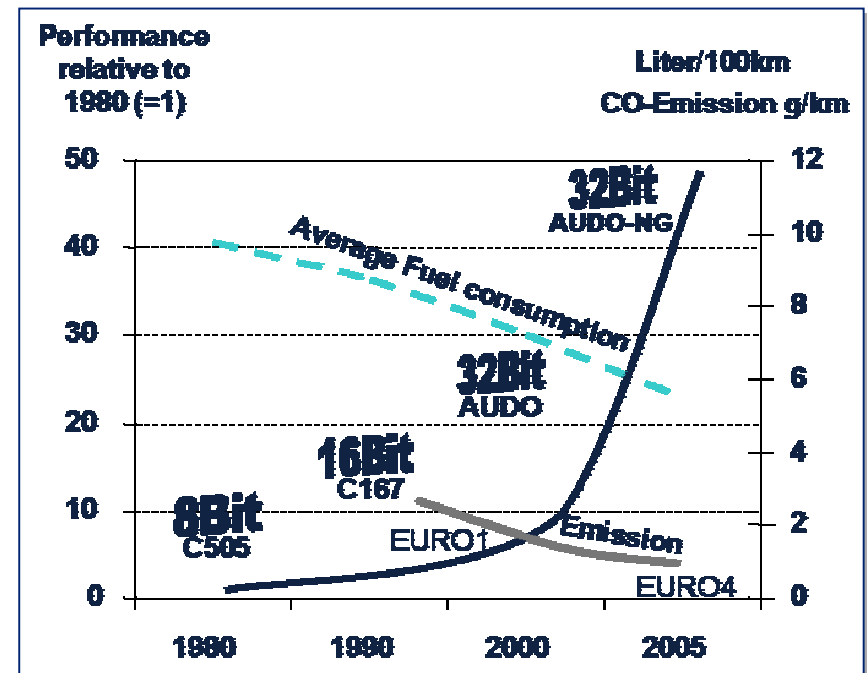
Automotive Semiconductor Solutions

Strong Portfolio Enhanced Recently by SensoNor Acquisition

		Sensing	Computing	Actuating
Powertrain <ul style="list-style-type: none"> - Diesel Engine Mgmt. - Gasoline Engine Mgmt. - Transmission Control - Starter/Alternator 		<ul style="list-style-type: none"> ■ Pressure Sensors ■ Hall Sensors 	<ul style="list-style-type: none"> ■ 16 bit μC ■ 32 bit TriCore® (μC + DSP) 	<ul style="list-style-type: none"> ■ MOSFETs ■ IGBTs ■ Regulators ■ Transceivers ■ Smart Power ■ System ICs
Safety Management <ul style="list-style-type: none"> - ABS/Traction Control - Suspension - Airbag + Restraint Systems - Power Steering - Tire Pressure Monitoring 		<ul style="list-style-type: none"> ■ Pressure Sensors ■ Hall Sensors ■ RF ICs 	<ul style="list-style-type: none"> ■ 8 bit μCs ■ 16 bit μCs ■ 32 bit TriCore® (μC + DSP) 	<ul style="list-style-type: none"> ■ MOSFETs ■ Regulators ■ Transceivers ■ Smart Power ■ System ICs
Comfort Management <ul style="list-style-type: none"> - Light Control - Heating, Ventilation, Air Condition - Door & Seat - Smart Battery Terminal 		<ul style="list-style-type: none"> ■ Hall Sensors ■ Temp Sensors ■ RF ICs 	<ul style="list-style-type: none"> ■ 8 bit μCs ■ 16 bit μCs 	<ul style="list-style-type: none"> ■ MOSFETs ■ Smart Power ■ Regulators ■ Transceivers
Infotainment <ul style="list-style-type: none"> - Telematics - Navigation - Multimedia - Car Audio - Dashboard 		Telematics Gateway Controllers, Wide Range (GSM/GPRS) and Short Range (Bluetooth, WLAN) communication solutions, GPS, High Frequency ICs, CAN/MOST Transceivers, Plastic Optical Fibres, Multimedia Cards, Power ICs, Security ICs		

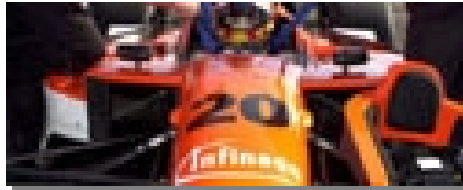
Powertrain - Increasing Energy Efficiency Needs Complex Data Processing and Controlling

- Most significant potential for fuel efficiency is the efficiency of the engine. This requires high performance control.
- Increasing number of sensors:
 - Euro3: in average 15
 - Euro4: between 20 and 30
 - Cam less engine: average 30
- Increasing amount of data to be processed for engine management:
 - 1996: 16 bit microcontroller to fulfill Euro2 has same power as an Intel 386 processor
 - 2005: 32 bit microcontroller to fulfill Euro4 has same power as an Intel Pentium I processor



Motor Sports and Business: Learning from each other

Motor Sports



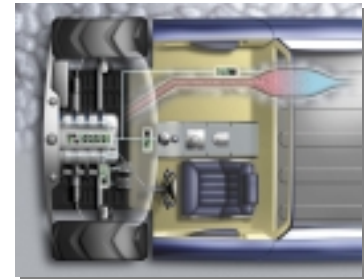
- Highest priority on performance
- E.g. shift by wire first in motor sports

- Main focus on safety through mechanics
- Electronics may support mechanics if allowed (e.g. TPMS, ABS)

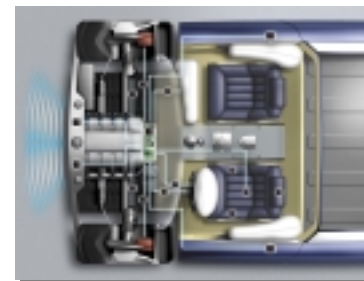
Business



- energy efficiency
- E.g. energy distribution and management (Fuse and relay replacement) first in street vehicles



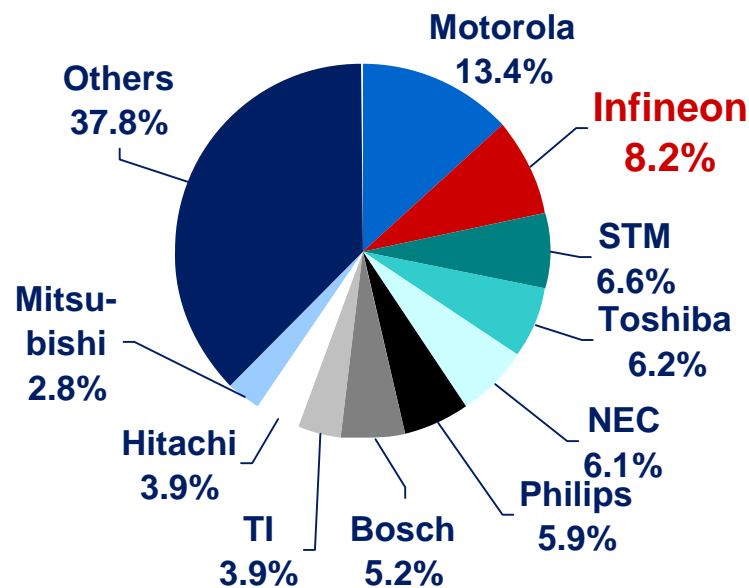
- Electronics allow additional safety applications, mechanically not solvable (e.g. airbags, ESP, intelligent light management)



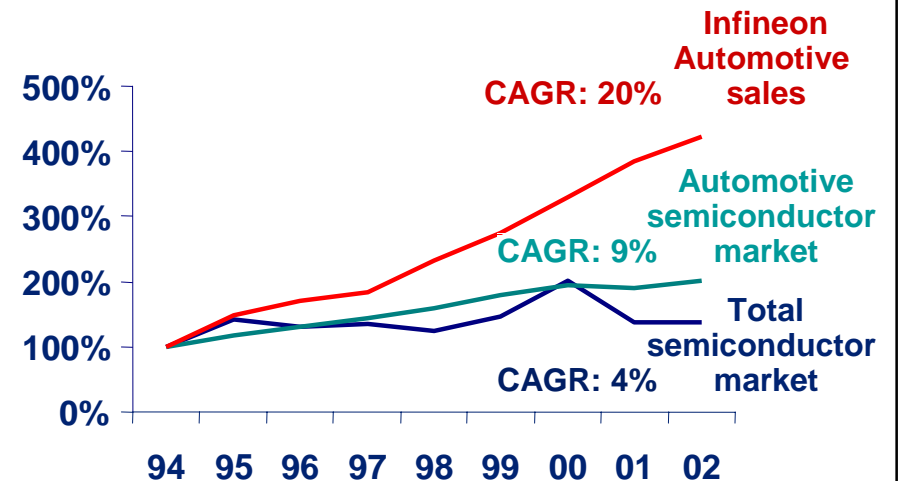
Infineon Automotive Ranks No.2 Worldwide Continuously Outperforming the Market

**Infineon Automotive 2002
No. 2 World, No.1 Europe**

Continuous Outperformance



- Market: \$11,505M US.
- USGrowth 2001/2002: 6%



- Strong European market development compared to rest of world
- Strengthened regional business in NAFTA/Japan
- Improved relationships to major automotive system vendors

Strong market position in Europe secures technological leadership

Highlights Automotive Semiconductors (FY 02/03)

- Continuously outperformed Automotive Semiconductor Market and secured #2 WW and #1 EU position
- Increased revenue in NA and became No. 4
- Grew 4 times faster than market in JP
- 20% Growth in Automotive Power Business
- First success of Power ASSP approach
- Further establishment of next automotive 32 bit microcontroller generation (Powertrain / Safety)
- Strategic entry into growing "Infotainment" market
- Rounded up automotive product portfolio and expanded US business by successful SensoNor acquisition
- Strategic partnerships with leading car manufacturers for co-development on future automotive semiconductor technologies

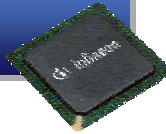
Converting & Controlling Power

Defining Automotive Intelligence

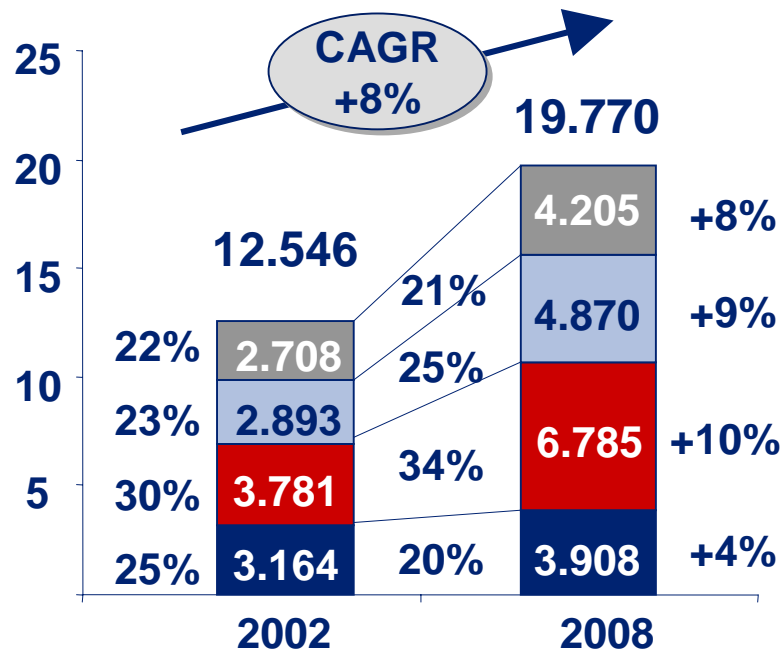
Automotive Outlook

Automotive Semiconductor Market Market Development by Application

Overall CAGR: 8%



in \$bn



■ Powertrain ■ Safety
■ Body Systems ■ Driver Infotainment

Key Trends

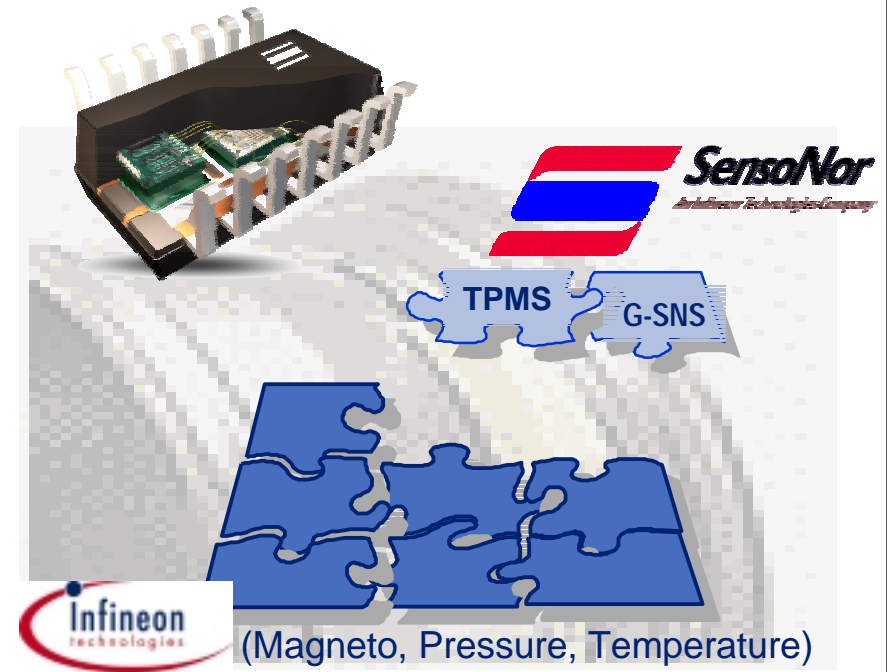
- Increasing sensor content is key to intelligent vehicles
- Improved software and IC performance to shorten design cycles of vehicle manufacturers
- Reduced weight and power dissipation ("silicon instead of heat sink")
- Increasing Infotainment applications, driving GSM/GPRS/UMTS chipsets, Bluetooth and GPS solutions
- In-car networking requires intelligent Bus Systems ("system on vehicle")

**Semiconductors are key enabling technology
for increased automotive performance**

New Laws: e.g. Direct Tire Pressure Monitoring

One-stop Shopping for Direct TPMS Solutions

- **Today:** No. 1 supplier of pressure based side airbag sensors and Hall based wheel speed sensors (ABS).
- **Key sensor trends:** Further integration of functionality and standardized signal transmission concepts.
- **Semiconductor sensors:**
One of automotive electronics key drivers with CAGR of 20%.
- **TPMS:** More and faster innovations through bundling SensoNor's sensor expertise and Infineons RF, ASIC and Transponder competencies.
- **Aim:** Double Infineon's market share for automotive semiconductor sensors to 15%.



New Markets: e.g. China

Cost Effective Semiconductor Solutions

- Largest market for consumer drives (white goods), strong growing market for consumer & PC
- Highest growth rates in the automotive market - but on the other side it is very cost sensitive
- Increasing awareness for environmental care: Higher power efficiency, lower emission, lower fuel consumption
- Demand for similar safety / comfort standards known from EU/US/JP
- Local industry slowly also expanding into electronics
- Infineon's ongoing China activities:
 - Close contacts with OEMs, Tier 1 suppliers and their local JV companies in China
 - Technical co-operations with Universities, setting-up Automotive, μ C, Power labs
 - Started local project regarding consumer drives with focus on APAC/China
 - Increase local resources in sales, marketing and support, but also in R&D

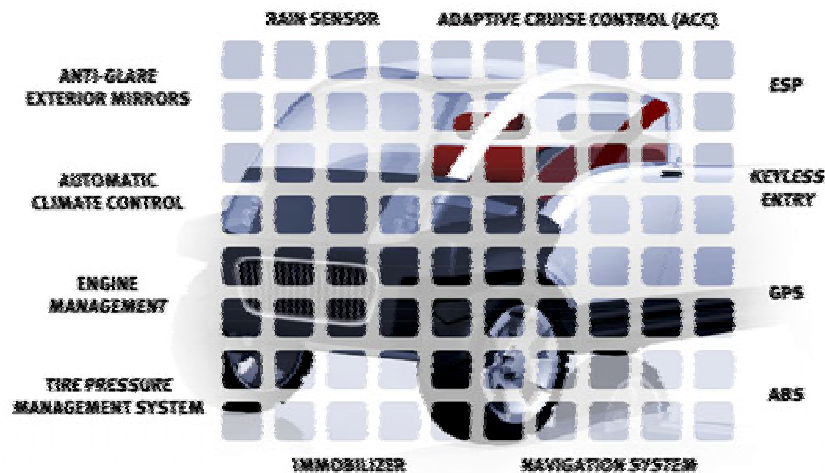


Largest growth for cars
<100k RMB (~11k €)

Defining Automotive Intelligence

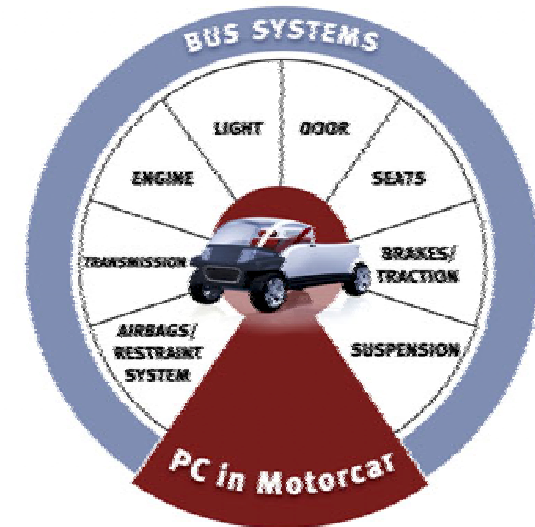
Semiconductors are Light Vehicles' Nerves, Brain and Muscles

Today



Up To 80 Separate Components/Systems

In 2010



All Vehicle Components Networked

- Automotive electronics can no longer focus on isolated applications
- Highly networked applications for sharing sensed data and to influence each other, e.g. ACC controls engine management and braking
- Need for standardized deterministic control and communication busses to guarantee safety and security at any time

The Road to 2010

90% of all Automotive Innovations will be driven by Electronics

Production of **73** million light vehicles from 8 OEMs
Electronic content: 35% (22% Hardware + 13% Software)
Semiconductor content per light vehicle: ~**300** Euro

2010



2002

Production of **57** million light vehicles from 20 OEMs
Electronic content: 22% (18% Hardware + 4% Software)
Semiconductor content per light vehicle: ~**200** Euro



Never stop thinking.