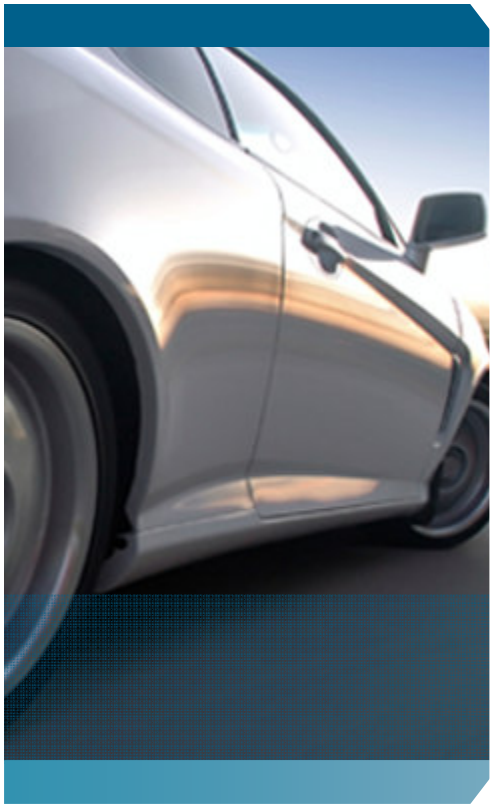

Freescale Technology Forum

Design Innovation.

Nov 5th , 2008

Automotive Market Trends

Driving Automotive Semiconductor into a Greener, Safety Oriented Future

Jerwern Yi (易生海）

Automotive Marketing Manager，China

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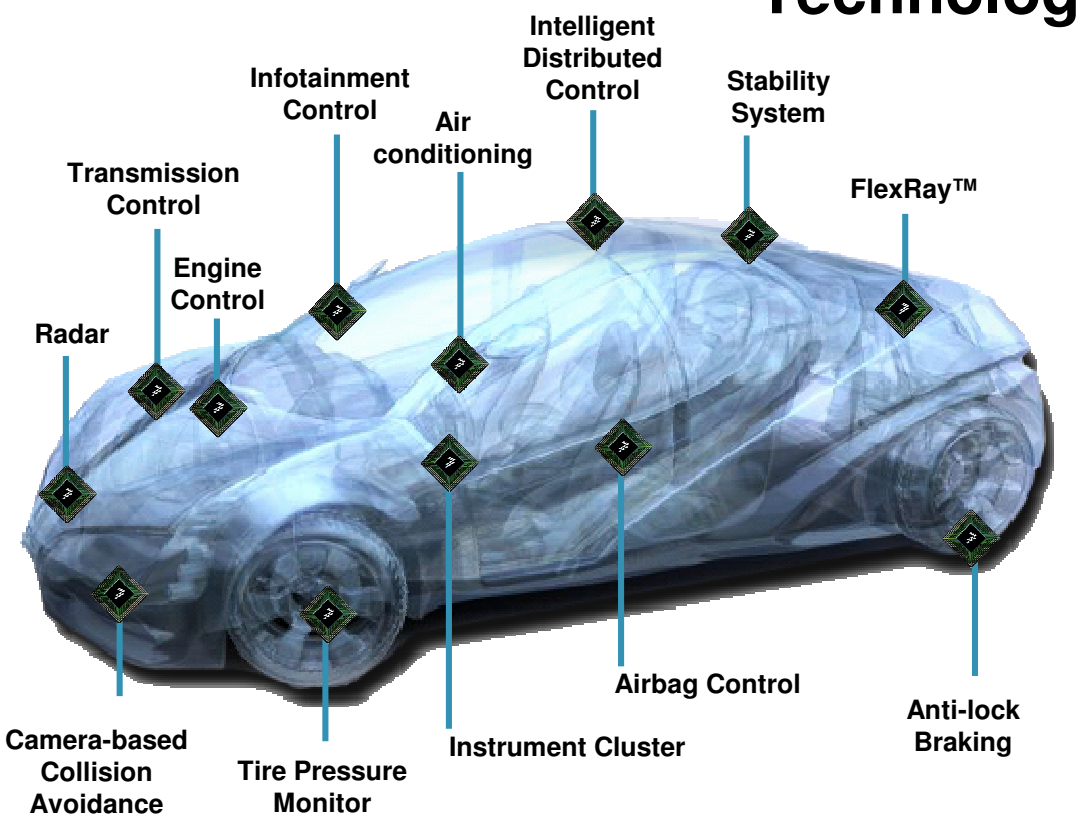
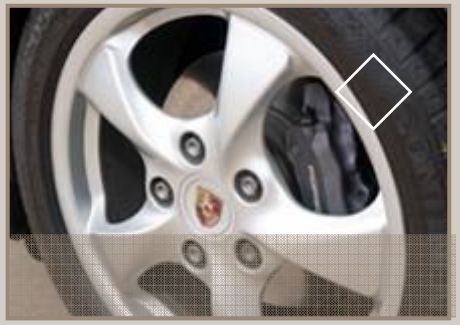
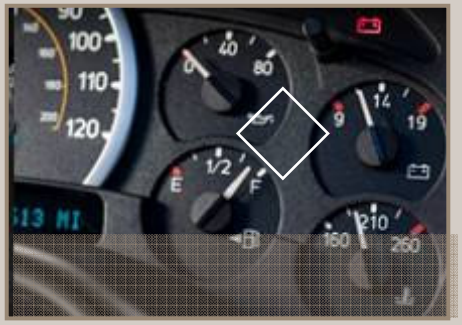
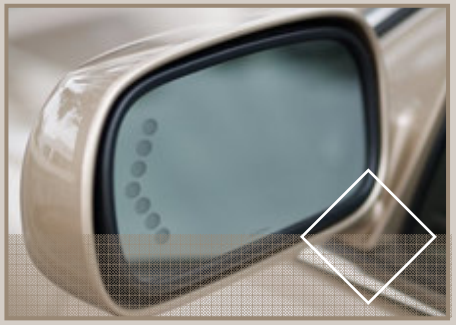
Technology that changes our world



- $5.7B Revenues (2007)
  - 30% automotive
  - No. 1 in automotive semiconductors supplier since more than 20 years
- Over $1.2B investment in research

#1 in total auto ICs
#1 in auto microcontrollers
#2 in MEMS sensors



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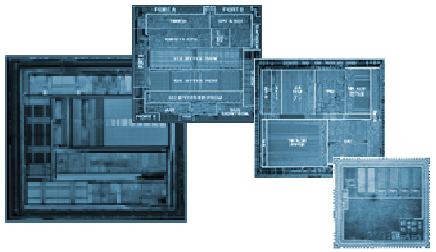
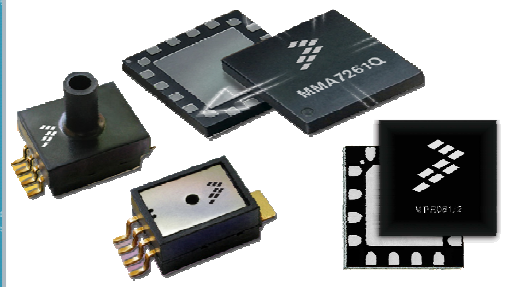
Freescale Leadership Products and Technologies



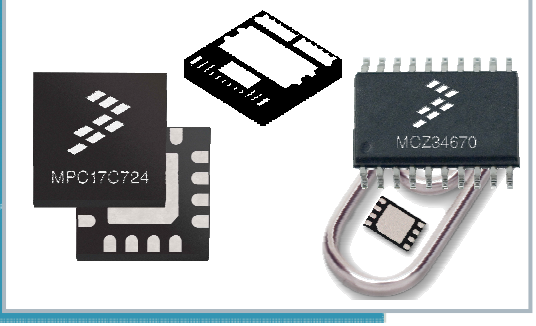
▶ Microcontrollers

- Market-leading architectures (Power Architecture™, S12, S08) covering the performance spectrum
- Industry-leading flash technology
- Strong tool and software ecosystem



▶ Sensors

- More than 25 years of experience designing and manufacturing automotive-grade MEMS
- Leadership integration capability, with analog and MCUs



▶ Analog

- Highly efficient integration of power, analog and digital on single chip or SiP utilizing SMARTMOS™ technology
- Global design capability for automotive analog and power
- Rich library of automotive analog IP

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Global Automotive Relationships

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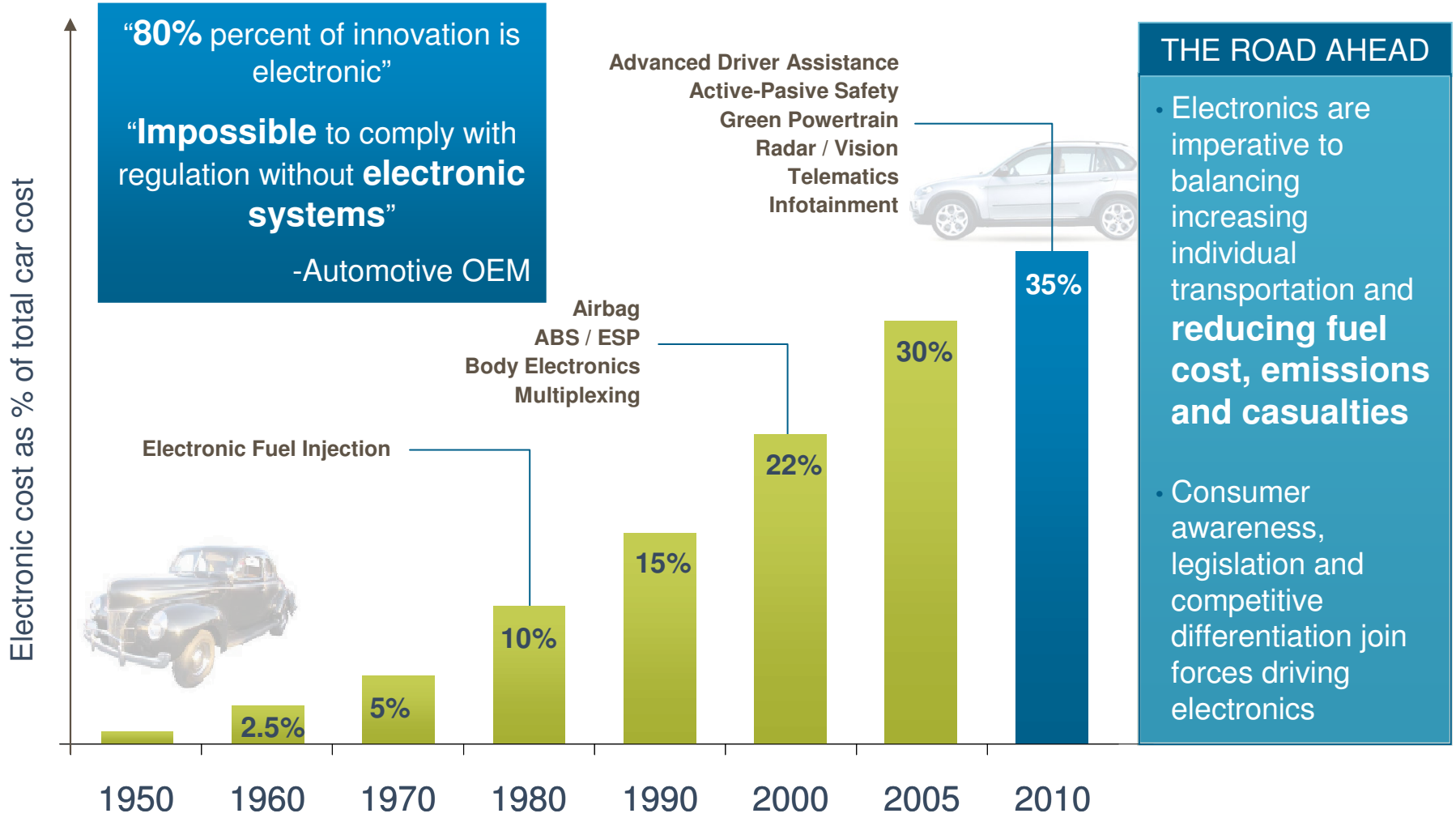
Automotive Electronic Content Growth

"**80%** percent of innovation is electronic"

"**Impossible** to comply with regulation without **electronic systems**"

-Automotive OEM



THE ROAD AHEAD

- Electronics are imperative to balancing increasing individual transportation and **reducing fuel cost, emissions and casualties**
- Consumer awareness, legislation and competitive differentiation join forces driving electronics

Sources: Bosch, PSA, Freescale Strategy

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Automotive Electronic System Trends

Going Green

- Stringent emissions regulation
- Hybrids, gasoline direct injection
- Electronics replacing hydraulics

Safety

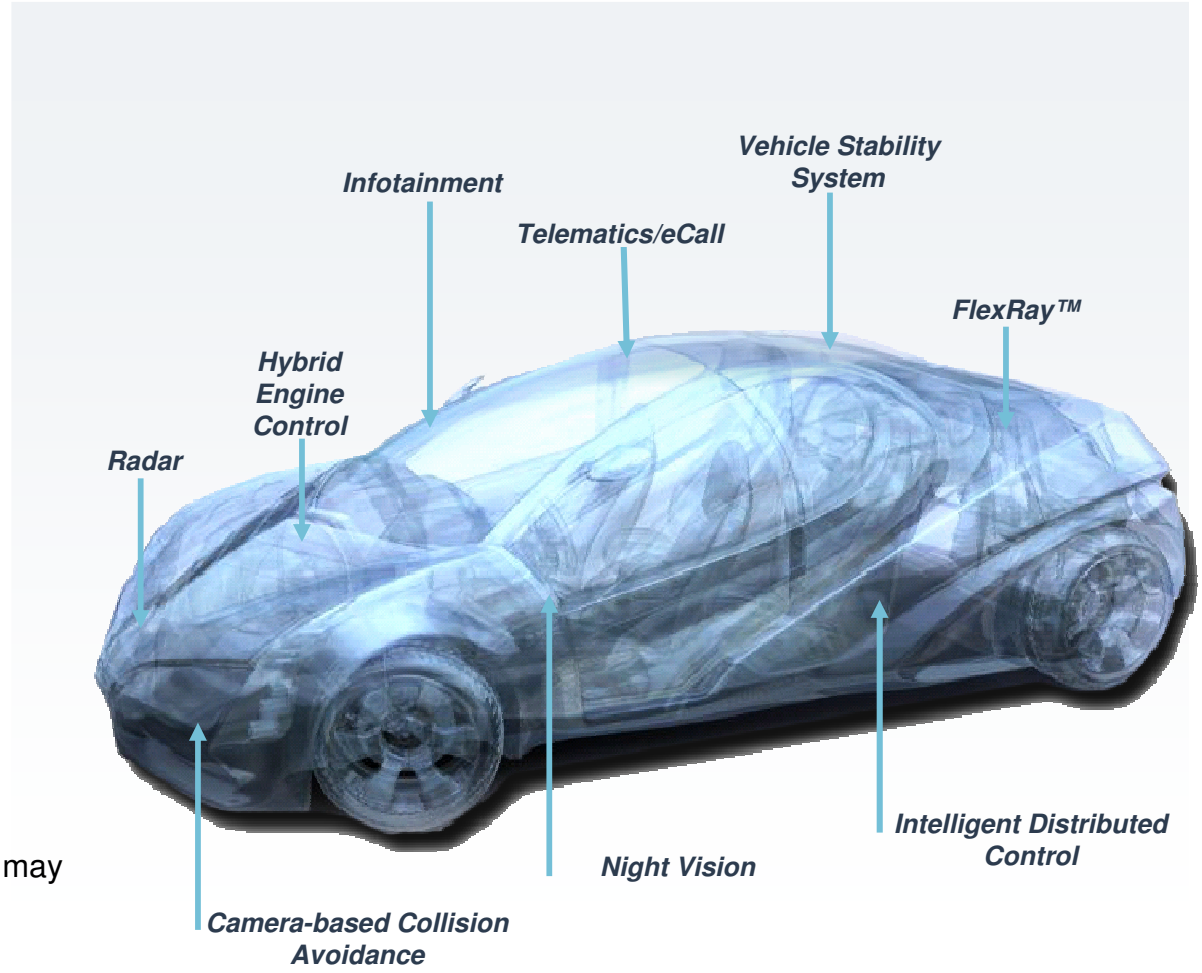
- Active safety systems proliferating
- Intelligence driving performance
- Higher standards of reliability required

Connectivity/ Infotainment

- “Standard” convenience features
- Wireless inside and out
- Regulations: Telematics/eCall systems may become mandatory

The Affordable Vehicle

- 30M cars in emerging markets by 2009
- Ultra-low-cost vehicles



*source: IMS Research

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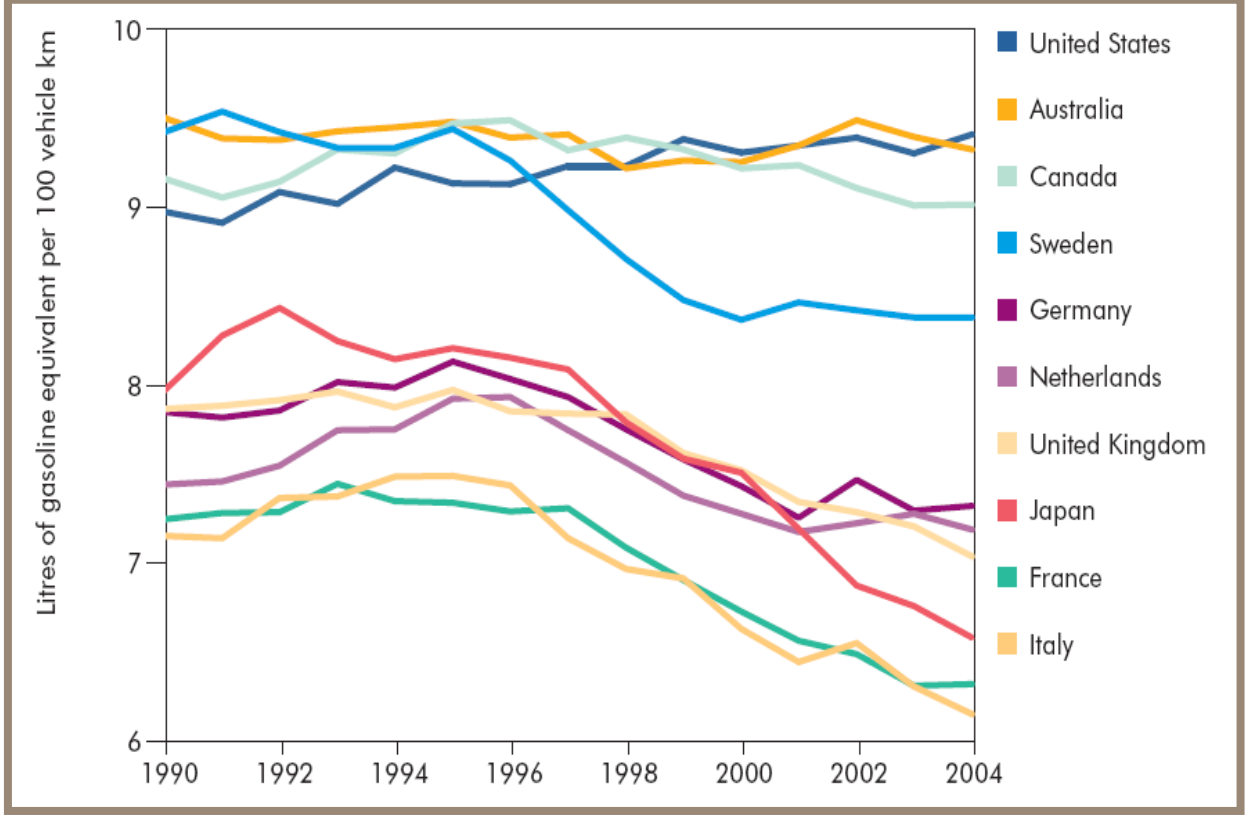
Green , Emissions Reduction



Source: IEA

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Environmental regulations around the world

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Automotive industry going “green”

▶ Drive for fuel efficiency: $4 per gallon gasoline in US, $10 in Western Europe

▶ Environmental / green — regulation

- US NHTSA target to improve CAFE standards by 40% in 2020
  - Increase CAFE from 25 mpg to 35 mpg (CO_2 reduction from 219g/km to 156 g/km)
- EU target to reduce CO_2 emissions by 2012 to 120g/km
- Emerging market likely to adopt European emission standards

▶ Sustainable solutions must be found to reduce the amount of fuel consumed

- Hybrid cars gaining significant popularity in the US
- Diesel + Mild hybrid gaining popularity in Europe
- Electrical vehicles and combustion range extenders
- Improved small engine management and ebikes for emerging markets
- Reduce vehicle weight through more efficient subsystem design, reduction of cabling

▶ Materials used in vehicles must be environmentally friendly

- Elimination of hydraulic systems
- Decreased use of Pb and other potentially harmful chemicals

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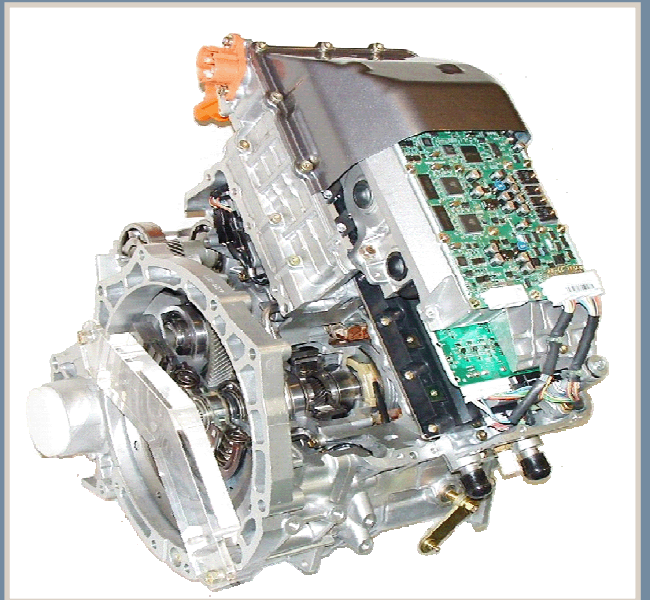
Engine Efficiency—MPC55xx MCU Solutions

- 32-bit MCUs built on *Power Architecture™* technology
- *Dual Core Capability* from eTPU optimises Engine control by providing task partitioning
- *SIMD DSP* enabled complex computing of the model based combustion algorithms
- Proven *embedded automotive grade flash* that functions in harsh engine environment
- MPC55xx *Knock Detect Software* improves fuel economy up to 5%, prolonging engine life
- Enhanced *ADC performance*, driven by increasing number of sensors and actuators

Going Green



MPC55x family is the main controller for ~50% of all Powertrain ECUs

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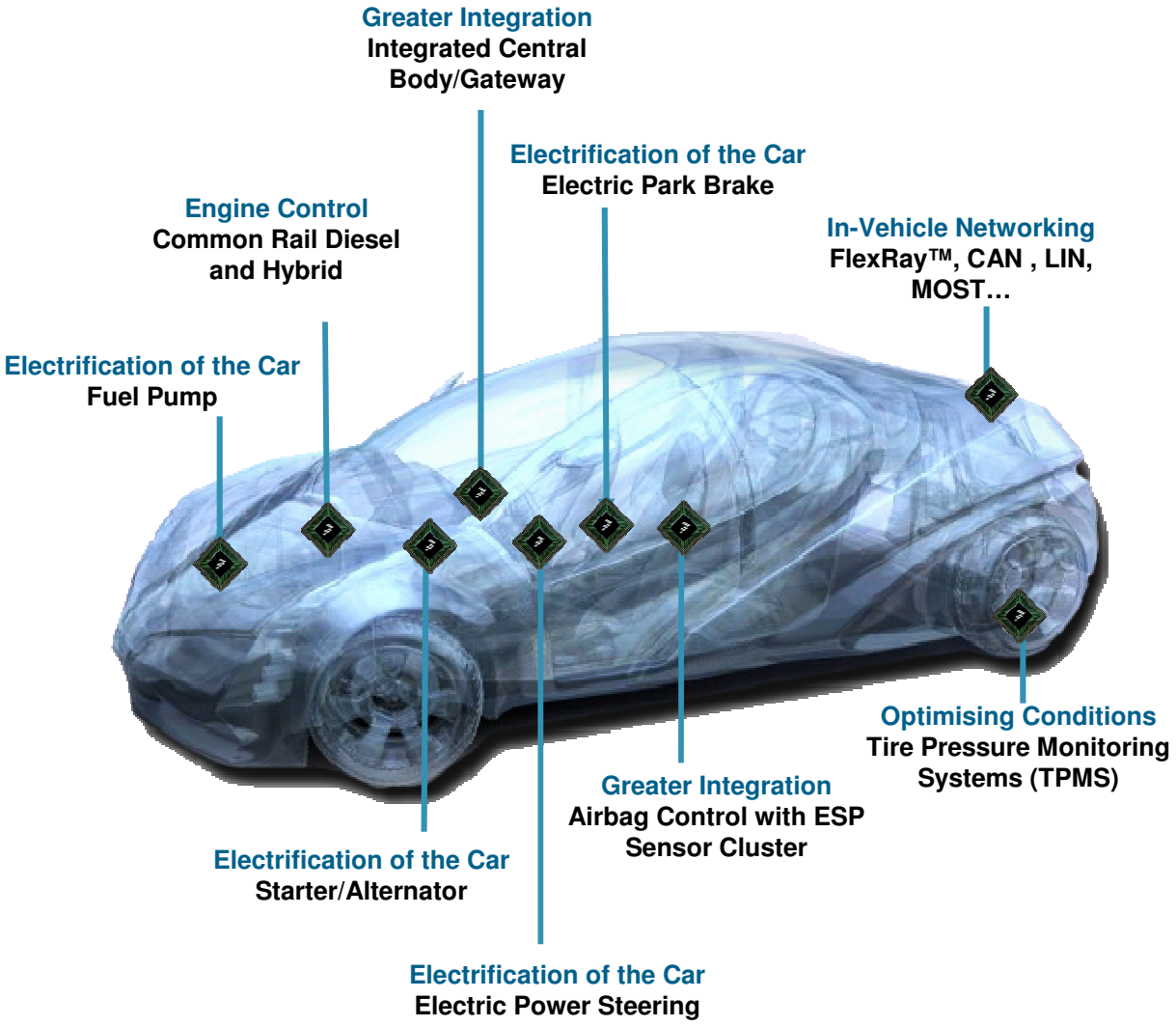
Emissions Reductions Focus Areas



Weight Reduction

► *Electrification of the car* reduces weight by replacing Hydraulics, mechanics

►New *In-Vehicle Networking* techniques means fewer wires, lighter wiring harness

►*Greater Integration* of features means less modules, with less wires

Energy Efficiency

►More efficient *Engine Control* technology such as Common Rail Diesel and Hybrid Engines

►*Optimising Conditions* by alerting the driver to potential problems, i.e. TPMS

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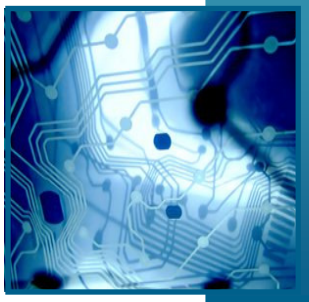
Electrification of the Car

▶Electric Power Steering (EPS)

- Replacing hydraulics results in weight reduction
- Freescale offers Power Architecture™ based 32-bit chassis MCUs, MC3370 power supply and MC33927 3-Phase Motor Pre-driver



▶Electric Park Brake

- Reduction of mechanical components results in weight reduction
- Freescale offers S12X 16-bit MCU for DC motor control, with MMA2260EG and MMA1260EG low G sensors for tilt measurement

▶Starter Alternator

- Electric motors help move the vehicle, provide stop/start capability, improving fuel efficiency especially when idle
- Freescale offers 32-bit chassis MCUs built on Power Architecture™ technology for motor control functionality

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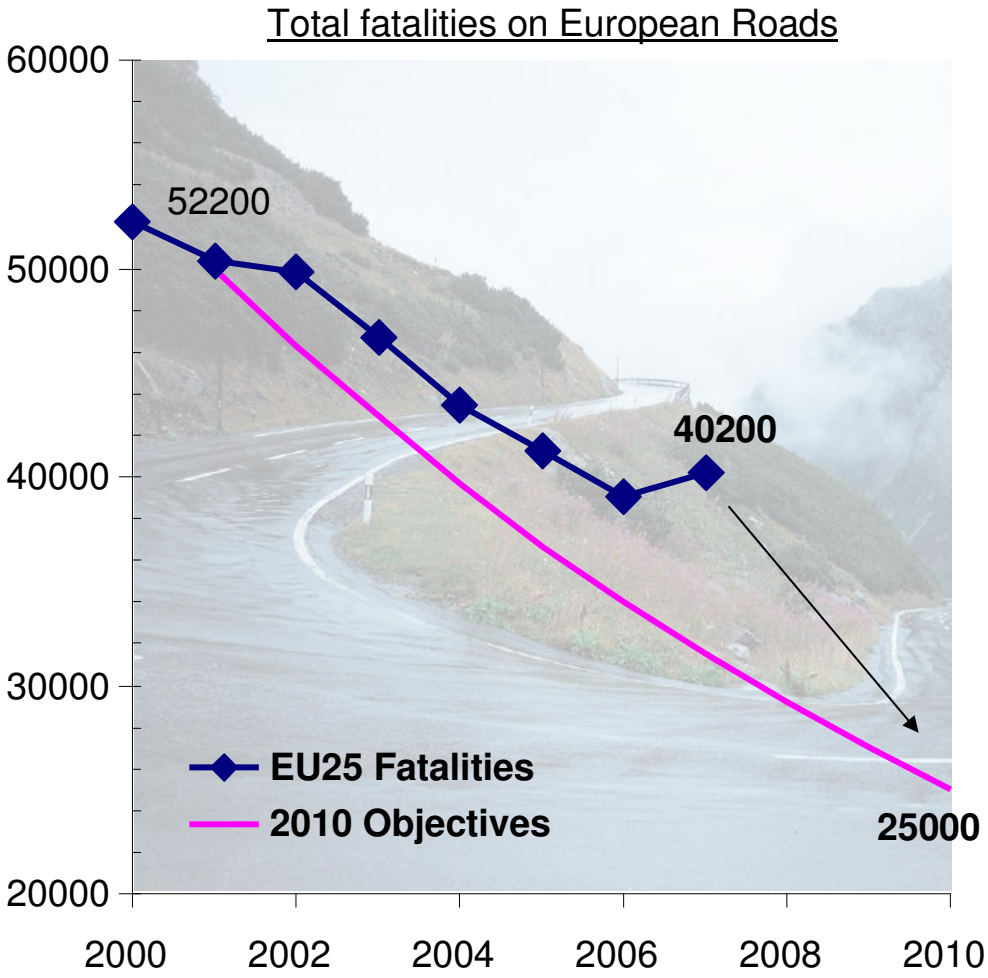
Safety

“The best car safety device is a rear-view mirror with a cop in it”

Dudley Moore (1935-2002)
English Actor

Example: Europe



Source: EU CARE, EuroNCAP, EuroRAP

1990: 70900 fatilities
2000: 52200 fatalities
2007: 40200 fatalities, increasing !
2010: 25000 fatilities (goal)

Road fatalities are costing the European society 2% of GDP

Large difference in death rate per 100k inhabitants across Europe

Sweden	4.9
UK	5.6
Germany	7.1
France	9.2
Italy	9.6
Czech Republic	13.5
Poland	15

3x more risk

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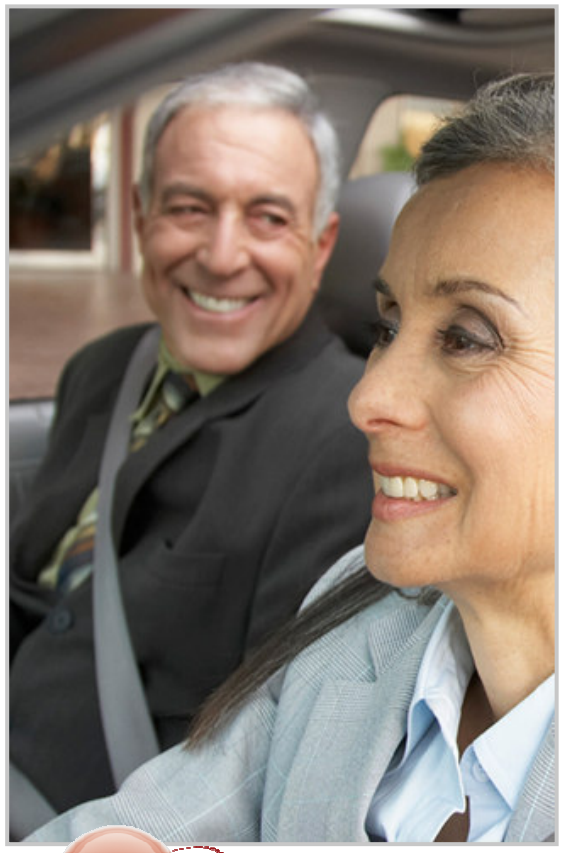
Automotive Safety Trends



Health & Safety

- US NHTSA: ESP mandatory for all cars sold in the US by 2012
- UN proposal to mandate ESP in Europe by 2012
- European E-call expected to be mandatory in Europe by 2010
- Advanced Driver Assistance System to assist aging driver population (Europe, North America, Japan)
- Proven, low-cost safety solutions like airbag and ABS are being implemented quickly in developing regions
- Emerging markets likely to adopt US/European crash test standards
- TPMS is now mandatory in the US
- Pedestrian protection now mandated in Europe
- Higher standards of reliability required
- Open industry standards and collaboration

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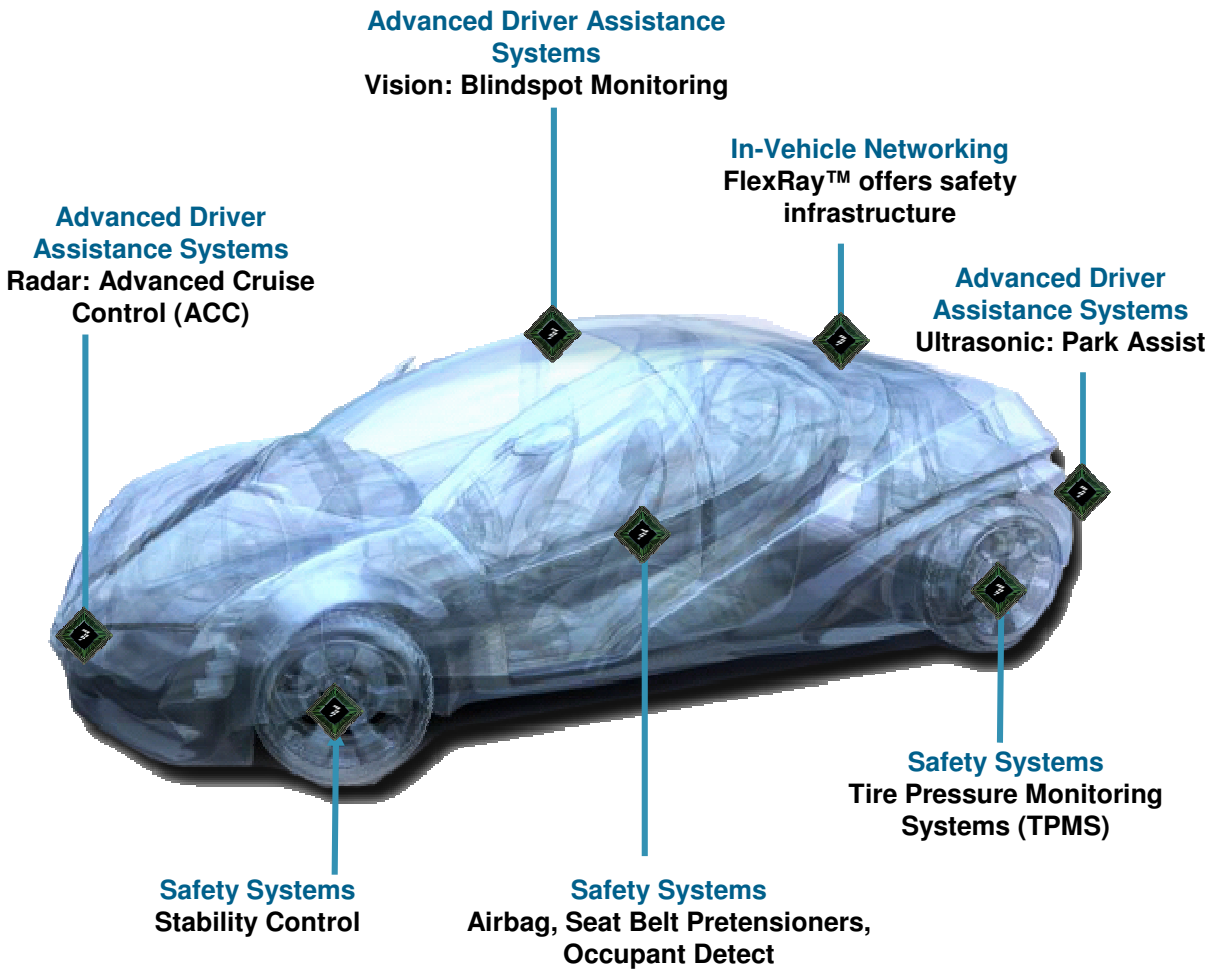
Safety Focus Areas



Safety Applications

► Many *Safety systems* such as Airbag, TPMS and ESP are heavily legislated

► *Advanced Driver Assistance Systems* are a growth area using Ultrasonic, vision and radar technology

Market Trends

►Safety critical applications are being developed with *Functional Safety* certification in mind such as IEC61508 SIL3 compliance

►FlexRay *In-Vehicle Networking* provides additional infrastructure for safety systems

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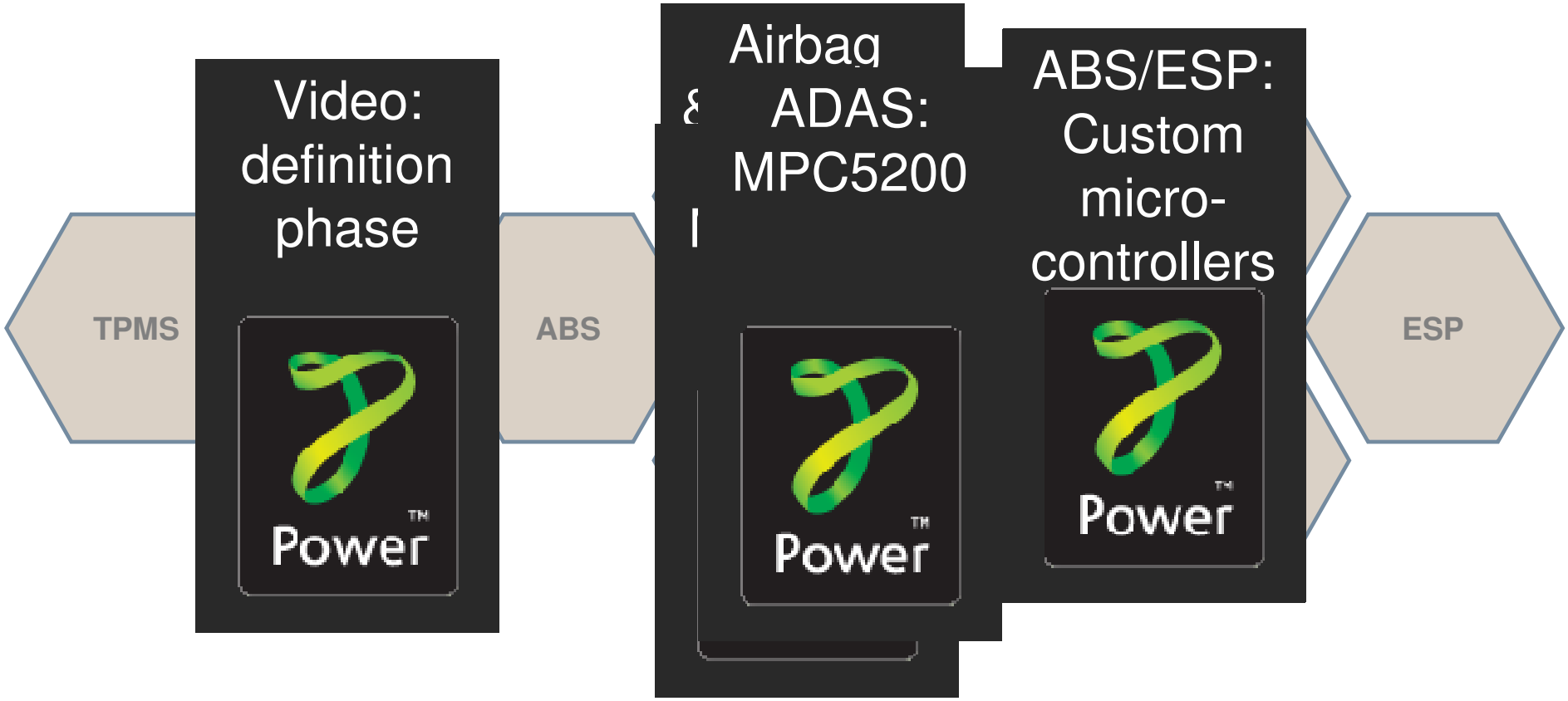
Automotive Safety Systems & Freescale Solutions



32-bit Power Architecture Technology is playing a dominant role in automotive safety applications.

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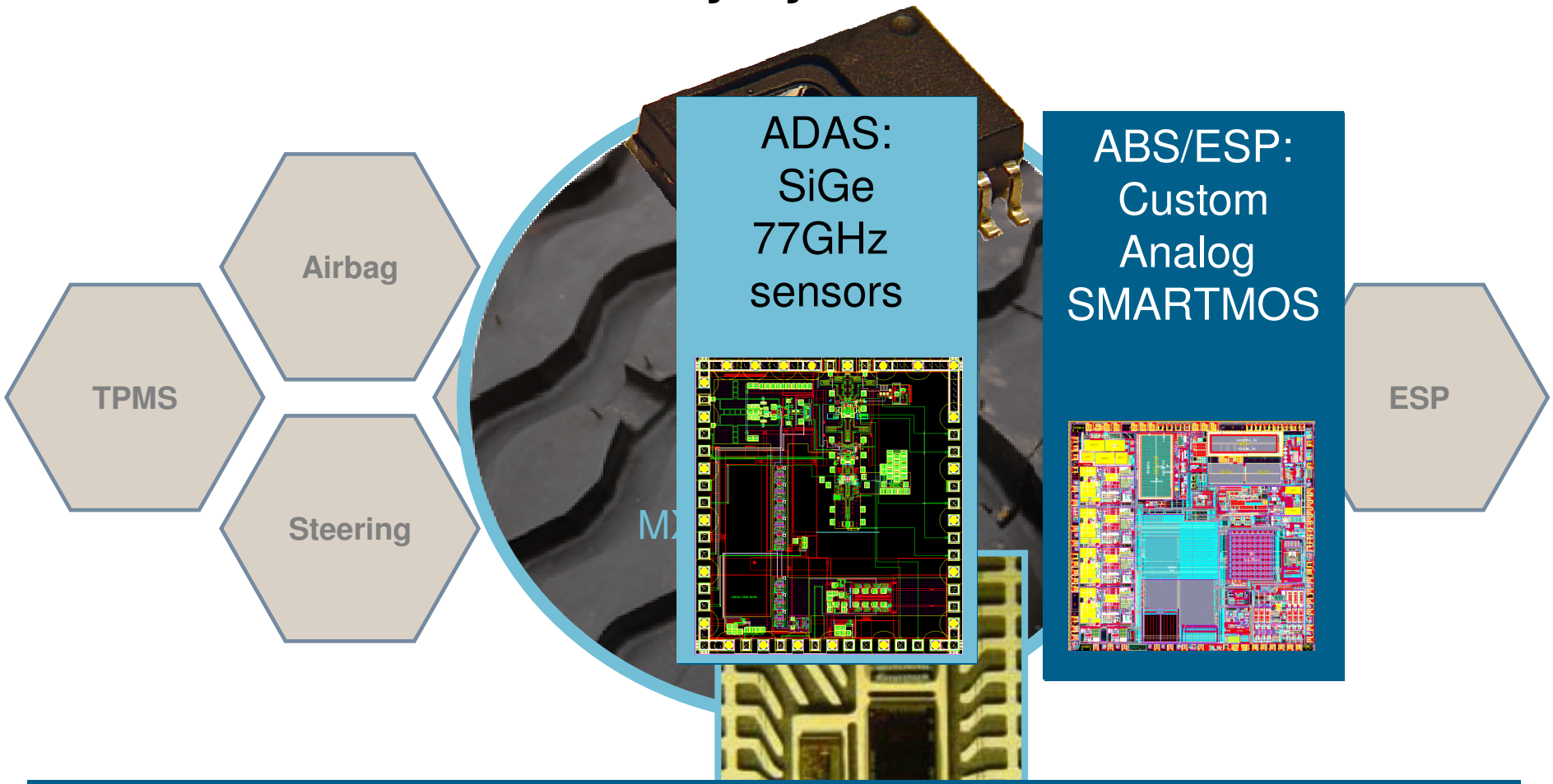
Automotive Safety Systems & Freescale Solutions



Our microcontroller portfolio and our system-level competence is greatly supported by our custom & standard analog and sensor products.

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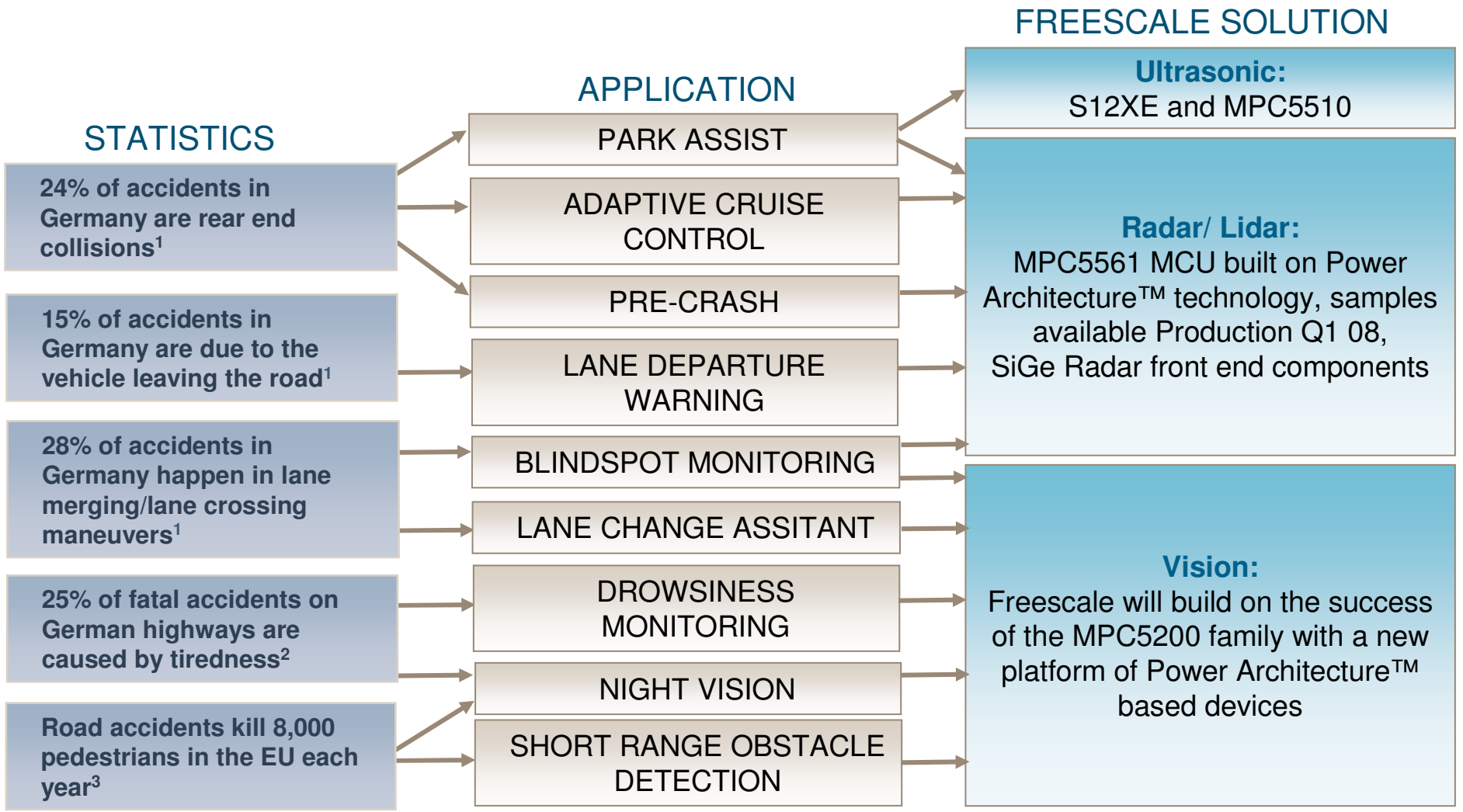
Advanced Driver Assistance Systems



1)INVENT-FAS 2) German Insurance Association (GDV) 3) UN ECE

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Sensors for Automotive Safety Systems

▶ Airbag Modules

- Accelerometer two-chip solution for greater design flexibility
- Integrated satellite sensor solutions
- HARMEMS next-generation technology

▶ Radar Systems

- Accident avoidance
- Blind spot detection
- Lane departure warning

▶ Tire Pressure Monitoring Systems (TPMS)

- Improves vehicle safety
- Precise direct tire pressure measurement
- Fully integrated device in single package

▶ Vehicle Dynamic Control

- Improves stability
- Detects driver's control inputs and actual response of the vehicle
- Provides overall control and monitoring of chassis systems

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Summary, Key messages

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Investment for the Future

▶ Advanced Safety

- High-performance Power Architecture™ solutions for radar and vision systems
- Pioneer in FlexRay™ technology for by-wire systems
- Gyro and low-g sensors for vehicle dynamics
- 77 GHz RF solutions for radar
- Cost reduced components for emerging markets

▶ Green Technologies

- Multi-core Power Architecture processors for next-generation powertrain (GDI, hybrids)
- Intelligent power switching and communication solutions to replace hydraulic systems
- Cost reduced components for emerging markets

▶ Infotainment

- mobileGT™ alliance of third-party software providers for Power Architecture solutions
- i.MX application processors for advanced multimedia
- Symphony audio DSPs for radio head units, external amplifiers and aftermarket audio solutions
- Cost reduced components for in car networking applications

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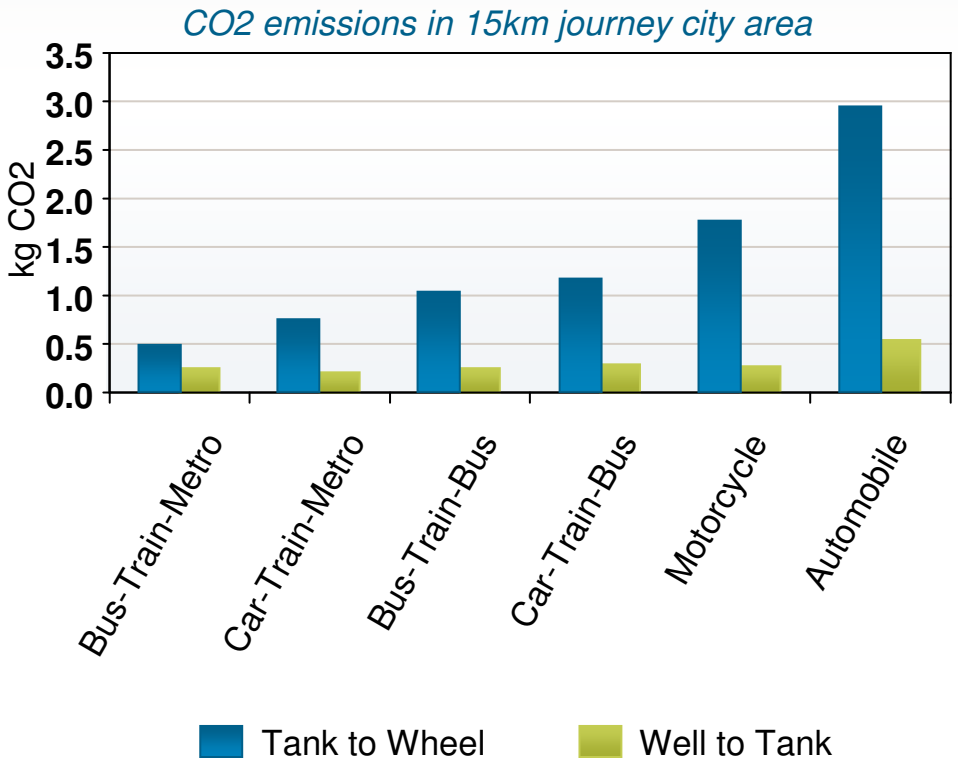
Sustainable **Mobility.**

- **Reduce** emissions and fuel consumption of personal cars

AND

- **Change** habits and shift to collective transportation means



Source: ADEME

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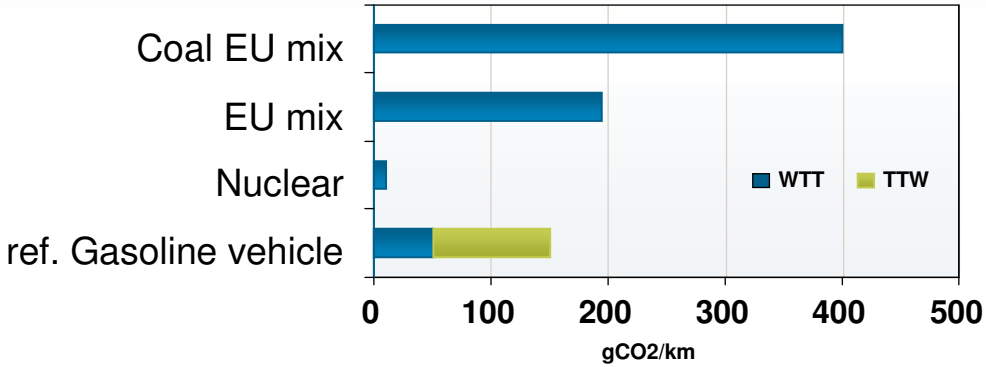
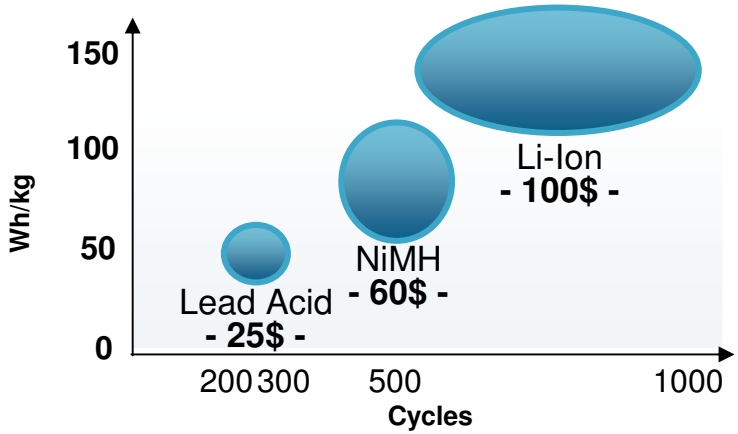
More **Electric Cars?**

- Well to tank **efficiency** and emissions
- **Refueling** time & business model
- Finding the right **economic balance**
- Going the **extra kilometer**

Electricity in transportation



Battery diversity



Source: Global Insight & Freescale

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Toward More Advanced **Driver Assistance?**

- In large cities, it is estimated that **20%** of the cars are only looking for a place to park *(ATEC-ITS)*
- Using **"eco-routes"** is estimated to save **16** to **19%** *(Carwings – Nissan)*
- People trained on.**"eco-driving"** are consuming on average **11.7%** less *(eco-driving Europe)*
- More Telematics
  - Communication of information, reservation, toll…
  - Traffic information, navigation, parking, …

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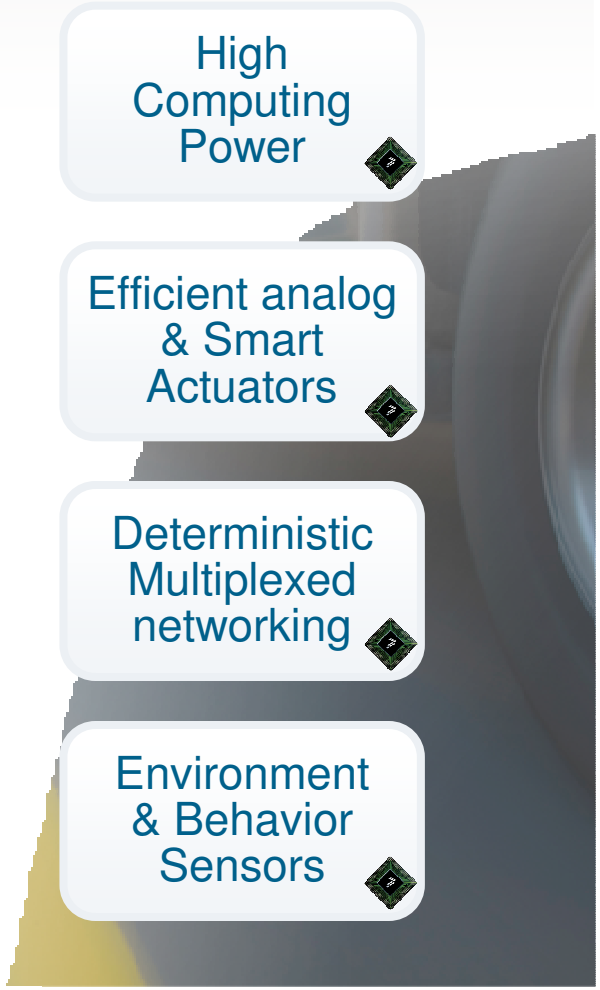
Key Enabling Technologies: Semiconductors and Electronics

- Whatever energy, the objective is to **reduce the consumption**
- Powertrain **optimization**
  - Increase the Engine efficiency
  - Minimize the energy losses by a well-defined energy management
- **Reduction** of the vehicle weight
  - Wires are the 2nd heaviest component
  - Reduce length & thickness
- **Replacement** of mechanical & hydraulic elements
  - Powered as required
  - Steering and Braking by Wire



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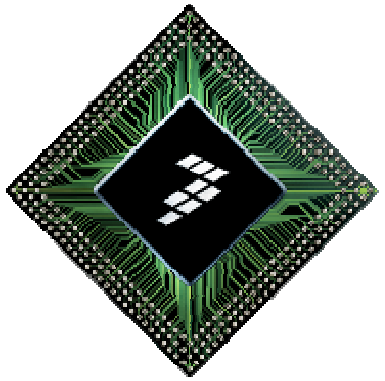
The world's leading automotive



Related Session Resources

Sessions

Session ID	Title

Demos

Pedestal ID	Demo Title

Meet the FSL Experts

Title	Time	Location

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