OPTIREG™ PMIC TLE9243QK
Transmission Power Management IC
Product presentation

PMIC

OPTIREG™

Find it online !

Infineon Automotive Division

Q4 2024

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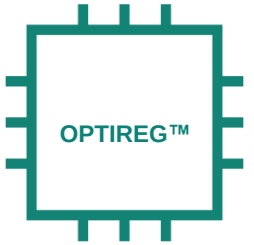
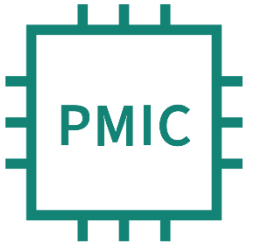
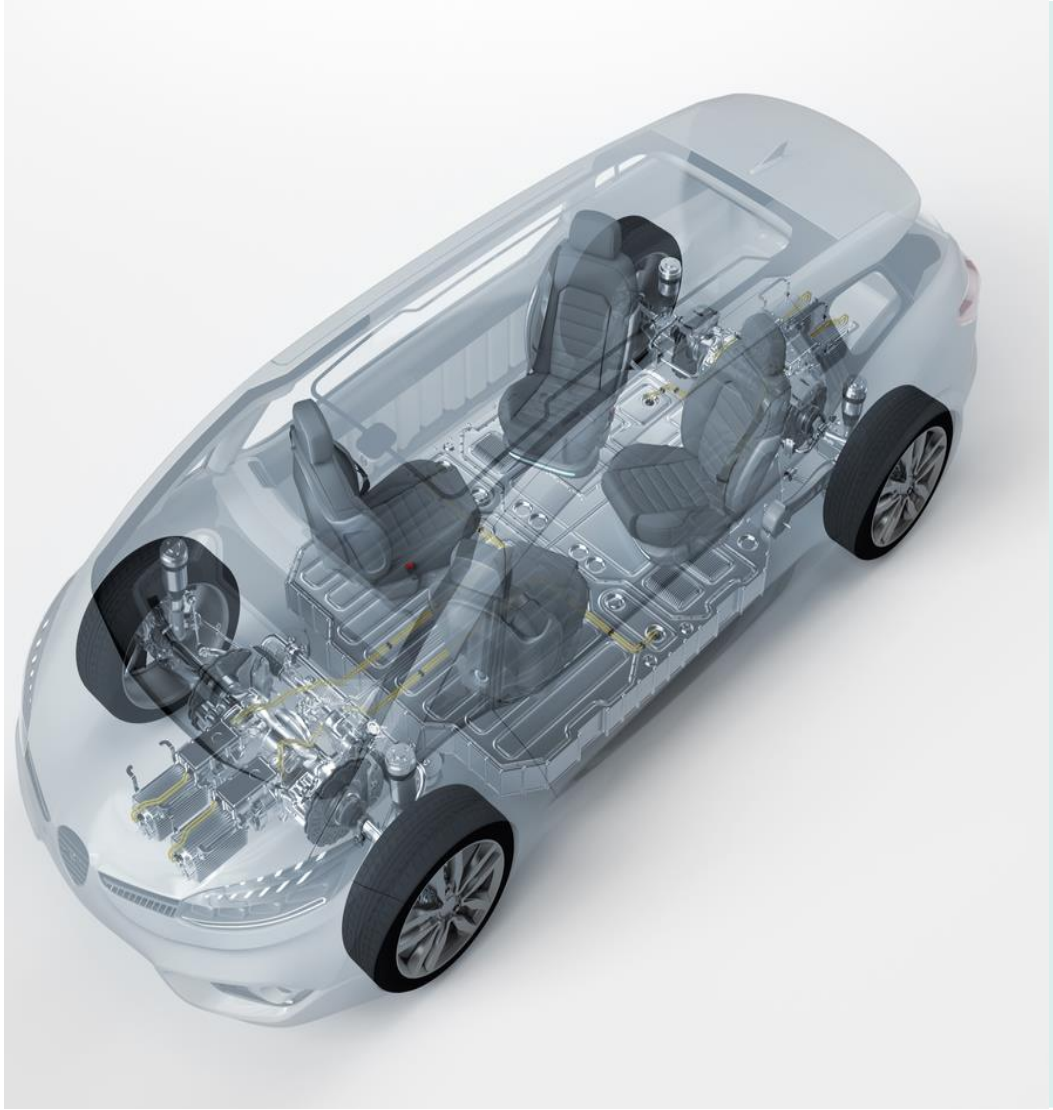
OPTIREG™ PMIC families: Power for Microcontrollers





OPTIREG™

Power Supply is a key function in every automotive ECU



PMIC
OPTIREG™
CAN/LIN
DCDC/LDO
SBC
DC
DC
Linear post regulators
DC-DC

Generic ECU in a car

Power supply OPTIREG™
µC
Actuators
Traction inverter
Radar
Transmission
Networking
Sensors
CAN
LIN
Ethernet
SerDes

Infineon offers both discrete and integrated power supply products for automotive applications

Linear post regulators | OPTIREG™ Switcher | SBC | OPTIREG™

OPTIREG™

OPTIREG™ Linear

These linear power supply solutions are suited for body, infotainment, chassis, safety, powertrain and transmission applications

- High Performance
- General Purpose
- Voltage Trackers
- Application Specific
- Application Specific (24 V)
- Post Regulators

OPTIREG™ Switcher

These switched mode power supply solutions are ideal for body, infotainment, chassis and safety applications.

- Buck Converter
- Boost Converter
- Buck Controller

OPTIREG™ PMIC

These integrated power supply solutions are ideal for functional safety relevant applications like chassis, powertrain, domain control and transmission.

- Safe Computing
- Safe Control

OPTIREG™ System Basis Chips

These high integration solutions offer power supply, communication, diagnosis and supporting feature in a single device

- Lite SBC
- Mid-Range+ SBC
- DCDC+ SBC
- Multi-CAN Power+ SBC

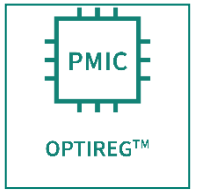
In Vehicle Network ICs

These modular, flexible communication solutions offer scalable feature sets and different packages

- Classical LIN
- LIN LDO
- Dual LIN
- Classical CAN
- CAN Partial Networking
- CAN FD
- CAN FD SIC

OPTIREG™ portfolio

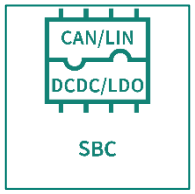
OPTIREG™ Powering Automotive



OPTIREG™
PMIC

- PMIC
- Application Specific PMIC

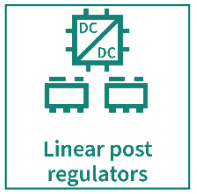
#17 Products
TLF35584/5, TLF30682, TLE9243, TLE7368, …



OPTIREG™
SBC

- Lite
- Mid-Range+
- DC/DC
- Multi-CAN Power

#32 Products
TLE9461, TLE9471
TLE926xB
TLE9271..4
TLE9278



OPTIREG™
Linear

- High Performance
- Application Specifics
- Trackers
- Post-regulators

#300 Products
TLS8xx, TLF80511, TLS2xx, TLF1963, TLE425x, TLS1xx, TLT807, TLF4xxx, …

OPTIREG™
Switcher

- Switcher
- Switcher HC
- Switcher HV

#15 Products
TLF51201, TLS5110, TLS4150, TLS4120, …

The OPTIREG™ PMIC: An integrated power supply including system safety functions

OPTIREG™ PMIC: Strong commitment to General Purpose and Application Specific PMIC solutions

PMIC OPTIREG™

Infineon

POWERTRAIN

ICE – PMICs

TLE9243QK

- System Safety Functions
- System Power Supply Functions
- ICE Base Functions

e.g. xEV – PMICs

TLE9744QK

- System Safety Functions
- System Power Supply Functions
- xEV Base Functions

AEC Qualified

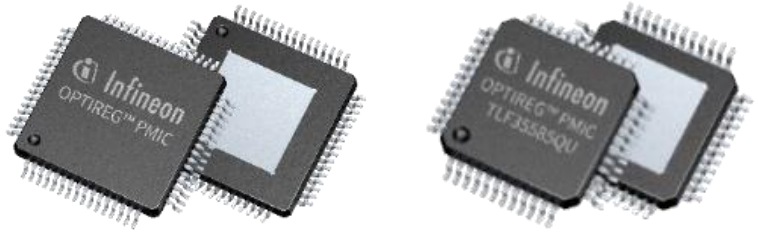
PROSIL ISO 26262 compliant

RoHS

PMIC OPTIREG™

General Purpose PMICs

- System Safety Functions
- System Power Supply Functions



SAFETY

ADAS – PMICs

TLF30682QV

- System Safety Functions
- System Power Supply Functions
- ADAS Base Functions

e.G. Chassis – PMICs

- System Safety Functions
- System Power Supply Functions
- Chassis Base Functions

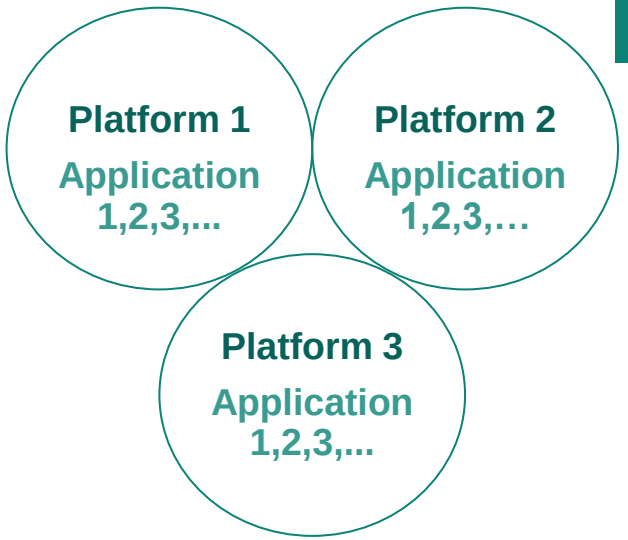
MOTOR DRIVES

Transmission
Double clutch transmission
Transfer case
Traction inverter
DC-DC HV/12V
On-board charger
BMS
48V
Integrated starter generator

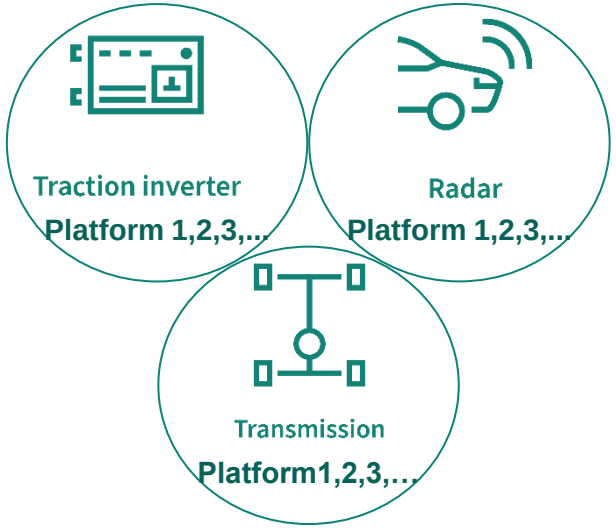
Radar
Lidar
Camera
Sensor fusion
Brake booster
Electric power steering
48V
Suspension
Electric parking brake

General Purpose (GP) vs. Application Specific (AS) -PMICs

Cross Application Approach



Cross Platform Approach



OEMs/Tier1s have different strategies for PMICs

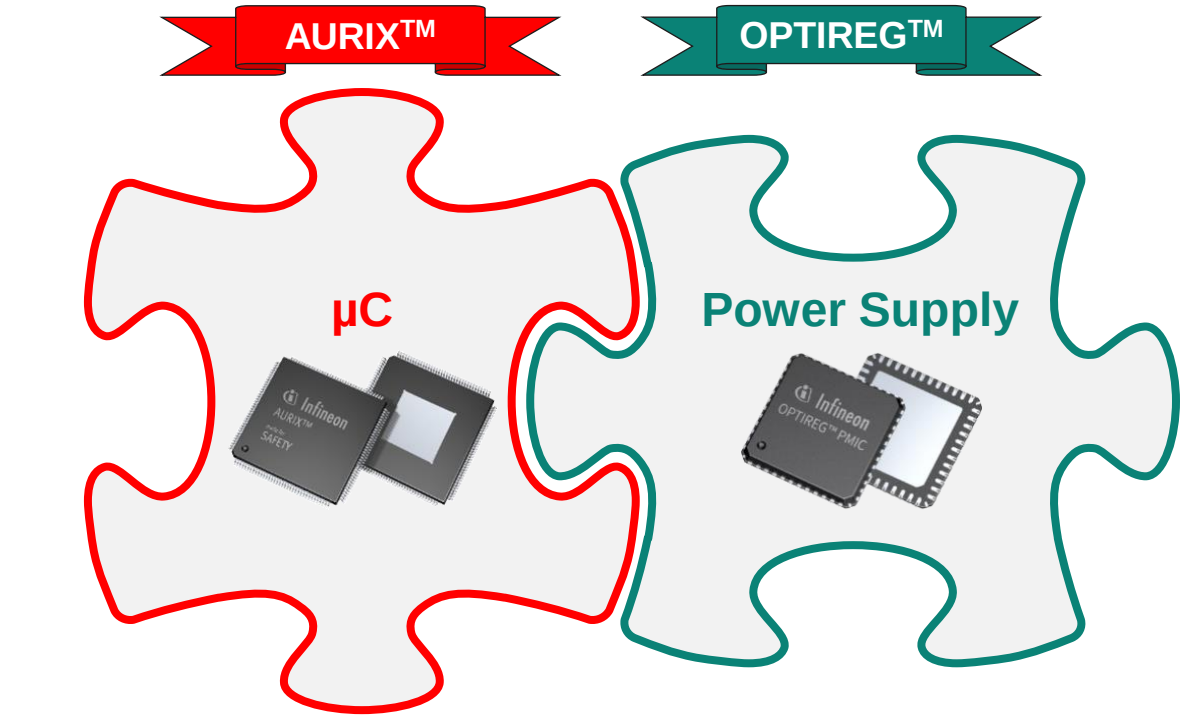
› **GP-PMICs,** for various applications

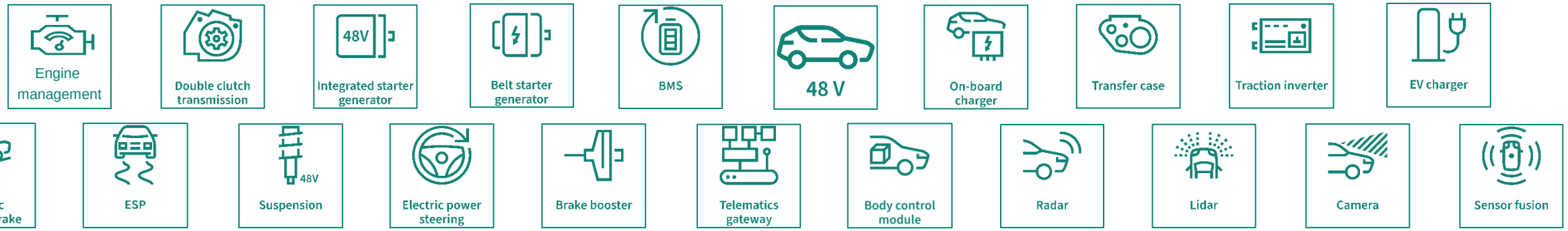
- ✓ **Software re-use, flexibility** for AS functions
- ✗ **Not fully system cost optimized solutions** (BOM and System FuSa)

› **AS-PMICs,** for **ONE** specific application

- ✓ **Significant system cost down** (discrete circuitry and failure modes, optimized System FuSa)
- ✗ **AS dedicated hardware and software development**

AURIX™ microcontroller & OPTIREG™ PMIC teaming up for Functional Safety in the focus automotive applications





Functional Safety
Relevant applications

Safe Control

Conventional Powertrain

- Engine management
- Transmission
- Transfer case
- 48V Integrated starter generator

Electrical Drive Train

- BMS
- Traction inverter
- On-board charger

Chassis

- Electric power steering
- ABS
- 48V Suspension

Safe Compute

Body

- Car lighting
- Telematics gateway

Safety / ADAS

- Airbag
- Radar
- Lidar
- Camera
- Sensor fusion

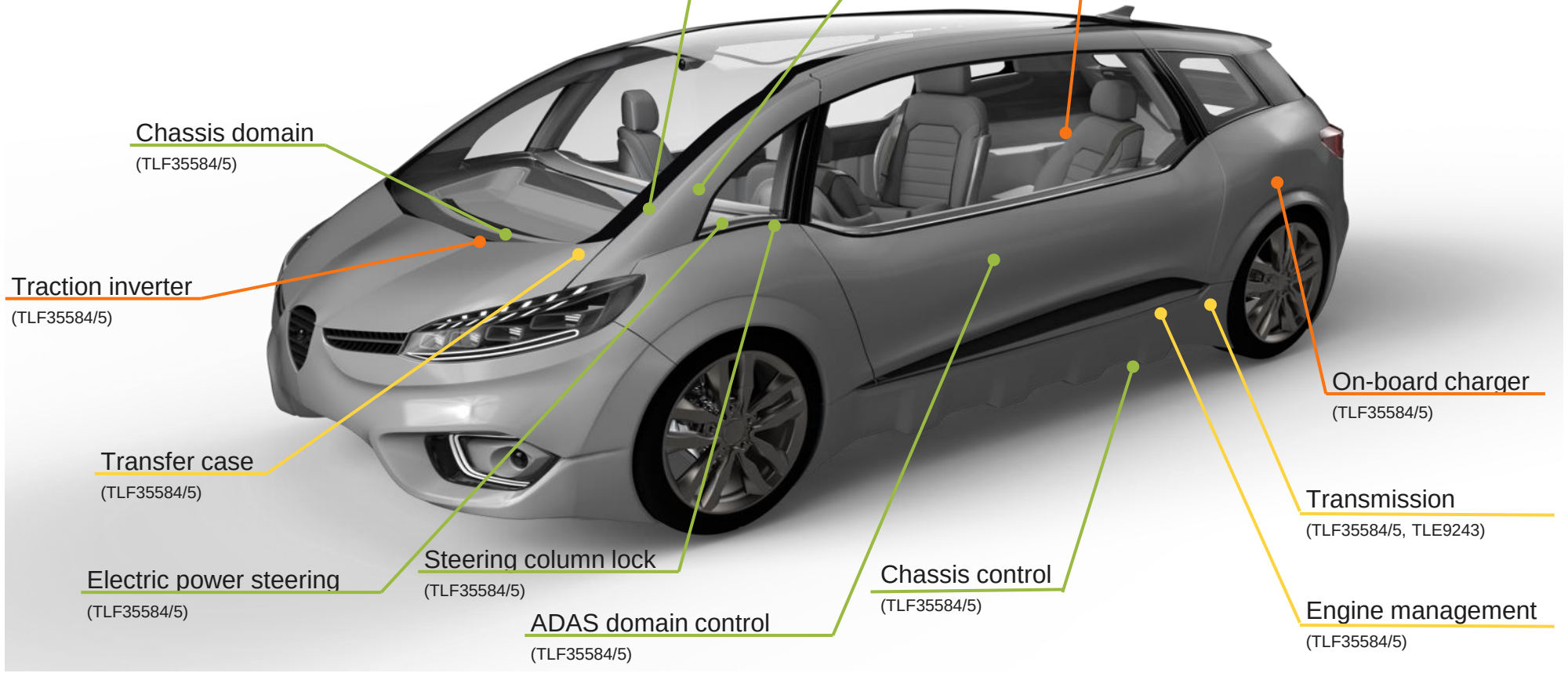
OPTIREG™ PMICs supports ASIL-D applications, enabling extended lifetime in harsh automotive environments

Application examples

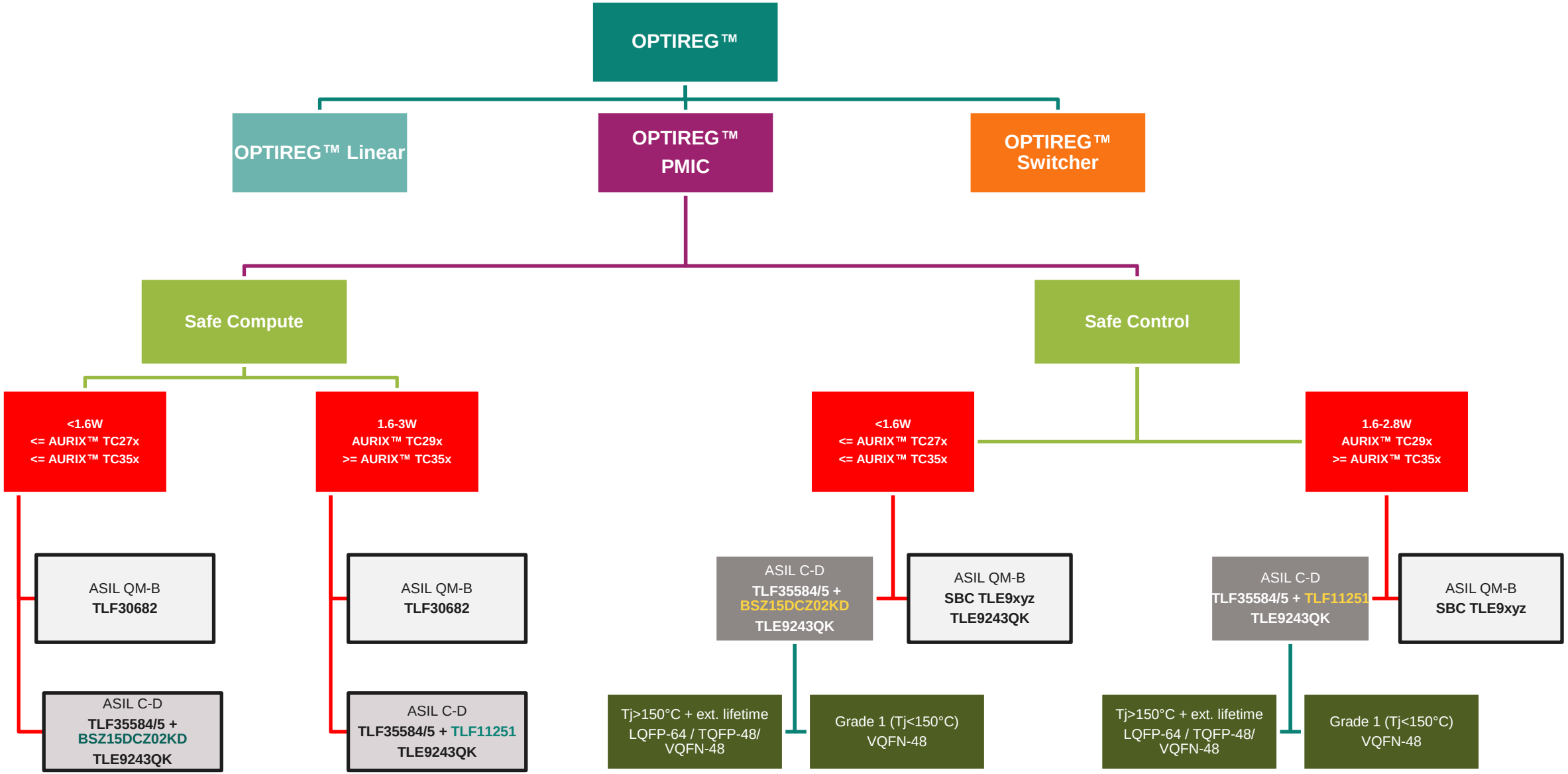
EDT/ xEV

Chassis & safety

Powertrain



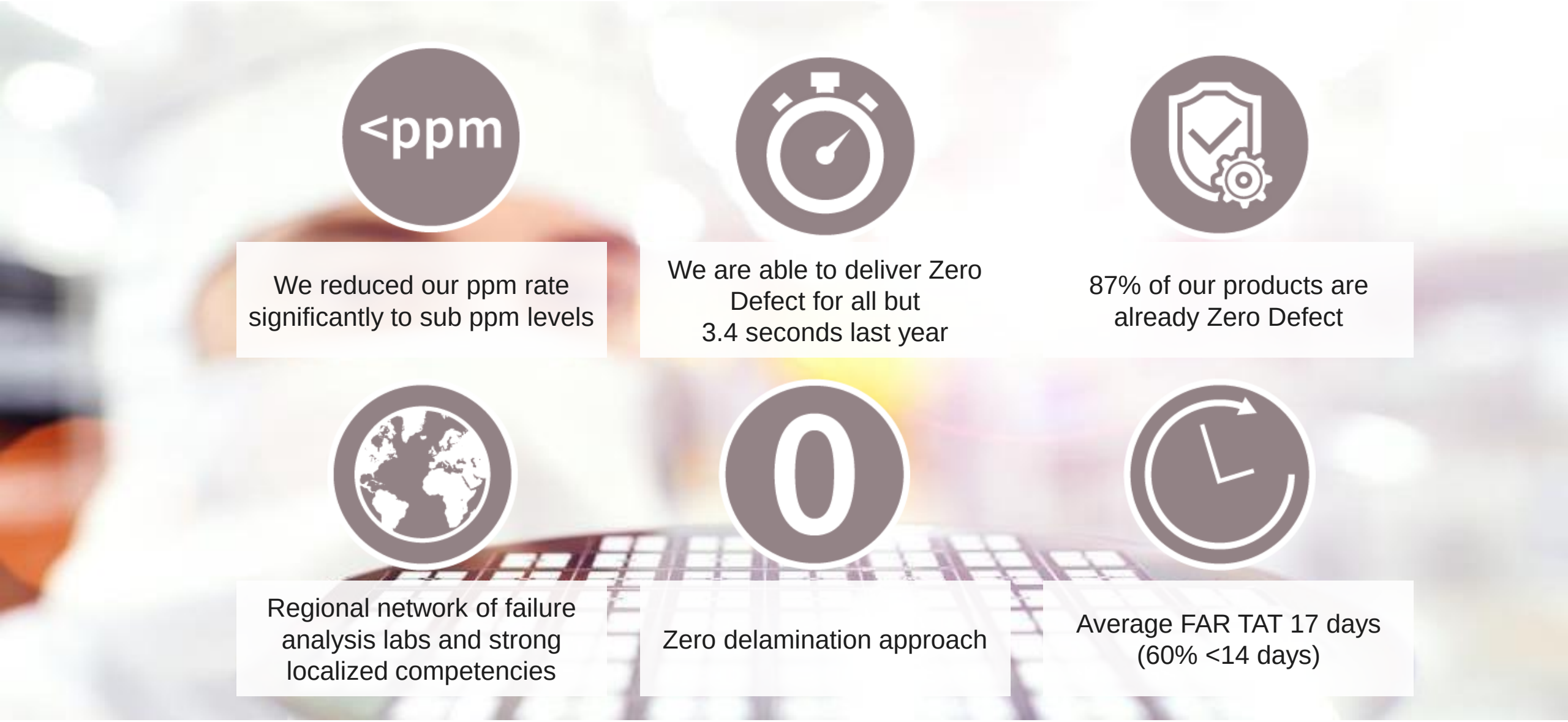
OPTIREG™ PMIC Decision Tree



Quality

Zero defect mentality and benchmark production quality

Infineon Zero Defect Mentality
We Do what we promise



We reduced our ppm rate significantly to sub ppm levels

We are able to deliver Zero Defect for all but 3.4 seconds last year

87% of our products are already Zero Defect

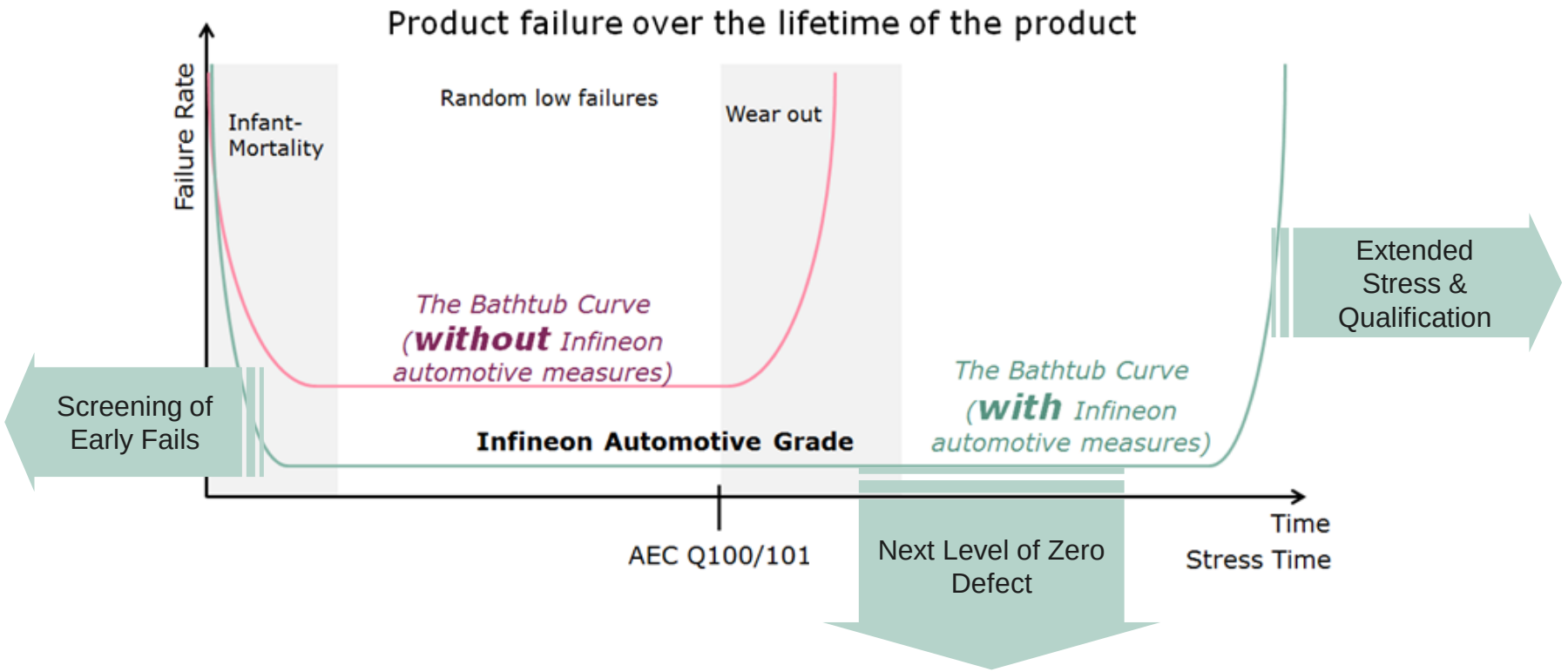
Regional network of failure analysis labs and strong localized competencies

Zero delamination approach

Average FAR TAT 17 days (60% <14 days)

Premium Quality
Zero Defect – our invest

Qualifying according AEC alone does not enable Zero Defect over 15+ years of product life time



Infineon takes additional measures in automotive product design, stress and qualification to push for Zero Defect

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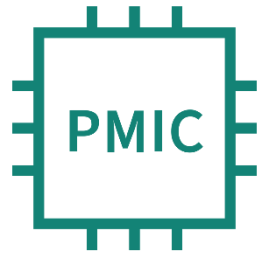
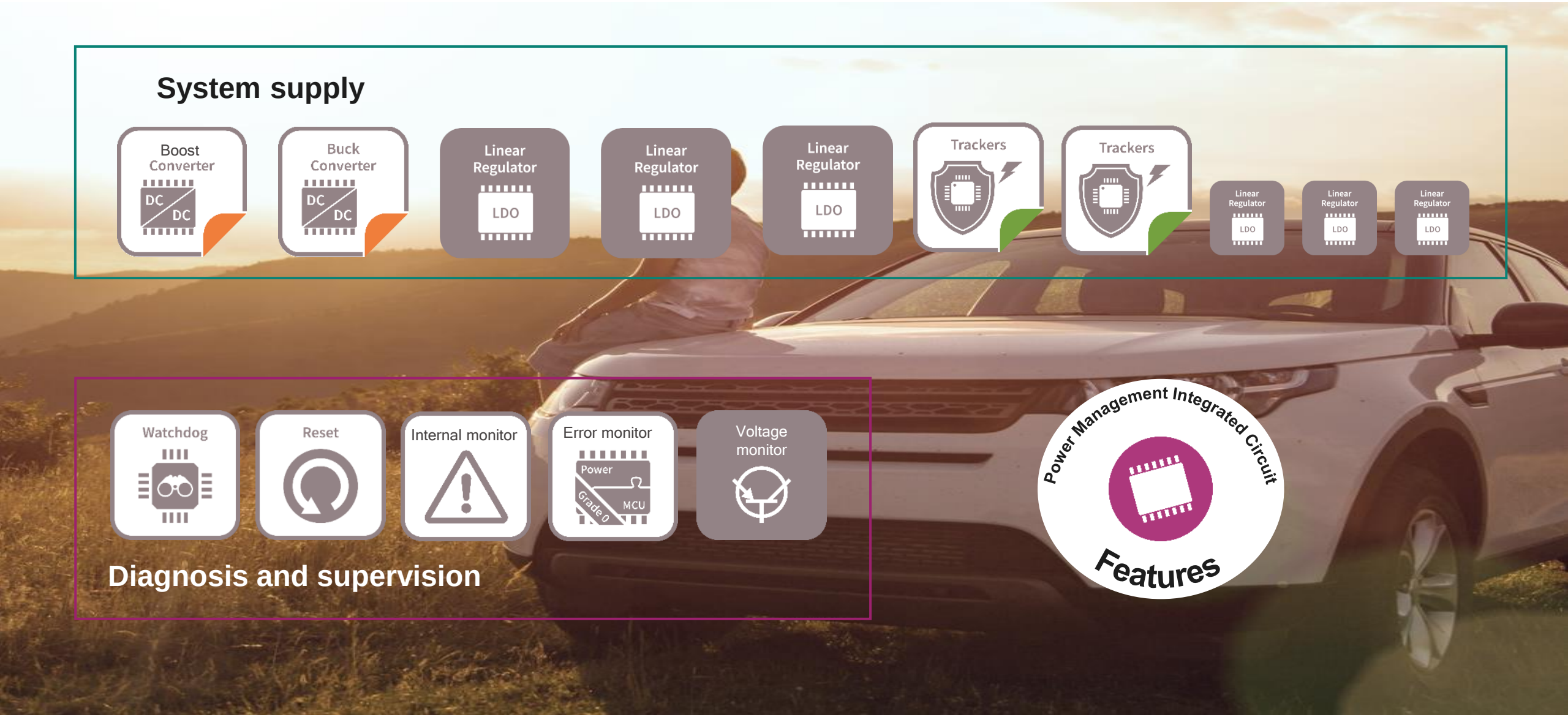
OPTIREG™ PMIC TLE9243QK
At a Glance



OPTIREG™

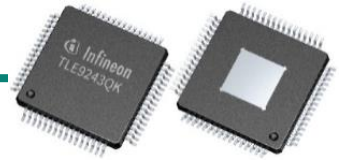
OPTIREG™ TLE9243QK PMIC: System power supply and safety functions integrated into a single package



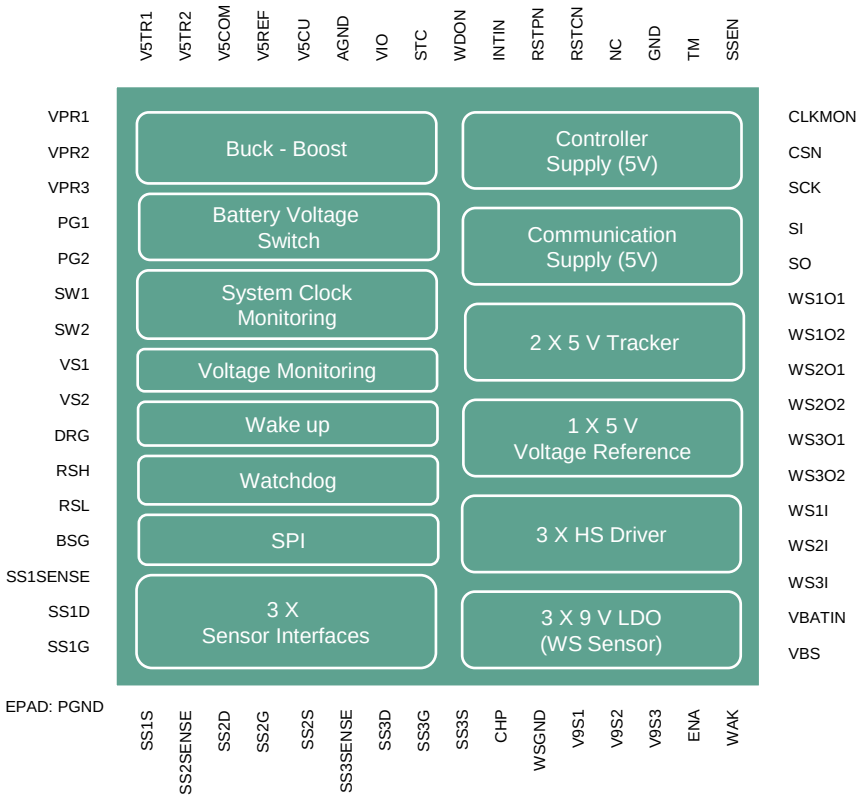
OPTIREG™ ICE-PMIC TLE9243QK
Application Specific PMIC for Transmission

Transmission OPTIREG™

Block Diagram



PG-LQFP-64
12x12mm²



Click here for Product page

In Production

Key Features

ASIL D

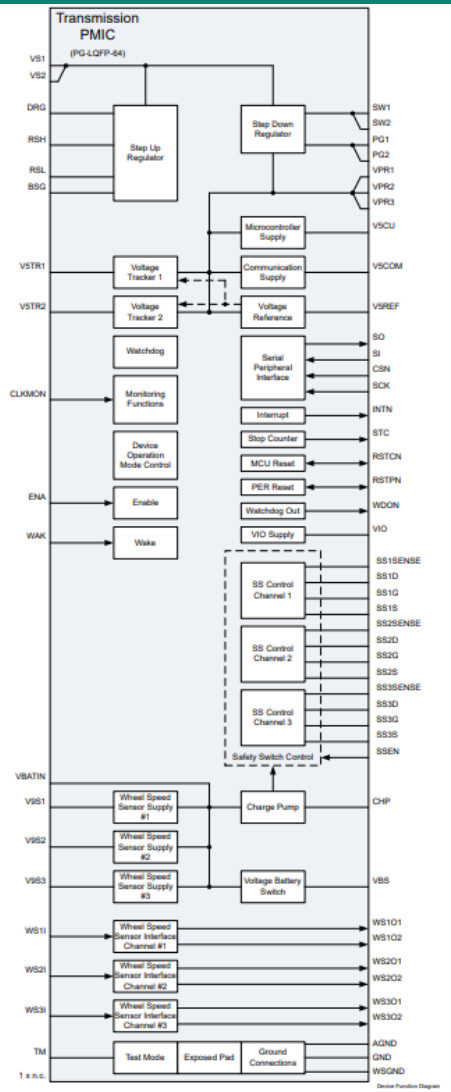
- **System Supply Functions**
  - Serial Boost/Buck Pre-Regulator with selectable Boost function
    - IQ = 1.6A; f: 2.2MHz
  - 1 x 5.0V LDO ±2%; 800mA (µC Supply)
  - 1 x 5.0V LDO ±2%; 240mA (Communication Supply)
  - 1 x 5.0V LDO ±1%; 150mA (Voltage Reference and µC ADC supply)
  - 2 x 5.0V Tracker ±10mV; 150mA (Sensor Supply)

- **Application Specific and Safety Functions**
  - Configurable Watchdog (WWD and FWD) and MCU clock monitoring
  - 32bit 10MHz SPI with 8 bit CRC
  - Configurable stop counter, reset, interrupt and wake-up sources
  - Charge Pump for Active Reverse Polarity Protection
  - Battery Voltage Switch (VBS) to reduce quiescent current
  - Three 9.0V LDOs ±3%; 50mA (For Wheel Speed Sensors)
  - Three Sensor Channels for current sensing (3 level)
  - Three high side drivers to control external n-channel FETs

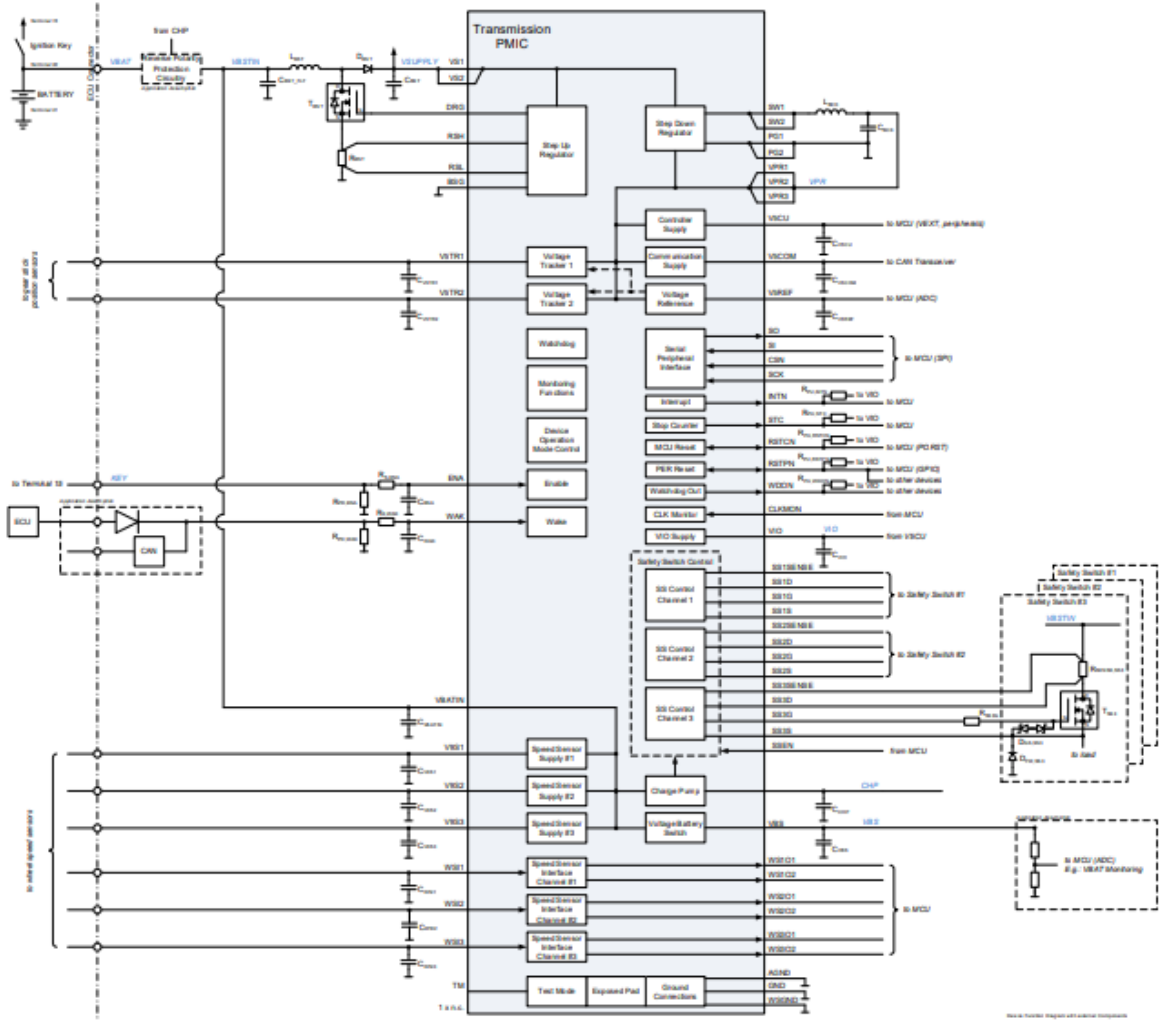
AEC Qualified ISO 26262 compliant RoHS

OPTIREG™ PMIC TLE9243QK: System power supply and safety functions integrated into a single package for transmission

Device function block diagram



Application block diagram



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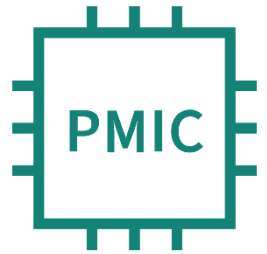
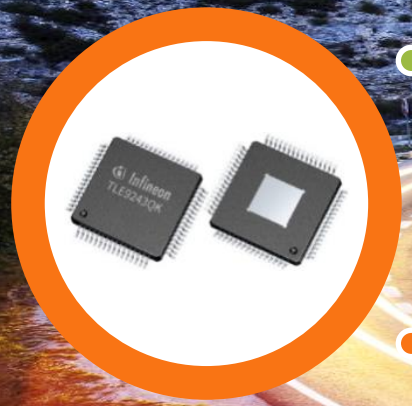
OPTIREG™ PMIC TLE9243QK
Benefits



OPTIREG™

Benefits of Infineon OPTIREG™ ICE-PMIC TLE9243QK



High level of integration and System cost reduction

- System power supply functions, system safety functions, and transmission base functions integrated into a single package, like 3 sensor signal conditioning interfaces
- Reduces external components and PCB space → Lower System Cost

High performance

- Enabling active reverse polarity protection to reduce system cost and improve low battery operation
- Supporting extreme harsh environments thanks to AEC-Q100 Grade 0 qualified (T_J = -40°C to 175°C)

Ease of design & flexibility

- 3 wheel speed sensors interface channels, 3 LDOs 9.0V @50 mA (±3%) for wheel speed sensors, battery voltage switch and 3 drivers to control external high side safety switches in one package
- Configurable watchdog function (WWD & FWD) for µC monitoring

Long term availability and Business Continuity Plan

- Long term production plans to support automotive production cycles
- In-house production site strategy

Developed according to ISO 26262

- Enables development of ASIL D systems
- Optimized and Harmonized Safety Concept for perfect fit in Transmission applications
- Strong in-house FuSa support via regional techical experts, documentation and online resources

ISO 26262 compliant

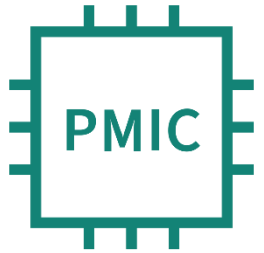
Transmission Power Management IC TLE9243QK – System Benefits

- Developed According to ISO26262
  - Safe State Controller and Watchdog Interface
  - CRC Based SPI Interface
  - Enables Development of ASIL D Systems

ISO 26262 compliant

- Transmission Specific Integrated Features → Lower System Cost
  - Saving MOSFET Driver w/ Current Sense and Diagnostics
    - Simple MOSFETs can be used instead of Protected MOSFETs
  - 3 x Speed Sensor Signal Conditioning Interfaces
  - 3 x 9V LDO Supplies for Sensors
  - Reverse Battery Protection

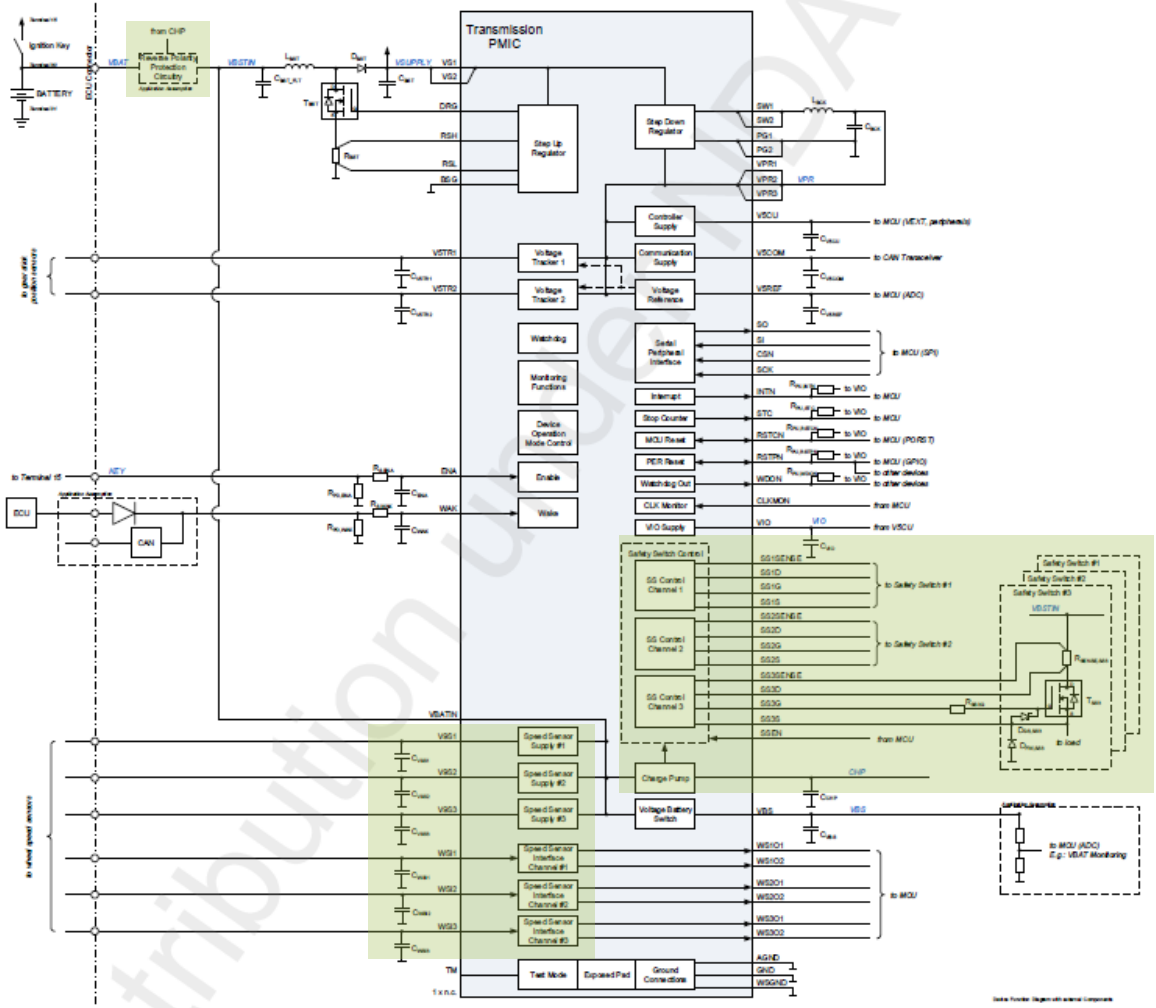
OPTIREG™ PMIC TLE9243QK
High level of integration and System cost reduction

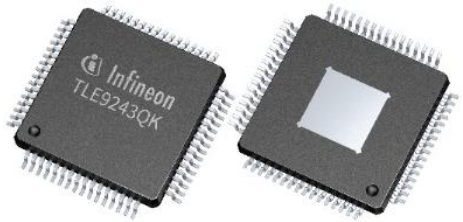


OPTIREG™

Transmission Power Management IC
TLE9243QK – Key Selling Points

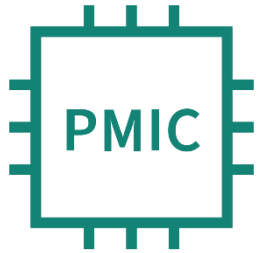
Transmission PMIC OPTIREG™





- Safety Switch Control for three external standard level Power MOSFETs
- Support of Active Reverse Polarity Protection
- Three Channel Wheel Speed Sensor Interface

OPTIREG™ PMIC TLE9243QK
High Performance



OPTIREG™

OPTIREG™ ICE-PMIC TLE9243QK supports extreme harsh environments thanks to AEC-Q100 Grade 0

Transmission OPTIREG™ PMIC

Why Grade 0 qualification:

- Electronic within the transmission system operates at T_A = 150°C
- Grade 1 qualified devices cannot be used if the ambient temperature is 150°C
- PCB layout flexibility: in PCB hot-spot areas Grade 1 cannot be place

Grade Classification	Junction Operating Temperature Range	
	MIN	MAX
Grade 0	-40°C	175°C
Grade 1	-40°C	150°C

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AURIX™ and OPTIREG™ PMIC Functional Safety & Dependability Internal and external safety measures

Infineon Automotive Dependability

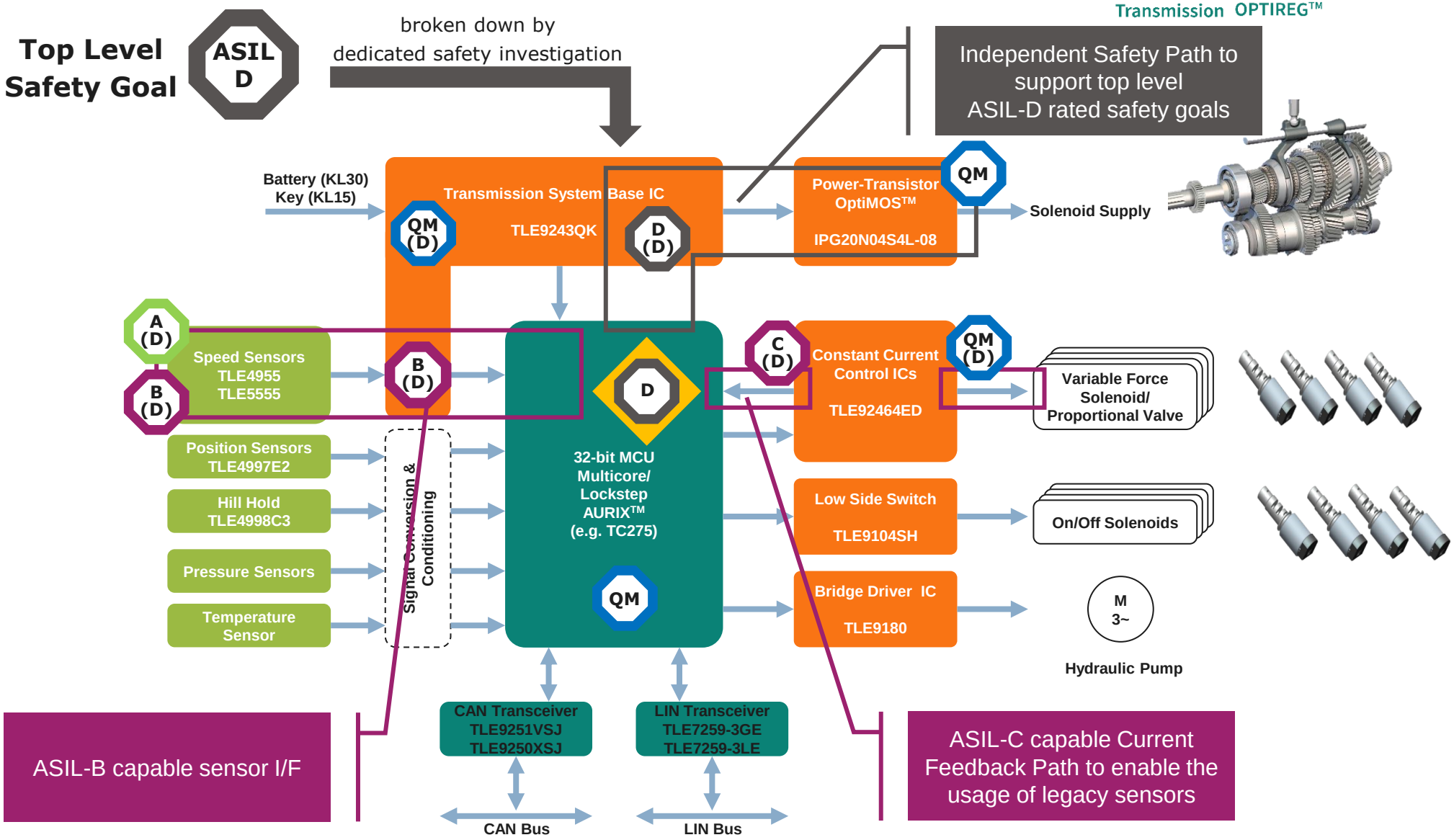
ISO 26262 compliant

PMIC

OPTIREG™

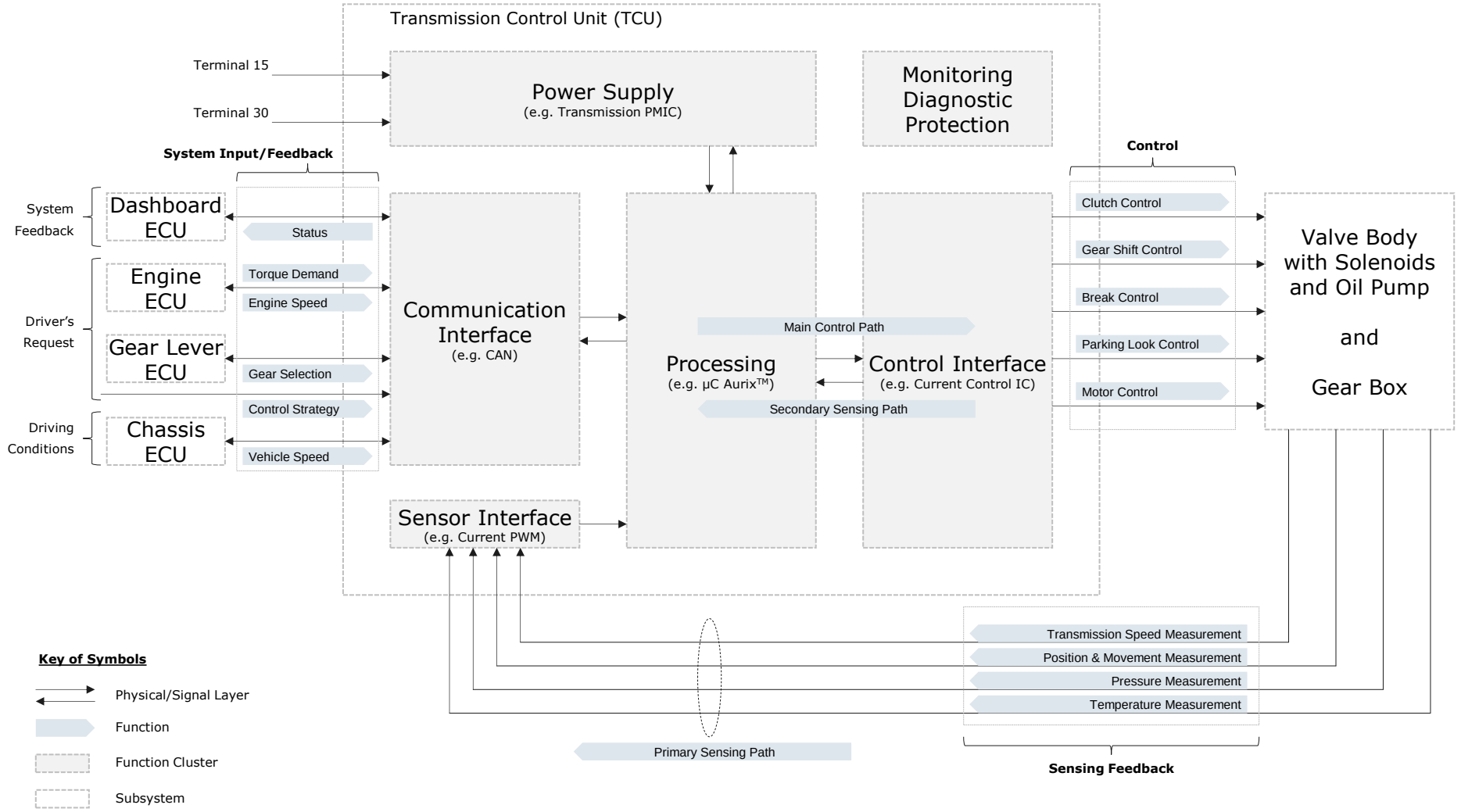
Transmission Systems – Safety Investigation
Harmonized Safety Partitioning

Transmission OPTIREG™

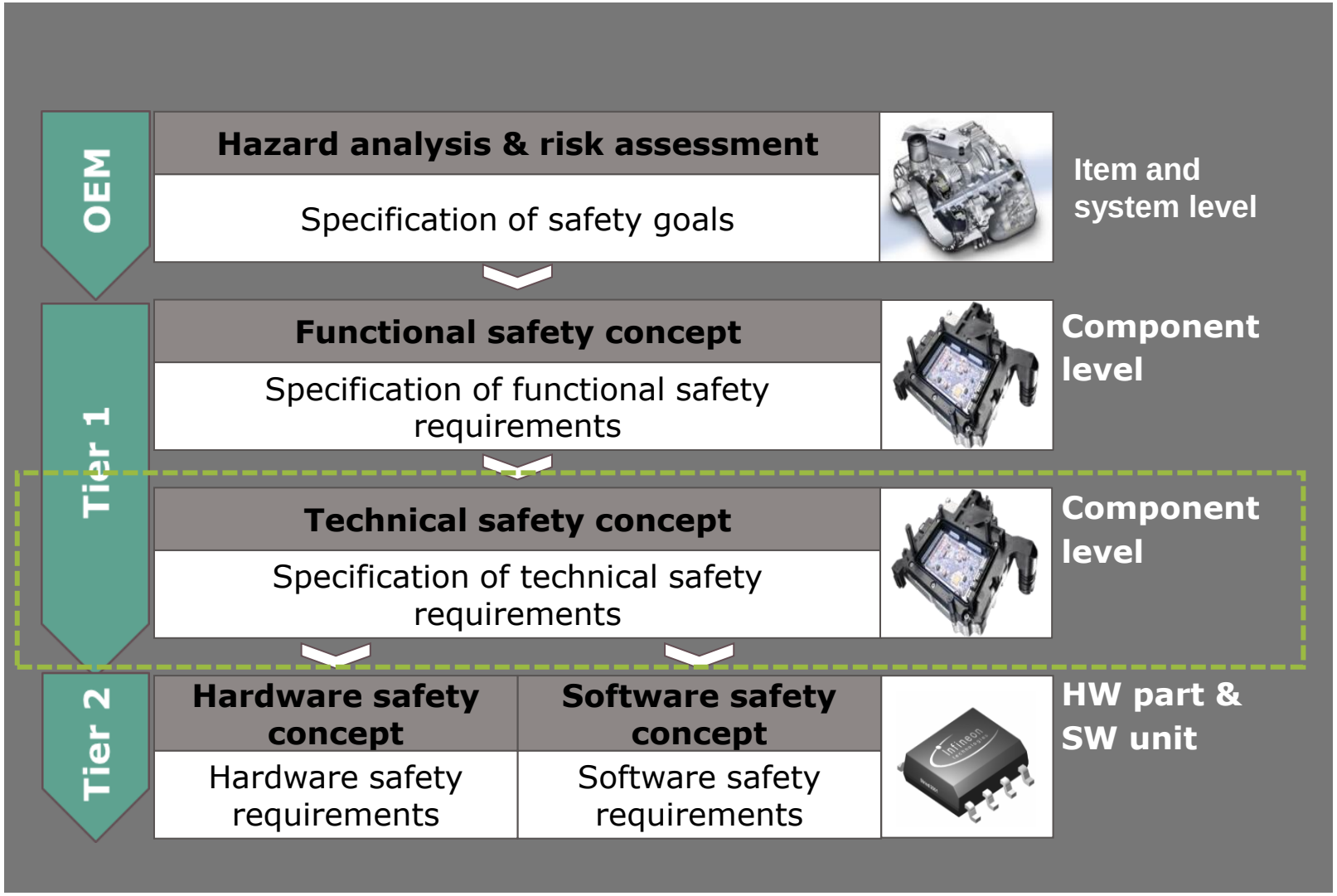


Assumed System Context
Abstract View of Hydraulic ECAT & DCT

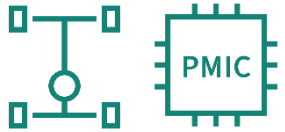
Transmission PMIC OPTIREG™



Assumed Technical Safety Concept and TSRs



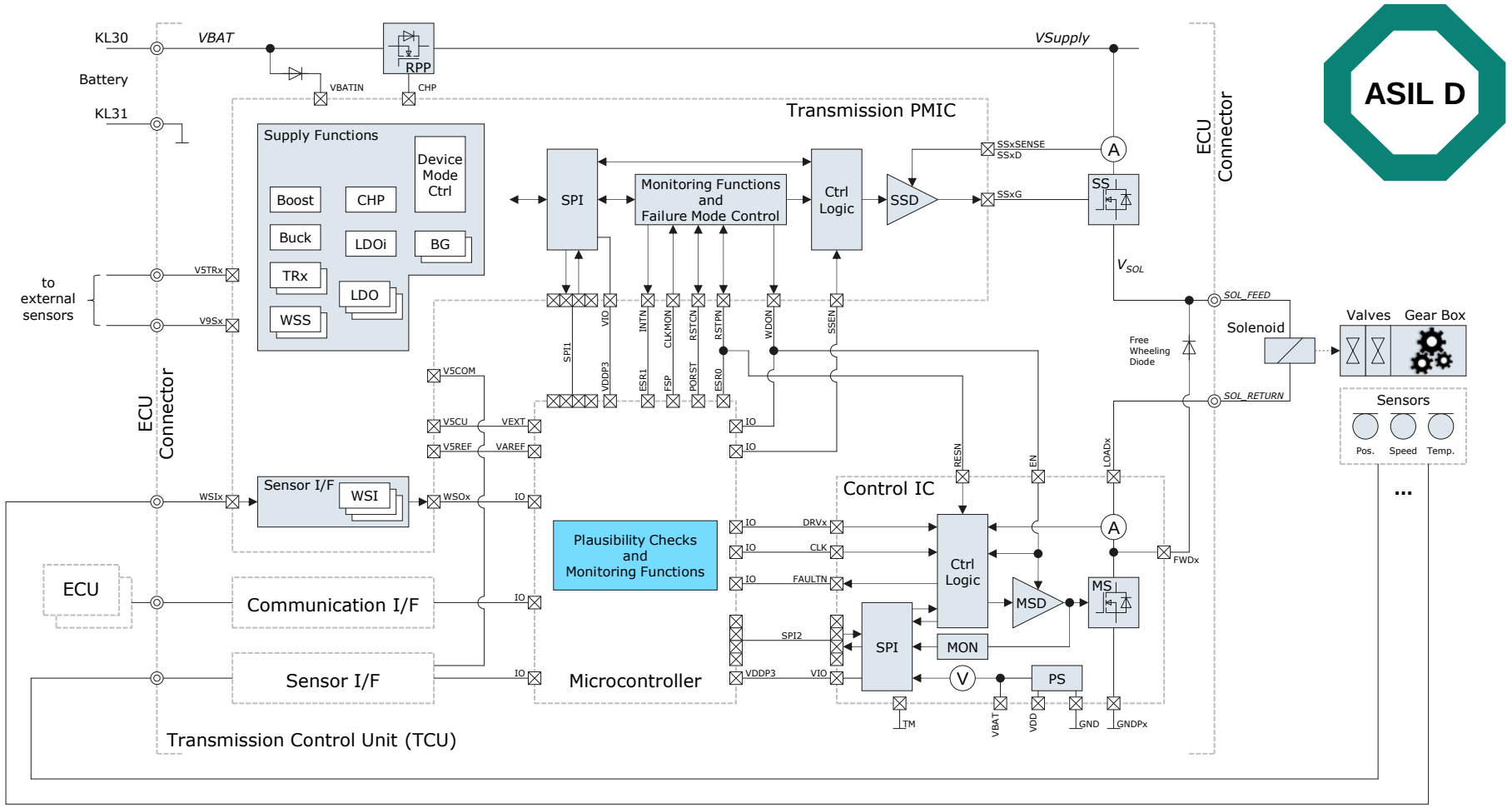
Summary Top Level Safety Requirements



Top Level Safety Requirement		Integrity	Relationship
SG-01	Unintended excessive deceleration	ASIL D	HARA
SG-02	Unintended acceleration	ASIL C	HARA
SG-03	Unintended disengagement of parking lock	ASIL B	HARA
FSR-01	Plausibility checks	ASIL D	derived from SG-01 and SG-02
FSR-02	Unintended activation of actuators	ASIL D	derived from SG-01 and SG-02
FSR-03	Unintended activation of parking lock actuators	ASIL B	derived from SG-03
TSR-01	Primary switch off path	ASIL D	derived from FSR-01
TSR-02	Secondary switch off path	ASIL D	derived from FSR-02
TSR-03	System Monitoring (TCU Level)	ASIL D	derived from FSR-02
TSR-04	Self Monitoring/Diagnostic (Component Level)	derived from component ASIL	derived from FSR-02
TSR-05	System Protection (TCU Level) • Reverse Polarity Protection	ASIL B	derived from FSR-03
TSR-06	Self Protection (Component Level) • VBAT protected inputs and outputs	derived from component ASIL	derived from FSR-02 and FSR-03
TSR-07	System Warning Functions	ASILB	derived from FSR-01 and FSR-02

Assumed electrical and/or electronic (E/E) system

Transmission PMIC OPTIREG™



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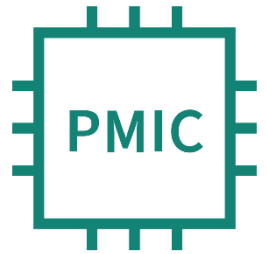
OPTIREG™ PMIC TLE9243QK
System solution for transmission



OPTIREG™

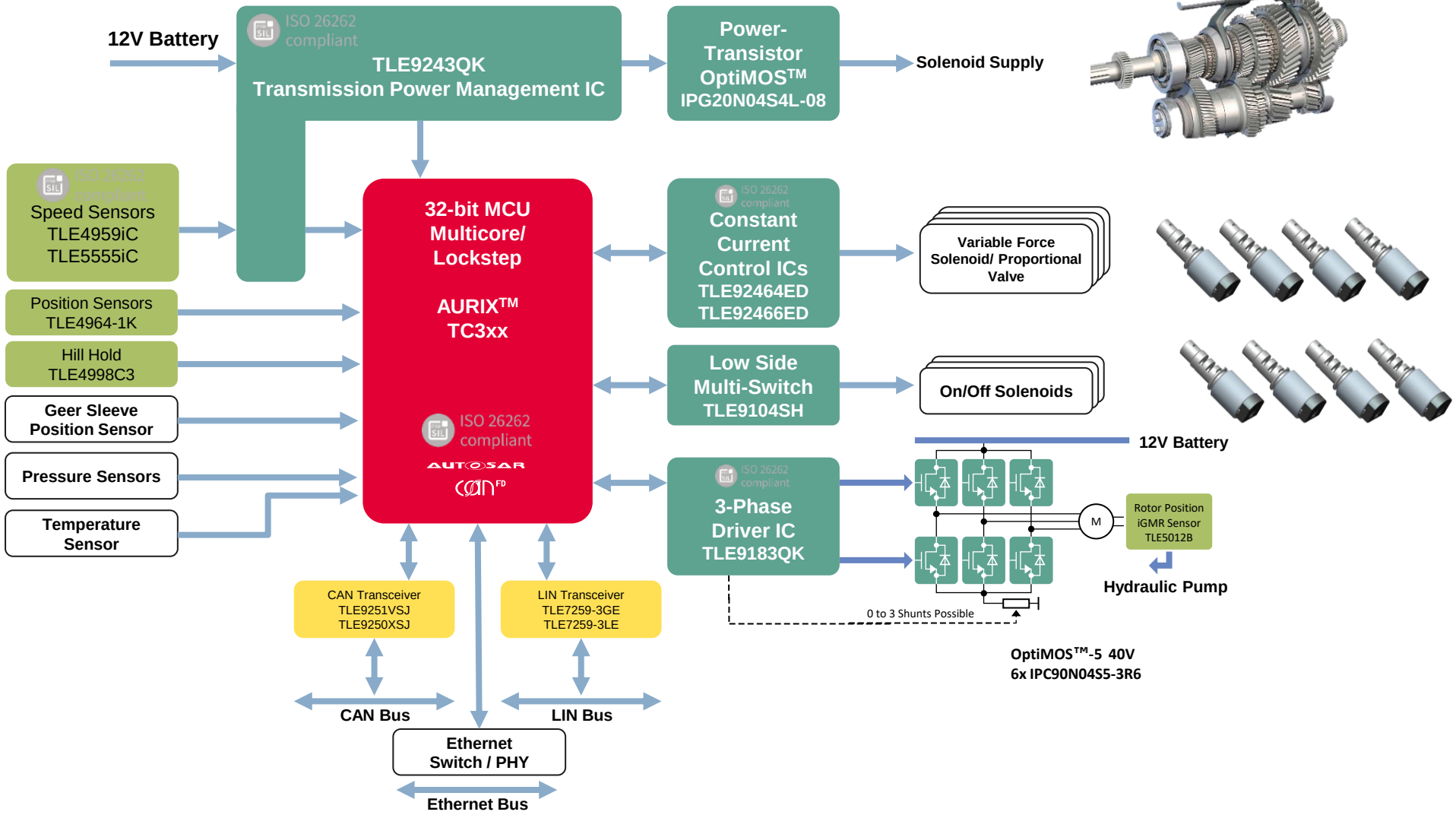
Key system benefits for Transmission Control

- **Strong system understanding**
  - System cost savings by reduction of external components
- **Common safety concept**
  - Full chipset enabling easy ISO26262 ASIL compliance
- **Supporting extreme harsh environments**
  - High temperature packages
  - Bare die devices
- **Long term production and dual production site strategy**
  - Long term production plans to support automotive production cycles
  - Dual production site strategies in place for supply security
- **Zero defect quality culture**
  - 6.0 Billion Parts Shipped in 2020 with **0.08ppm**
- **Premium support service available worldwide**
  - Local support engineers can give on-Site support in all regions

System Solution for Hydraulically Controlled Transmissions

Transmission PMIC OPTIREG™

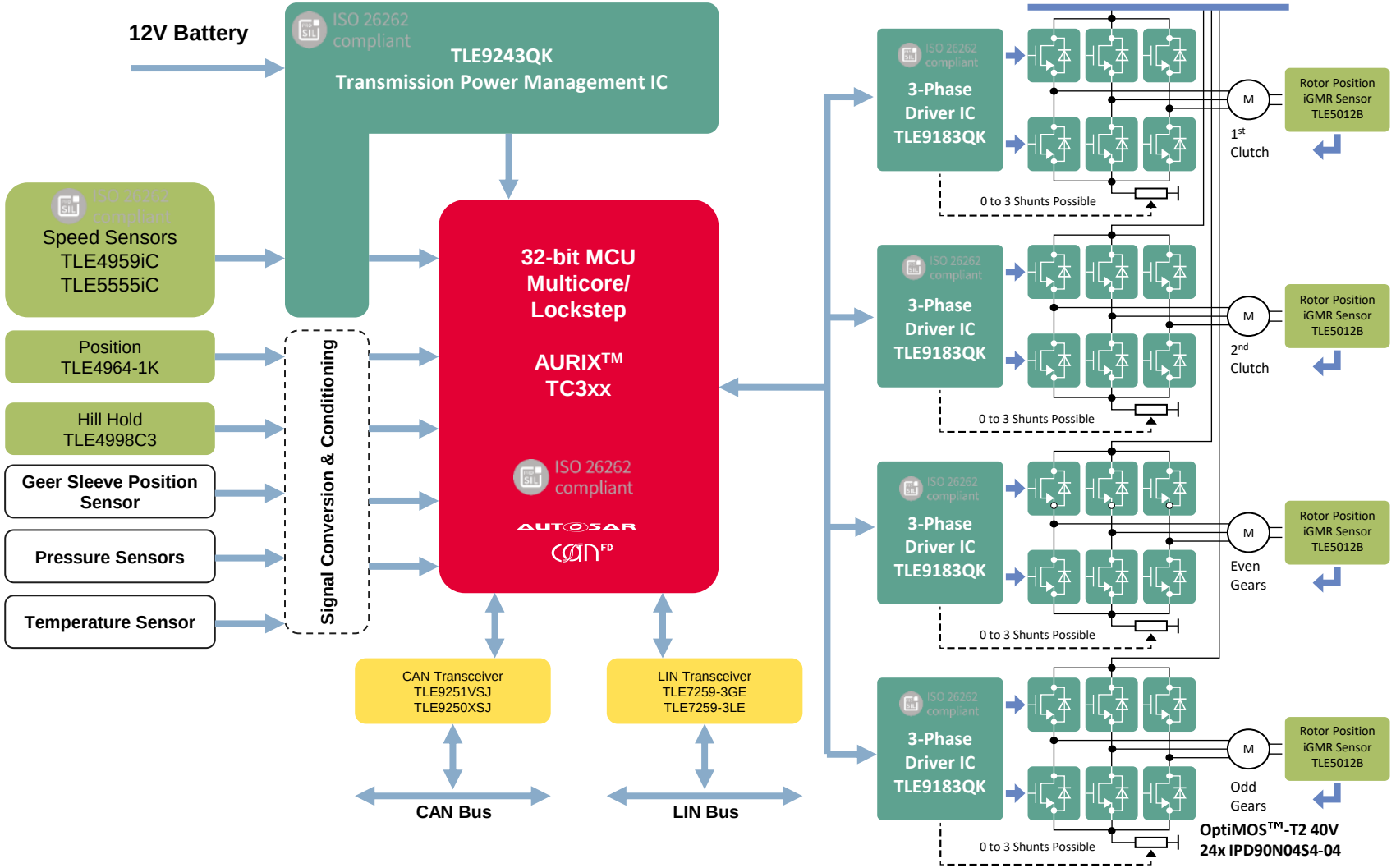
Application Diagram hydraulically controlled transmission



System Solution for Electromechanically Controlled Transmissions

Transmission OPTIREG™

Application Diagram electromechanically controlled transmission



Infineon System Solutions for Transmission Control

- **System solutions for all transmission types:**
  - Infineon offers Microcontroller, Sensor, and Power Devices for ECAT, CVT, DCT, DHT and Hybridized Transmissions
- **Our Transmission Products:**
  - AURIX™ Powertrain Microcontrollers
  - Solenoid Driver ICs and Multichannel Switches
  - BLDC Gate Driver ICs
  - Speed and Position Sensors
  - **Power Management ICs**
  - Transmission IO
- Fore more information click here

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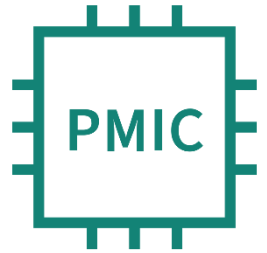
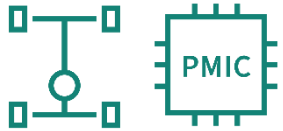
OPTIREG™ PMIC TLE9243QK Support



OPTIREG™

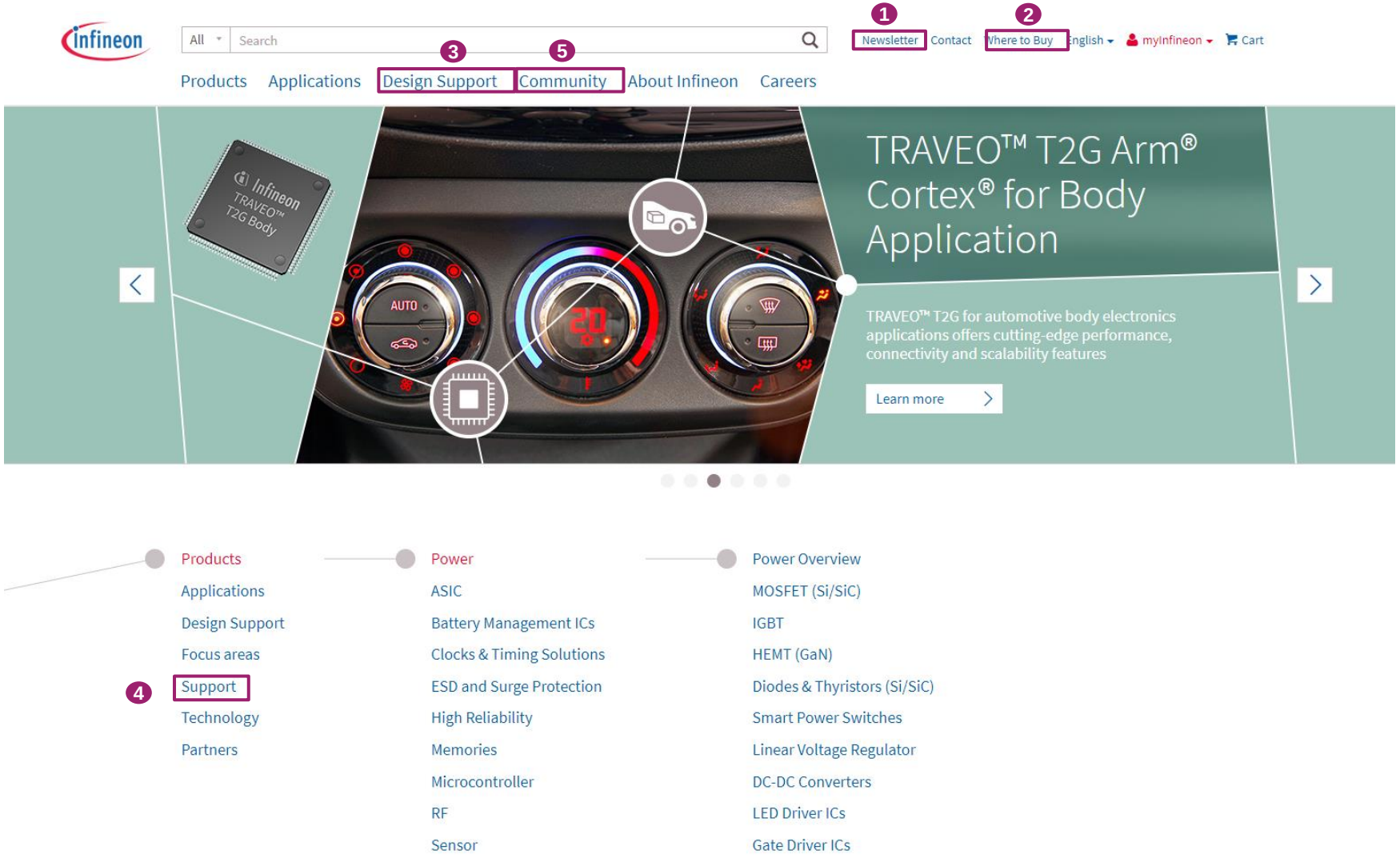
TLE9243QK: Support



Transmission OPTIREG™

Collaterals and Brochures	– Product Brief – Selection Guide – Application Brochure – Product Presentation – Press Releases, Ads	– Link to TLE9243 page
Technical Material	– Application Notes – Simulation Models – Datasheet, MCDS Files	
Evaluation Board	– Evaluation Board *on request*	
Trainings	– Trainings	

Support
Online tools and services



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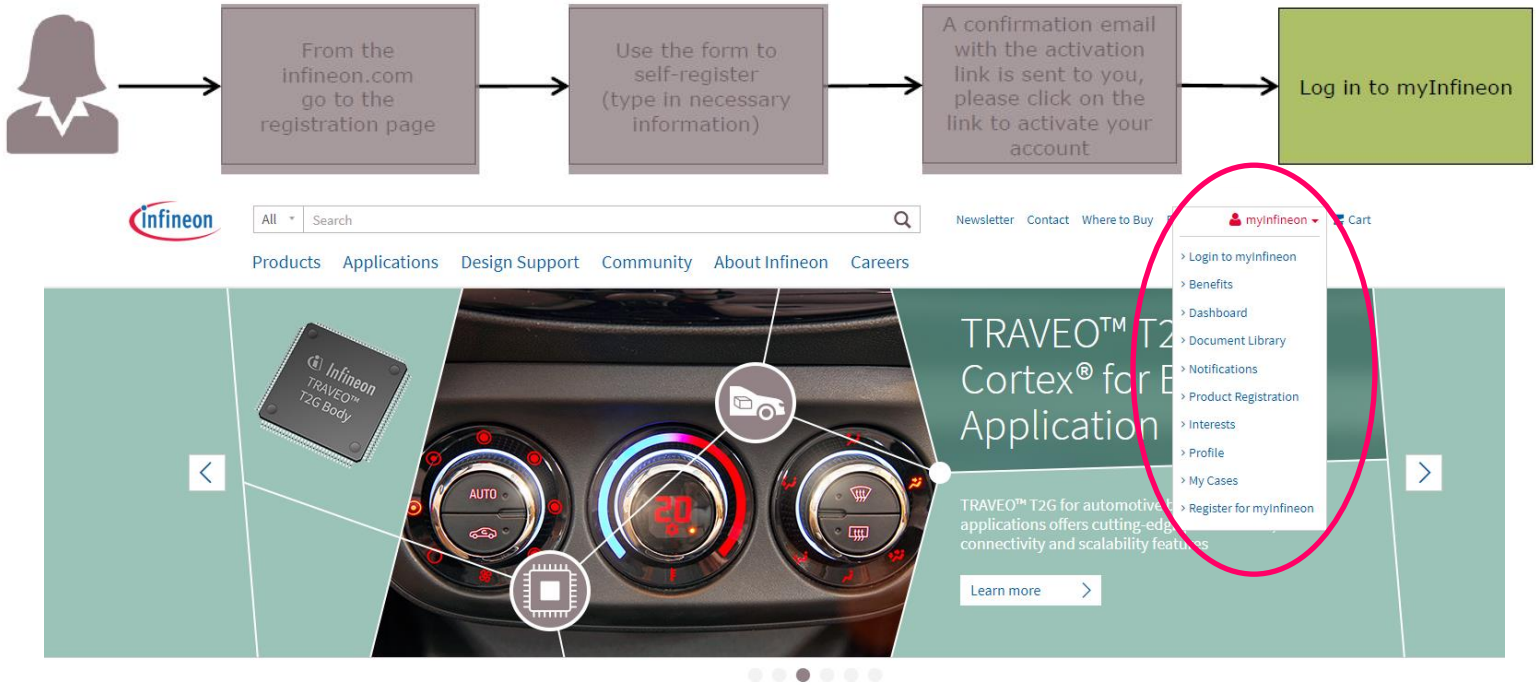
MyInfineon



My Infineon Collaboration Platform (MyICP)

What is MyICP ?

MyICP or **My Infineon Collaboration Platform** is a portal through which you can access all the documentation related to Infineon's microcontrollers.

While you may find plenty of details about Infineon microcontrollers on our official website, there are some **confidential** documents that require a › **Non-Disclosure Agreement (NDA)**. These can be accessed through MyICP.

How can I get acess to exclusive documentation

Step 1: Register to our MyInfineon platform

1. Sign up to MyInfineon › **here**

2. Type in the necessary information in the registration form

3 . Activate your account by clicking on the link in the e-mail sent to you

Step 2: Become a promoted user in MyInfineon

Registering as a user is not enough.

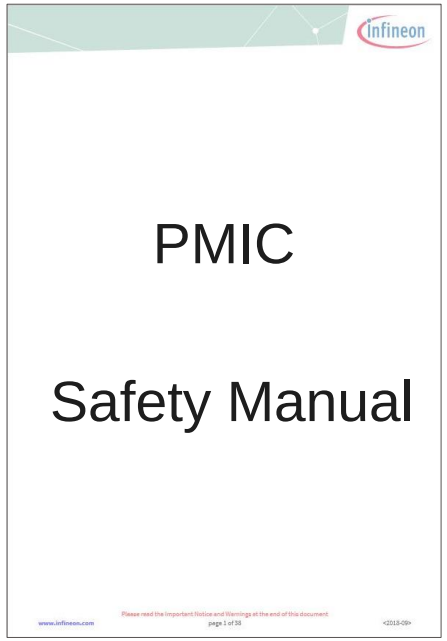
You need to be a promoted user in Infineon's network to access MyICP.

Send an e-mail to › optireg@infineon.com

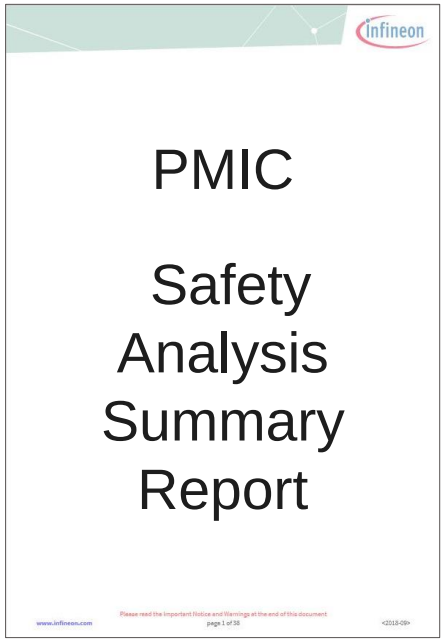
Step 3: Get access to the required documentation

This step is only possible after Step 2, i.e. after your account has been successfully promoted. It requires you to wait till you get an email from us.

OPTIREG™ PMIC
Customer safety documentation



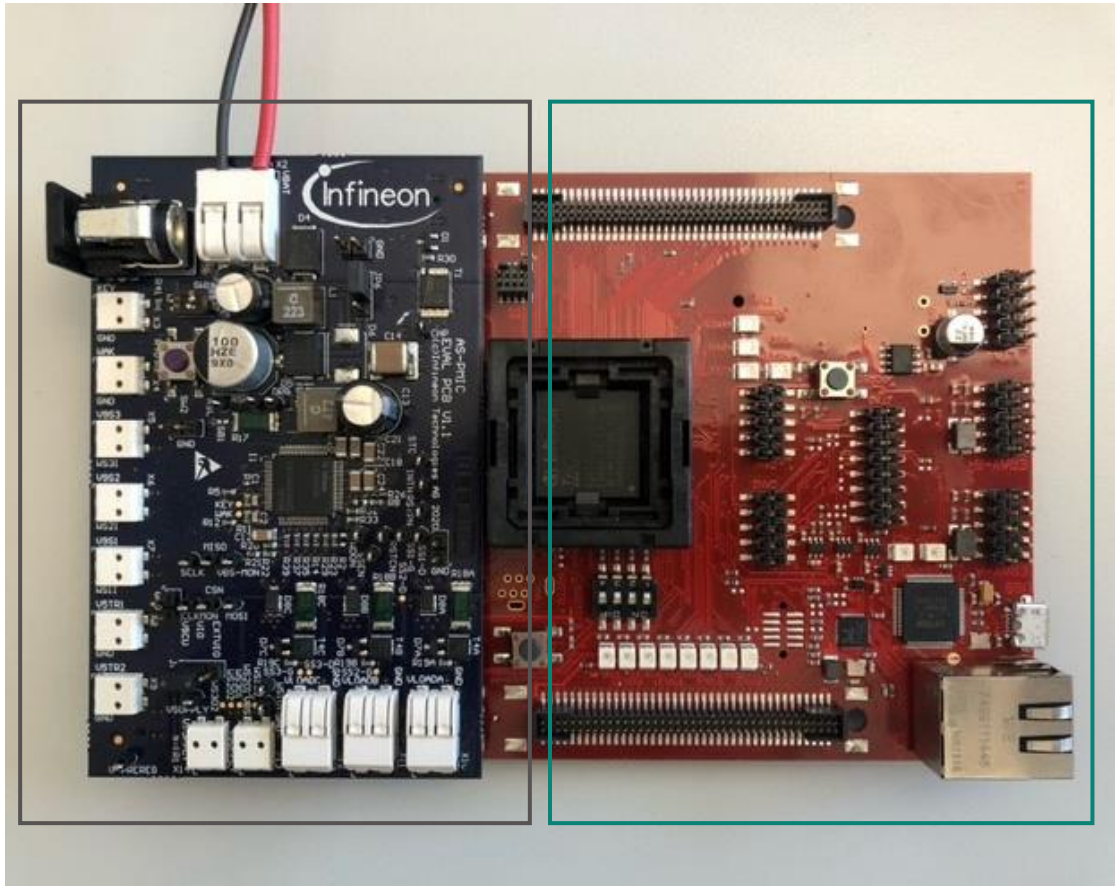
What the integrator has **to do** and to consider



Results of the **Safety Analysis** performed by Infineon ready to be used by the integrator

TLE9243QK is online and evaluation boards are available for ordering

you will find: product datasheet, evaluation board, user manual and software



TLE9243QK_DEV_BOARD

A development board to support you in testing the power capabilities of TLE9243QK. It can be used to connect supply, loads and sensors, providing easy access to all interfaces.

TLE9243QK_BASE_BOARD

An extension of the TLE9243QK_Dev_Board, a Triboard to support you in testing the power supply and safety features of TLE9243QK in combination with the AURIX™ : develop your code and establish the communication!

OPTIREG™ PMIC TLE9243QK
Additional Information

Order information

- TLE9243QK
  - OPN: LE9243QKXUMA1
  - SP#: SP003227362
  - MA#: MA005753955 for productive material C13 Step
  - MA#: MA005593572 for productive material C12 Step
- Evaluation Board TLE9243QK

TLE9243QK_BASE_BOARD
  - OPN:
  - SP#: SP005409057

TLE9243QK_DEV_BOARD
  - OPN:
  - SP#: SP005409059

Mapping of OPTIREG™ with various microcontrollers
Find the right OPTIREG™ for your microcontroller in just a few clicks!

Scan

Click

	Infineon AURIX™		Infineon Traveo™		Infineon	Texas Instruments	NXP	Renesas	ST Micro
OPTIREG™	TC2x	TC3x	I	II	PSoC®	Piccolo™/ Delfino™	S32K	RH850	SPC5x
	◎	◎	◎	◎	N/A	◎	◎	◎	◎
	◎	◎	◎	◎	◎	◎	◎	N/A	N/A
	◎	◎	◎	◎	N/A	◎	◎	N/A	N/A
	◎	◎	◎	◎	◎	◎	◎	◎	◎

OPTIREG™ PMIC trainings

Title	Content
Online Course Infineon's automotive PMICs: OPTIREG™ PMIC (S1)	By the end of this training, users will: • Recognize devices out of the OPTIREG™ PMIC product family. • Identify Infineon's portfolio of PMICs, and know which devices are currently under development.
Online Course OPTIREG™ PMIC - Technical safety requirements and goals (E2)	By the end of this training, users will: • Understand the strategy of main functional safety features (TSRs) of OPTIREG™ Safety Power Management ICs (PMIC). • After the training, you will be aware of the benefits and scope of our Safety PMICs, that are provided to safety-related applications.

Click on the training title to access it


Infineon