Microtec Nord 2018

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Automotive Digitalization:
Resilience and intelligent transfer concepts in the world of connected mobility

Introducing

Nexperia is a dedicated global leader in Discretes, Logic and MOSFETs devices. We became independent at the beginning of 2017…

…and bring decades of proven quality, commitment, and efficiency to automotive applications.

A new force in Discretes, Logic & MOSFETs

With a long history, broad experience and a global customer base.

Key Facts

- A dedicated company for Discretes, Logic and MOSFETs with leadership positions in all product areas
- Over 1.3 billion US$ revenues (2017)
- More than 13% market share
- High volume production of 90 billion units annually
- 11,000 Employees supporting customers globally
- 2 own frontend, 3 own backend manufacturing sites
- Over 60 years of expertise in semiconductors, the former Standard Products division of NXP
- Headquarters in Nijmegen, The Netherlands

The efficiency company for automotive

Innovation

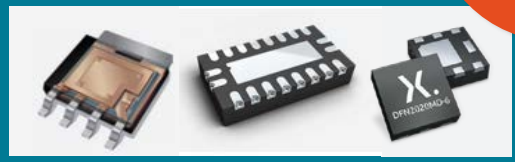
For electrification and safety

LFPAK MOSFETs
IVN protection
Configurable logic
FlatPower rectifiers
BISS transistors

Efficient products

+800 types launched within a year

Continuous innovation
silicon & package technology



Strategic focus on Automotive

sub-ppm
failure rate

Quality & reliability

Exceeding AEC-Q100/101

90 billion
products every year

Manufacturing

Vertically integrated – maximum efficiency

Discrete, Logic and MOSFET devices for…

Powertrain
48V Mild Hybrid
- DCDC converter 48V:12V
- Boost starter-generator
- Supercharger
- Water pump

Powertrain
12V ICE
- Engine control
- Fuel pump
- Transmission
- Alternator, battery, and starter

Lighting
- Front LED lighting
- LED Daytime running light
- Rear LED lighting
- Interior LED lighting

Infotainment
- Dashboard
- Car audio
- Connectivity audio
- Entertainment
- GPS
- Car navigation display

Comfort and control
- Power door
- Power window
- Climate control
- Seat control
- Mirrow and wiper control

Networking & Diagnostic
- CAN
- LIN
- FlexRay
- Ethernet
- BroadR-Reach
- Bluetooth, WiFi
- USB

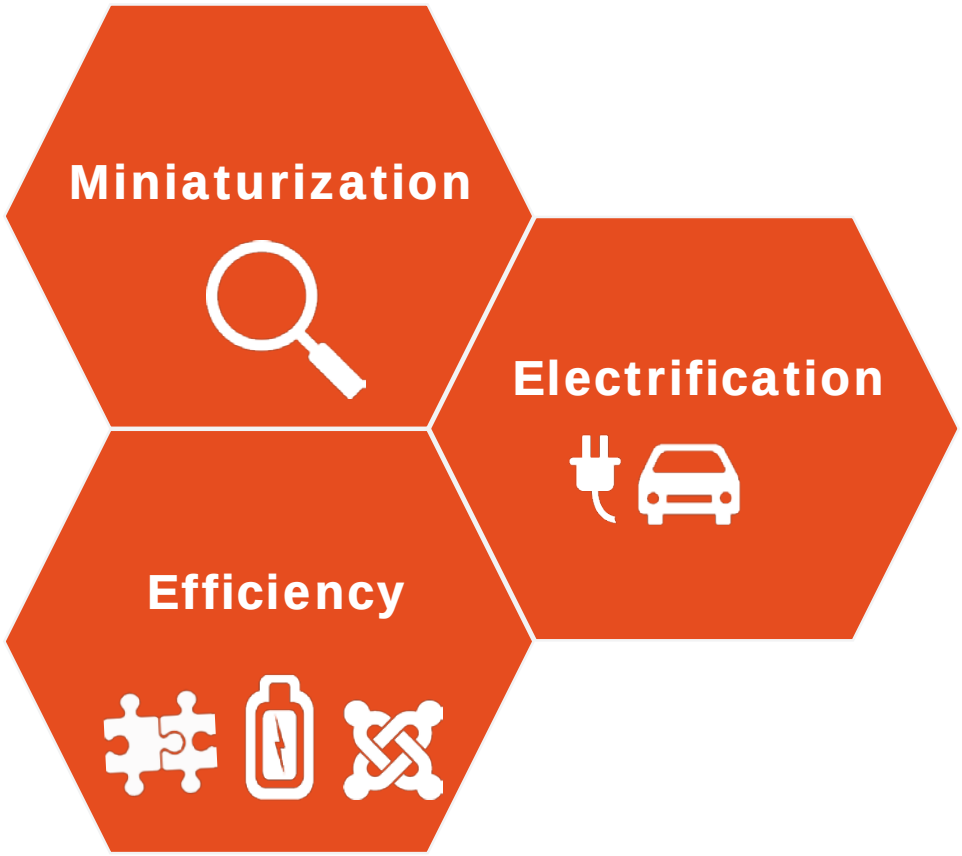
Safety and control
- ADAS
- Airbag
- TPMS
- Collision warning
- Parking assistent
- Back monitor

Chassis
- Steering / EPS
- Braking / ABS
- Electronic Parking Brake
- Traction control
- Suspension
- Roll stabiliation

Covering all basic functions enabling automotive electronic applications

- Switching MOSFETs
- ESD / surge protection
- Battery protection
- Free-wheeling diode
- Flyback diode
- DCDC conversion
- Voltage regulation
- Shift register
- I/O expansion
- LED drive

Continuous innovation in silicon & package technology to support Automotive trends

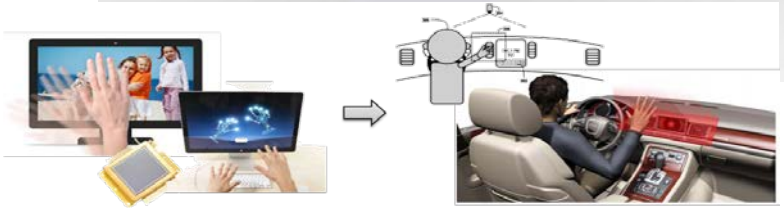


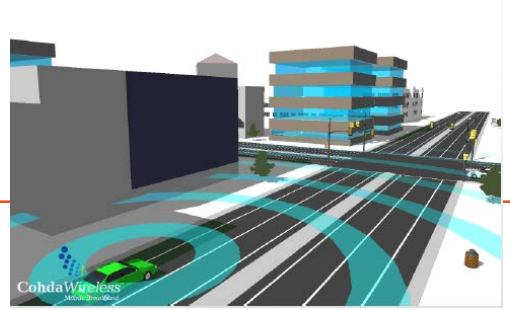
The „Digitalization of the car“ creates breakthoughs in connected mobility

- Autonomous driving
- Car-Car-communication
- Car-Infrastructure communication
- „The cabin of the future“

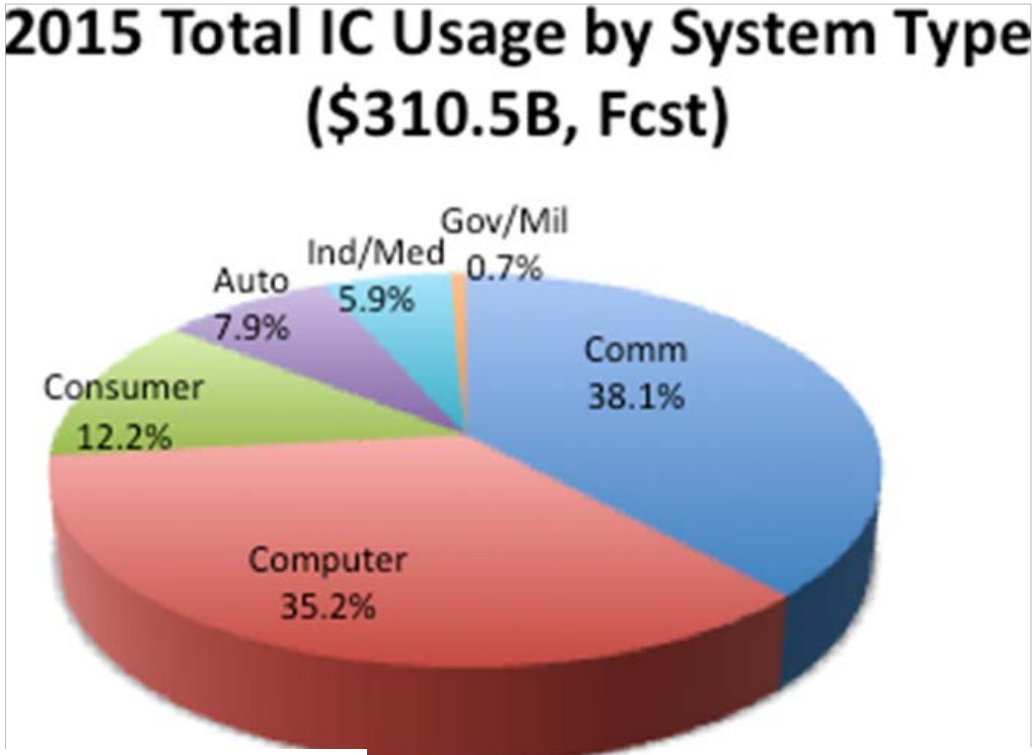
  gesture control

  microprojectors, etc.





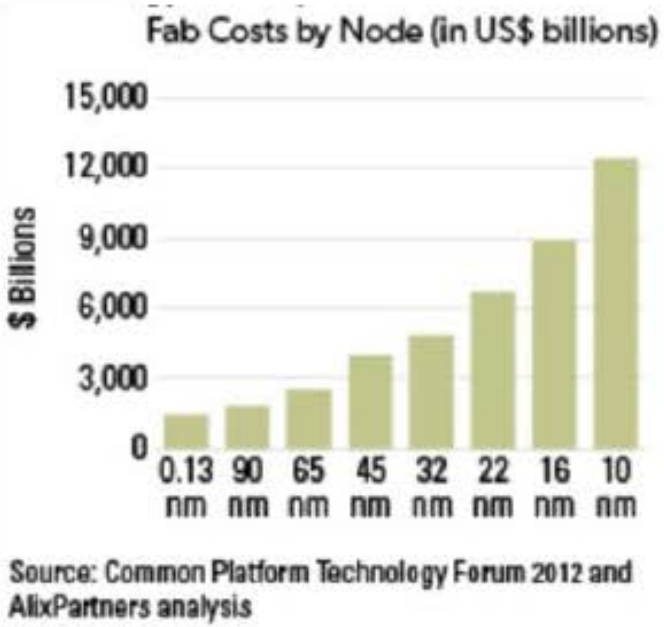
Global semiconductor market

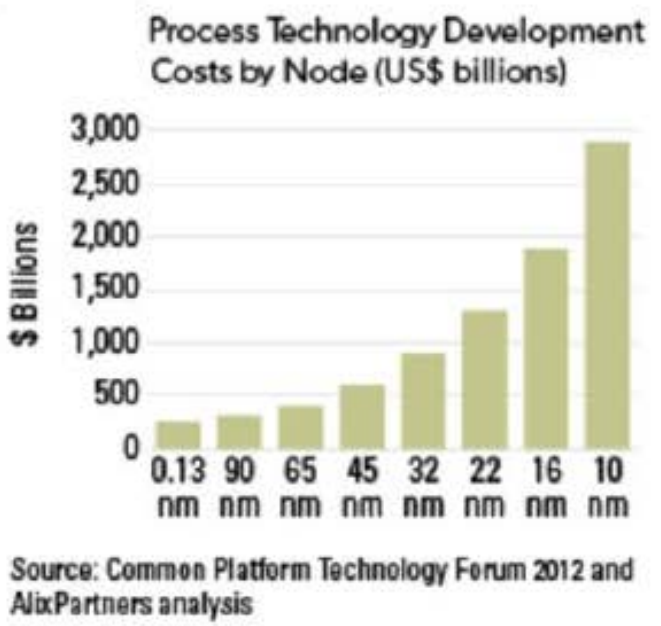


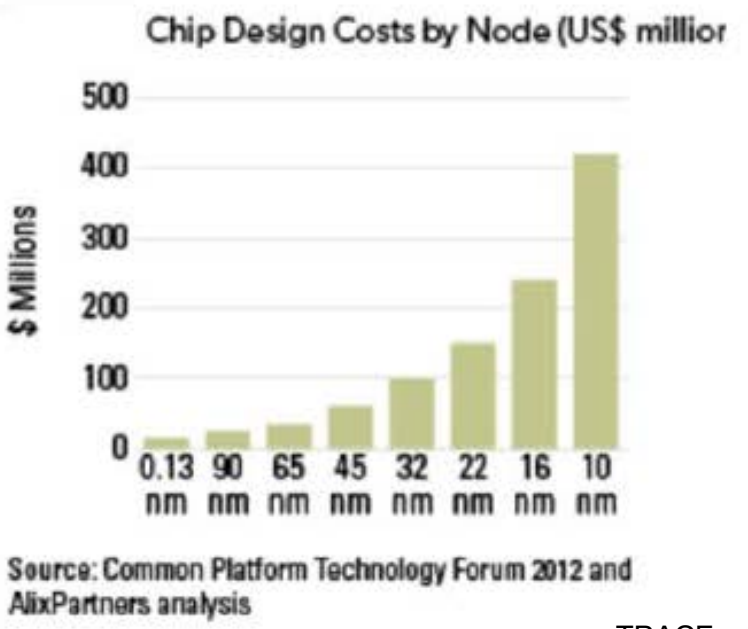
source: TRACE project

- **Automotive: low volume market**
- **Even lower market for new automotive applications**

Global semiconductor market investment challenges







source: TRACE project

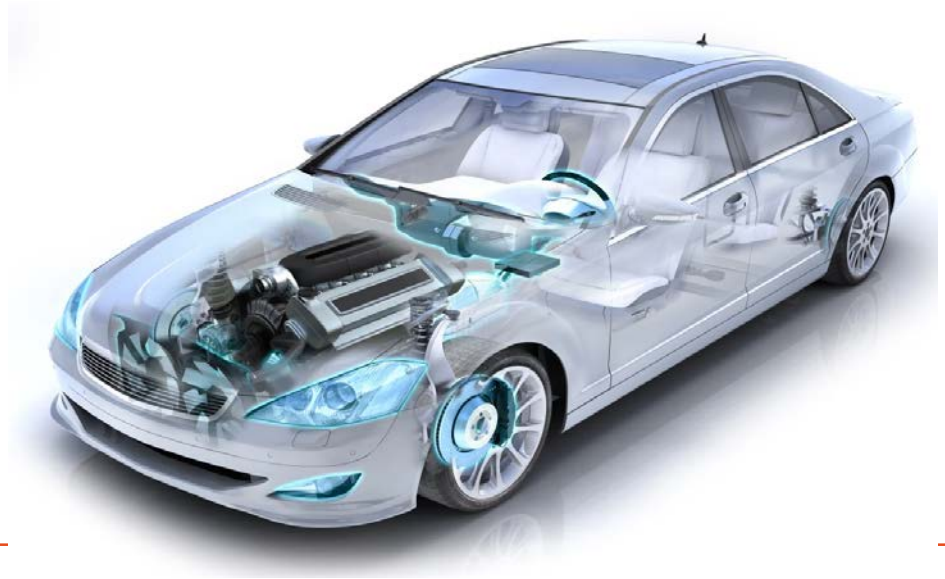
- **Investment strategy mainly driven by mass market communication & consumer electronics industry**
- **Automotive volumes are not capable of financing an own operative landscape in the future**

Automotive electronics market Summary

2 major challenges can be derived out of the „Digitalization of the car“

- Leveraging from communication/consumer electronics development and scale without loss of quality

- Improving robustness and resilience of electronic systems in order to manage the rising electronic content in the car without loss of quality



Enabling intelligent transfer concepts

EU-CATRENE project TRACE

Technology readiness in automotive for consumer electronics

Project at a glance:

- lead: BOSCH
- > 30 partner covering the whole automotive value chain
- Start: ~ Q2/2016

		Industry	Start-ups/SME	R&D
Produkt & System	OEM automotive	VW Daimler BMW Volvo		
	System level (Tier1)	Bosch Siemens Continental Vedecom	iMAR Open Wide Vedecom	
	Semiconductor Component level	Bosch NXP Nexperia AMS STM	TRONICS IMSYS	CEA
Kompetenz & Technologie	Design		Silkan RT	KTH
	Technology		QRTECH HELIOX	CEA Uni Siegen Uni Bordeaux
	Test & Validation	AKKA VW	Berliner Nanotest Goepel Fries CWM TWT	Swerea Fraunhofer Uni Bremen
	Simulation		Catena Coventor	Fraunhofer TU Delft FH Johanneum

Enabling intelligent transfer concepts

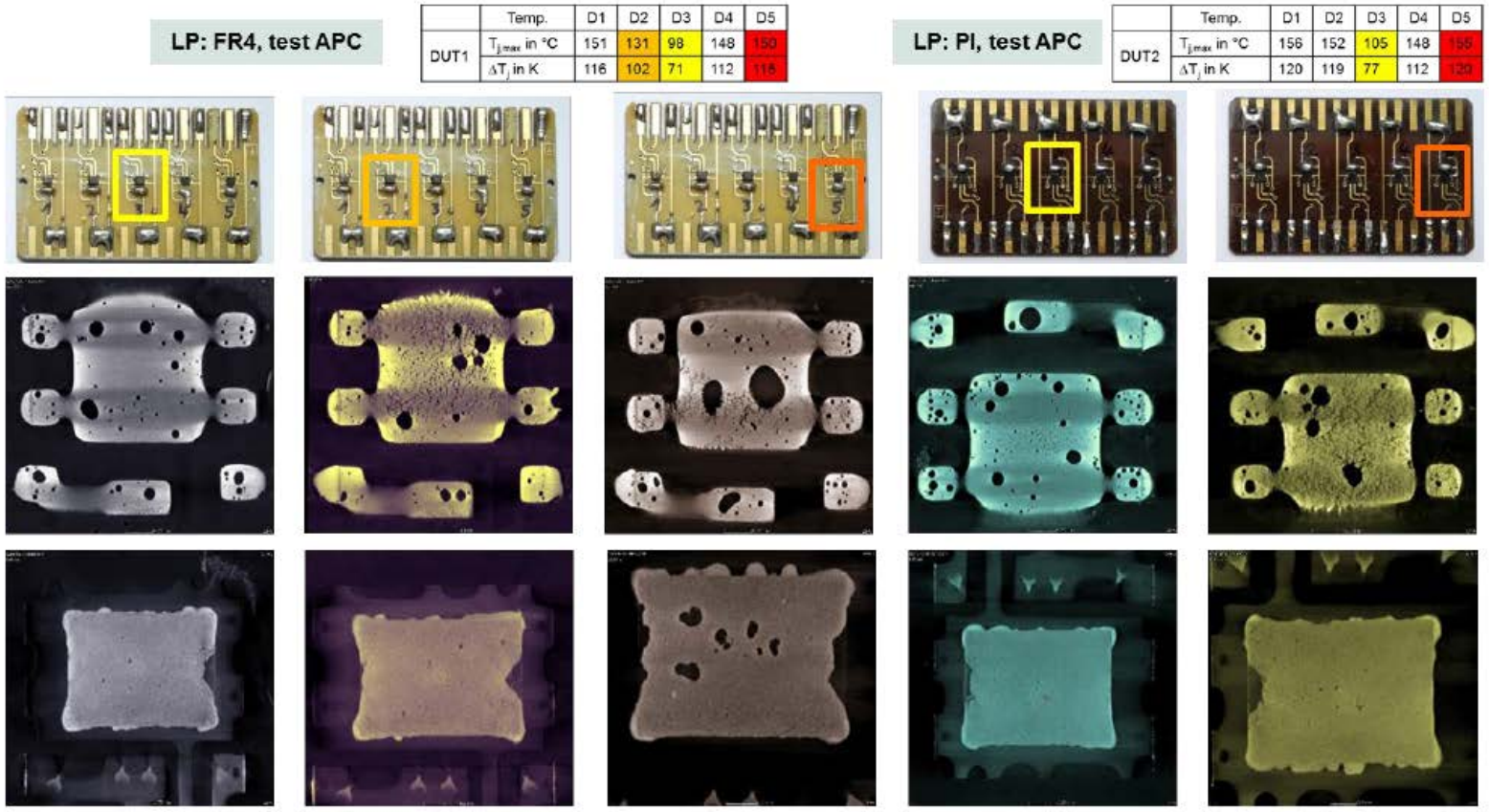
EU-CATRENE project TRACE

Technology readiness in automotive for consumer electronics

Consumer		Automotive	
			
Temperature range	0°C ... +40°C	Temperature range	-40°C ... +155°C
Lifetime	1..3 years	Lifetime	10 ... 15 years
Vibration	negligible	Vibration	0 ... 2000 Hz
Acceleration	negligible	Acceleration	500 m/s²
ESD safety	up to 3kV	ESD safety	up to 15 kV
Acceptable field failures	< 10%	Acceptable field failures	Goal: zero failure
Failure documentation	no	Failure documentation	yes
Long-term supply	no	Long-term supply	up to 30 years

Example: QFN board level reliability

Evaluating influence of board level stress/solder fatigue on system lifetime



		D1	D2	D3	D4	D5
DUT1	Temp.					
	$T_{j,max}$ in °C	151	131	98	148	150
	ΔT_j in K	116	102	71	112	115

		D1	D2	D3	D4	D5
DUT2	Temp.					
	$T_{j,max}$ in °C	156	152	105	148	155
	ΔT_j in K	120	119	77	112	120

Collaboration:
VW, Volvo,
Continental, Bosch,
NXP, Nexperia, Sverea,
Fhg ENAS

Leadless QFN power temperature cycling test with Fraunhofer ENAS under different test conditions:
CT-scan of solder joints before and after stress

Enabling resilience in automotive

RESIST
RESilient Integrated SysTems

EU-CATRENE project RESIST

Resilient integrated systems

Project at a glance:

- lead: NXP
- ca. 20 partner covering the whole automotive value chain
- Start: ~ Q2/2014

Technische Universität München
nexperia
EADS
heliox
MunEDA
Infineon
BOSCH
AIRBUS
iROC TECH
life.augmented
CNRS - Grenoble INP - UJF
ATMEL
TU/e Technische Universiteit Eindhoven University of Technology
Fraunhofer IIS
rbz
Universität Bremen
TU Delft Delft University of Technology
Hochschule Reutlingen Reutlingen University
cea list

RESIST

RESilient Integrated SysTems

RESilient Integrated SysTems

Project scope:

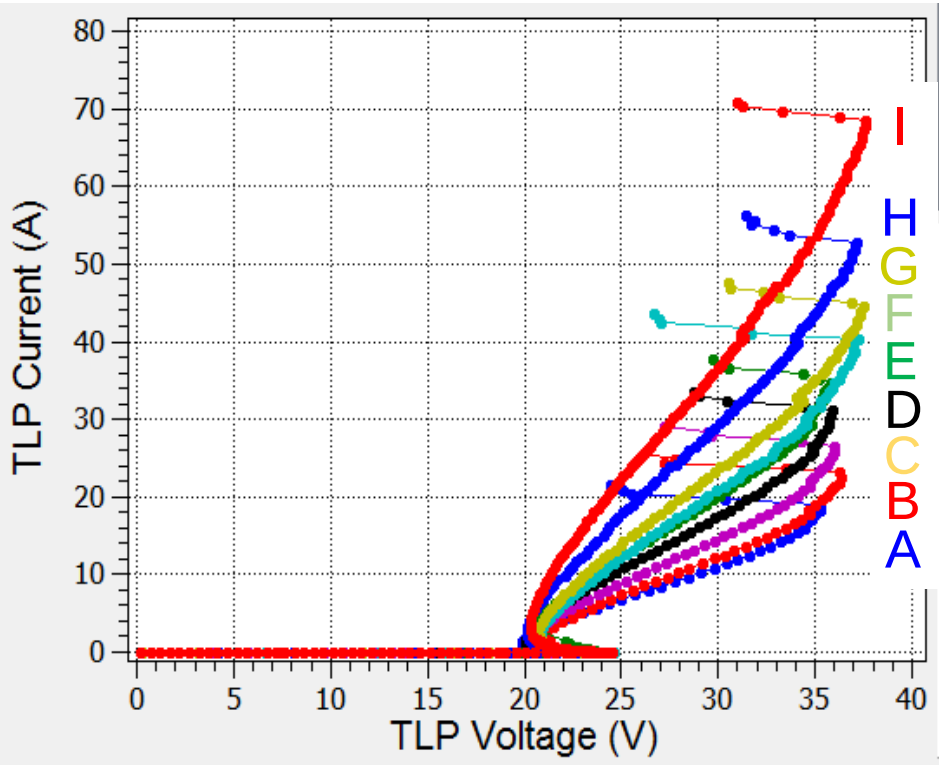
reliability aware design methods and run-time approaches
for next-generation resilient integrated electronic systems in Automotive and Avionics

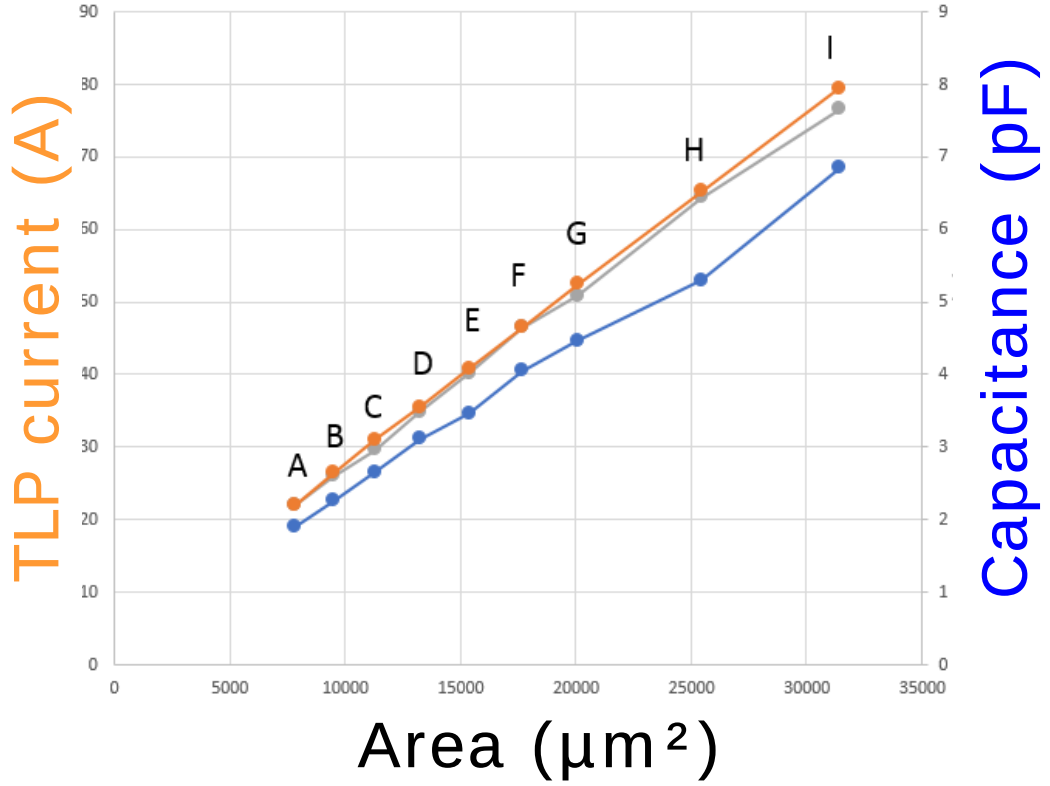
- **Enhancing lifetime of integrated circuits & embedded devices** from today's 10-15 years up to tomorrow's 25 years for **Automotive** and 35 years for **Avionics**
- Enable an innovative **'design for resilience'** approach that is at least 2x more cost-effective than conventional redundancy practices for the same level of system's reliability
- At least 20% **increase in the number of integrated components**, or integration density of such components, for integrated electronics systems in cars and airplanes for the same, or better level of system's reliability
- **Reducing reliability testing costs** by 25%, and reducing the qualification time by 30% for integrated electronic components

Activity overview

- Resist aims at increasing the quality of integrated circuits and systems by developing
  - Reliability aware design approaches
  - Techniques for improving the reliability
  - Health monitoring on IC/ system level
  - Design for resilience which is 2 times more cost effective than normal redundancy strategies
- Focus are automotive and avionics applications
- The focus is mainly on IC design

ESD concepts: ESD protection for Car Ethernet



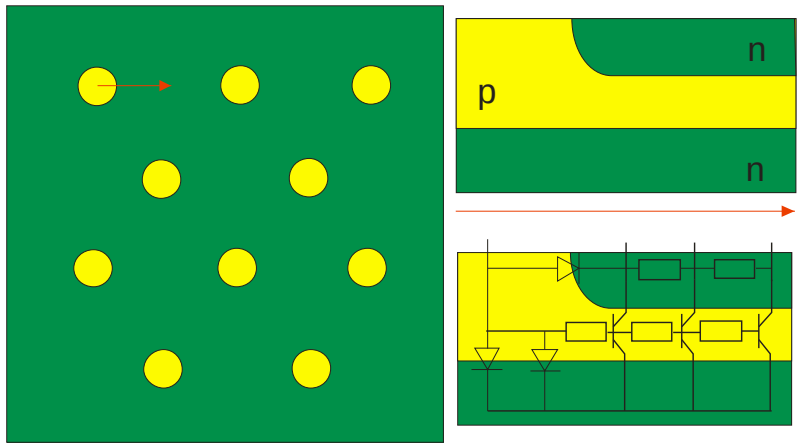


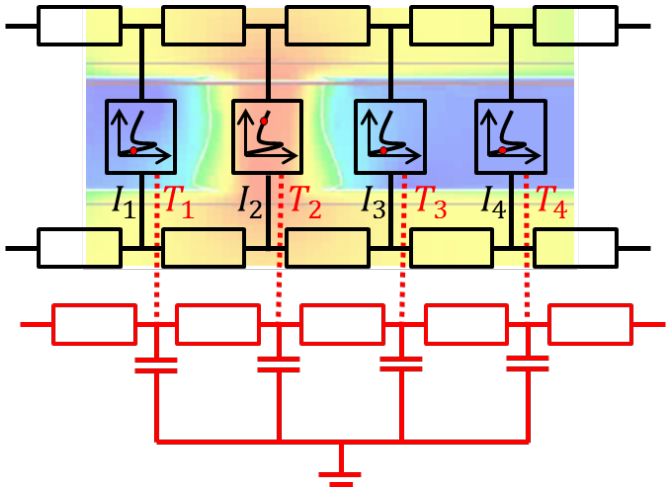
Capacitance and ESD robustness can be scaled

ESD concepts: ESD protection for Car Ethernet

ESD simulation algorithm

- Setting up a simulation tool box for modelling ESD-events on components & systems
- Aiming for finding layout dependent ESD weaknesses of components and systems
- Collaboration with Fraunhofer EAS in Dresden





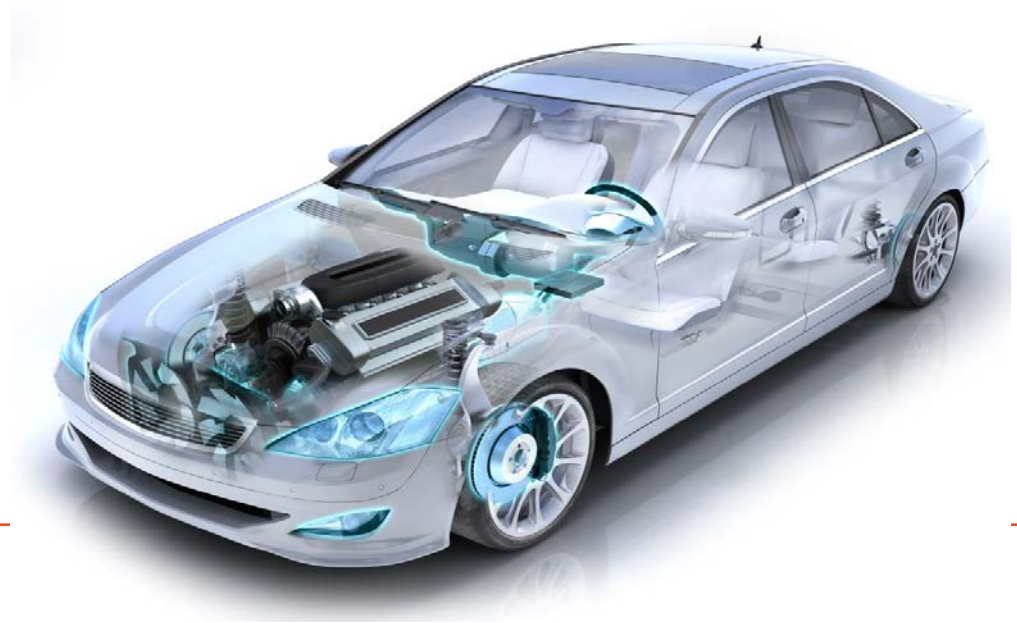
Summary

2 major challenges can be derived out of the „Digitalization of the car“

- Leveraging from consumer electronics development and scale without loss of automotive quality

- Improving robustness and resilience of electronic systems in order to manage the rising electronic content in the car without loss of quality

- The european industry is joining forces to come to the next level for both challenges



Bundesministerium für Bildung und Forschung

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EFFICIENCY WINS.