



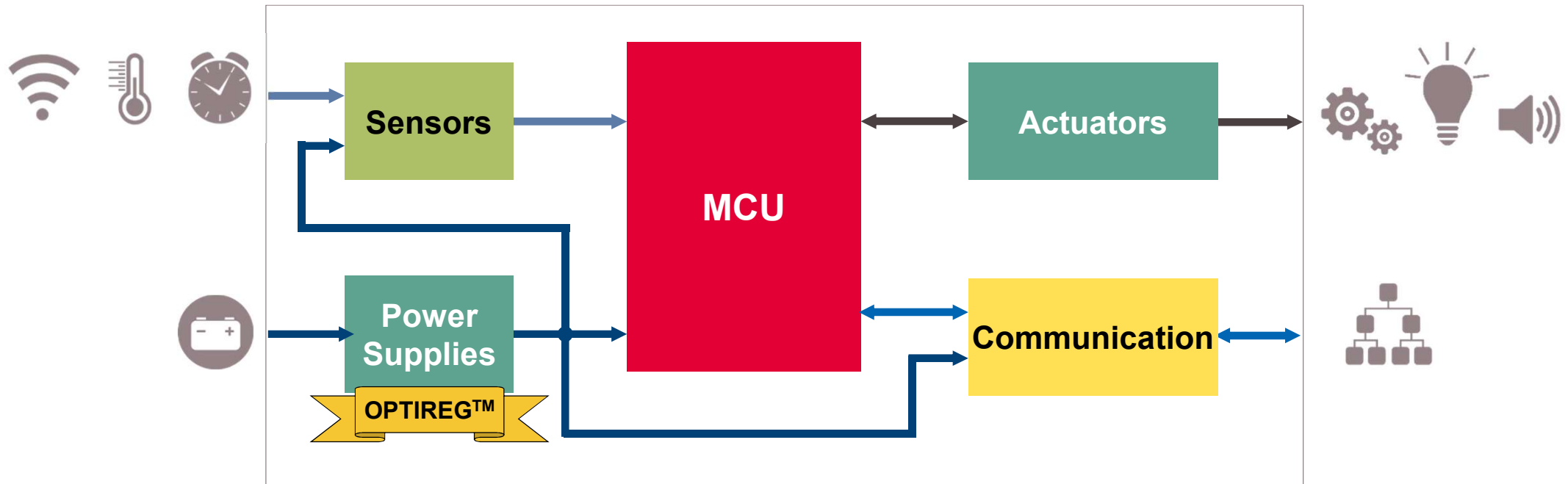
# Safely Powering Automotive Systems with OPTIREG™ TLF3x in combination with AURIX™ TC3x

IFAG ATV PS APS  
Q4/2022



restricted

# Automotive systems main components seek for steering (AURIX™) and supply (OPTIREG™ PMIC )



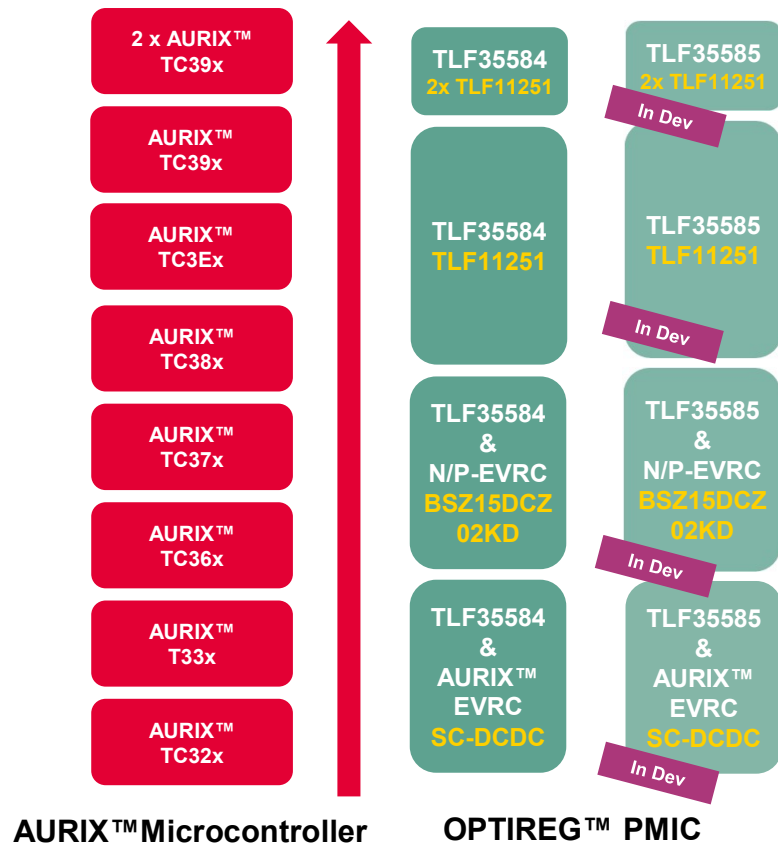
**system:** set of components or subsystems that relates at least a sensor, a controller and an actuator with one another

# OPTIREG™ PMIC

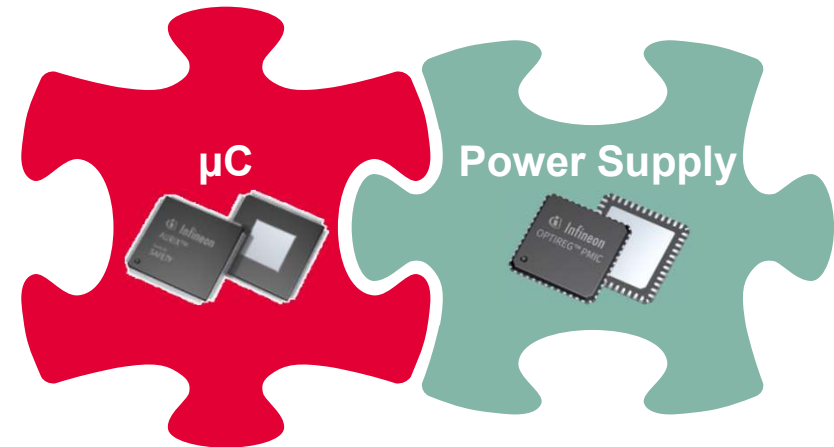
## Multi-Channel Power Supply IC optimized for Infineon µC families



### AURIX™ TC2x/TC3x and OPTIREG™ PMIC TLF35x Family



### OPTIREG™ PMIC : THE AURIX™ supply



### Infineon enables its customers' success

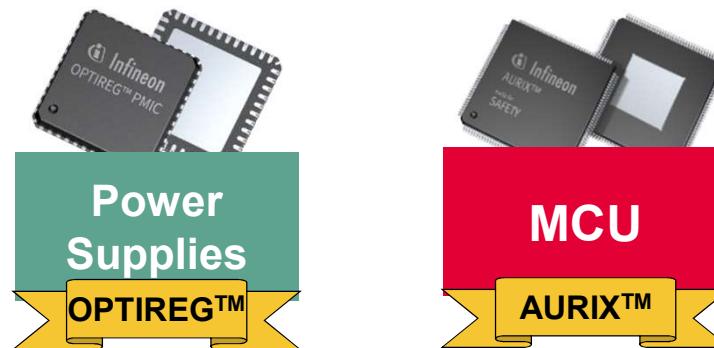
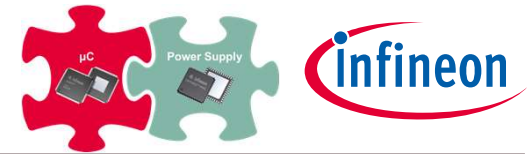
- › IFX offers a scalable PMIC portfolio which can cover the complete AURIX™ TC2x/TC3x portfolio w/o extra devices

> 70 Mpcs already shipped worldwide

> 30 different applications

> 300 projects secured at all major OEMs

# OPTIREG™ PMIC & AURIX™ microcontroller team up for system optimization and functional safety



# PMIC supervision ensures the highest level of functional safety, SIL 3

## Monitoring of fault events



### Voltage Monitor

- › Over voltage
- › Under voltage
- › Over current

### Watchdog

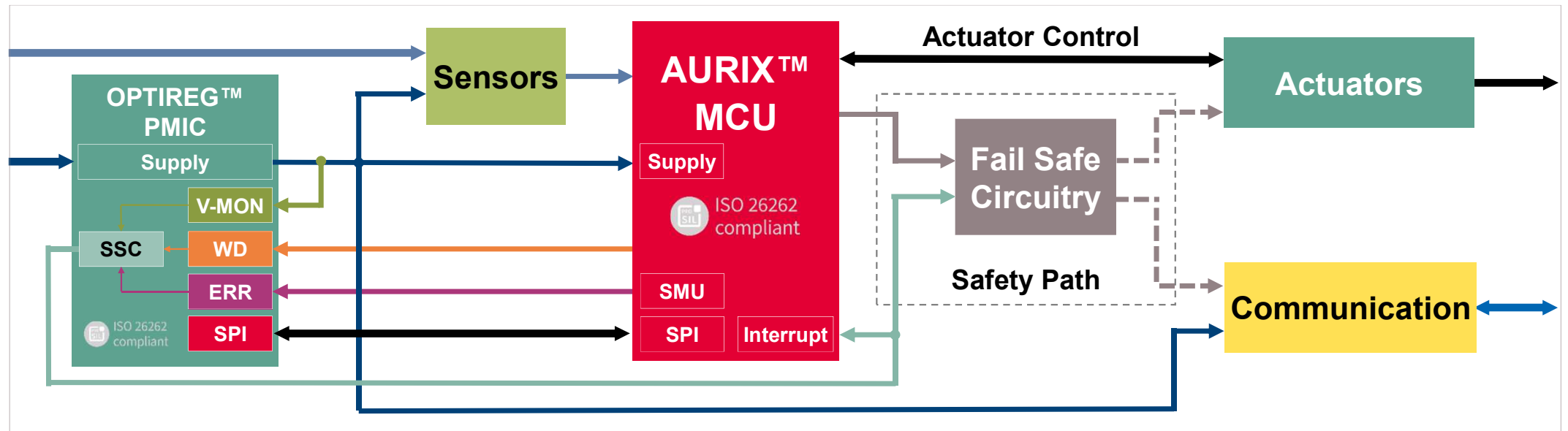
- › Timing error
- › Software execution error

### Error monitor

- › React on MCU Alarm

### PMIC internal

- › Internal supplies
- › SPI error
- › Thermal sensors
- › BIST



# TLF35584

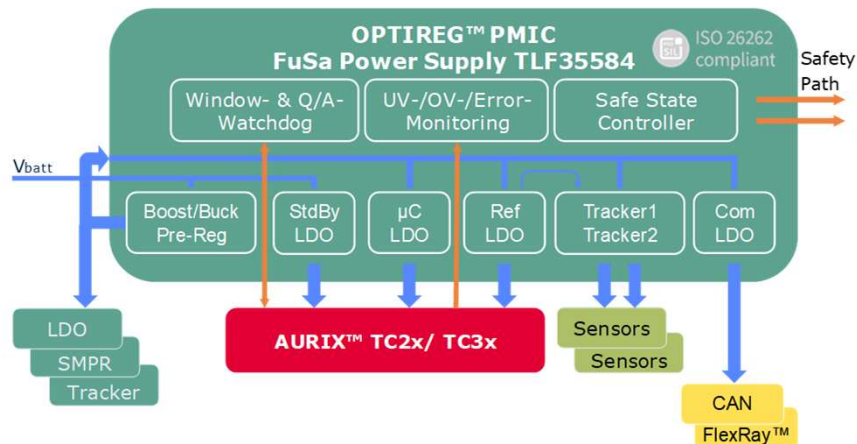
## OPTIREG™ PMIC for Functional Safety Applications



### Key Features

- › Buck/Boost-Pre-Regulator
  - IQ = 1.3A; f: 300kHz-2.5MHz
- ›  $\mu$ C-Supply: 3.3V/5V @ 600mA
- › Reference-LDO: 5V @ 150mA ( $\pm 1\%$ )
- › 2x Tracker: 5V @ 150mA
- › Communication-Supply: 5V @ 200mA
- › StandBy-LDO: 3.3V/5V @ 10mA
- › EN/Wake (T15 and CAN/FlexRay™)
- › SPI
- › Safety Features
  - Multiple bandgap (supply vs V-monitoring)
  - UV/OV-Monitoring, ERR-Monitoring
  - Functional-WD & Window-WD
  - Safe State Control
  - Secondary Safety Path
  - Protected safety area
  - Built In Self Test
  - Development acc. ISO26262

### Block Diagram



ISO 26262  
compliant

- › Vin: 3V .. 40V

### Package



PG-VQFN-48



PG-LQFP-64





# TLF35585

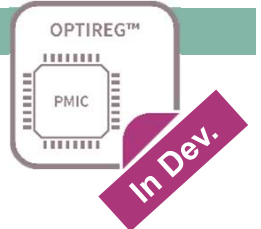
## OPTIREG™ PMIC for Functional Safety Applications



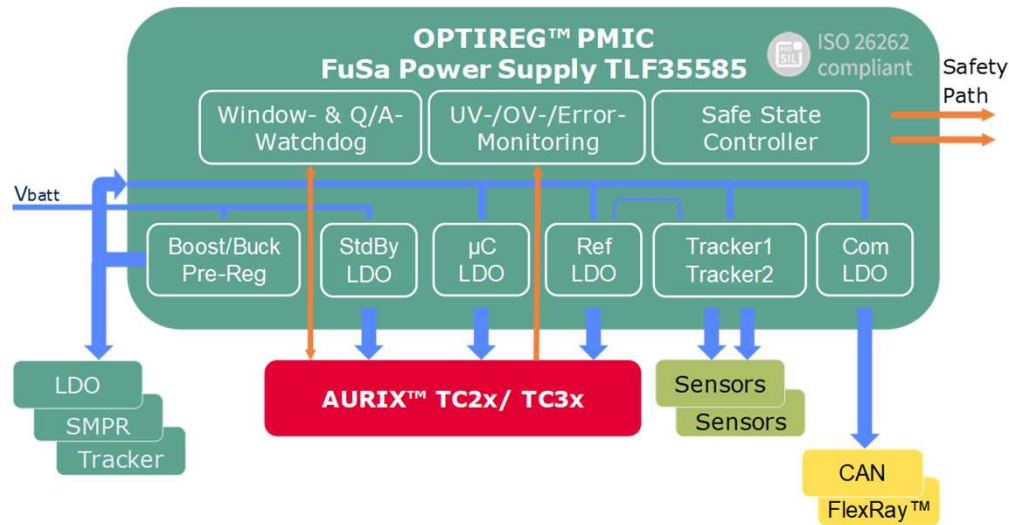
### Key Features

- › Buck/Boost-Pre-Regulator
- NEW** – IQ = 1.5A; f: 300kHz-2.5MHz
- › µC-Supply: 3.3V/5V @ 600mA
- › Reference-LDO: 5V @ 150mA (±1%)
- › Communication-Supply: 5V @ 200mA
- › 2x Tracker: 5V @ 150mA
- › StandBy-LDO: 3.3V/5V @ 10mA

- › EN/Wake (T15 and CAN/FlexRay)
- › SPI **Added Registers**
- NEW** › Low current consumption (<10-15µA)
- › Feature Enhancement vs. TLF35584
  - E.g. additional diagnostics information, extended timer functionality
- › Safety Features
  - Multiple bandgap (supply vs V-monitoring)
  - UV/OV-Monitoring, ERR-Monitoring
  - Functional-WD & Window-WD
  - Safe State Control / Secondary Safety Path
  - Protected safety area
  - Built In Self Test
  - Development acc. ISO26262
- › Vin: 3V .. 40V



### Block Diagram



### Package



PG-VQFN-48

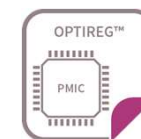


PG-TQFP-48



# OPTIREG™ PMIC TLF35585QV/US0x

## Timeline



### Product Schedule

EES: Functional samples (RT; limited coverage; limited QTY)

ES: Automated test; 3T

FES: full test coverage, final BOM/process flow

QS: Samples qualified

DR: Delivery release with PPAP (prel. PPAP upfront on demand)

### TLF35585QVS0x (VQFN-48)

EES (A-step)	Available
ES (B-step)	Available
FES (B-step)	06/2022
QS (B-step)	11/2022
DR/PPAP	02/2023

### TLF35585QUS0x (TQFP-48)

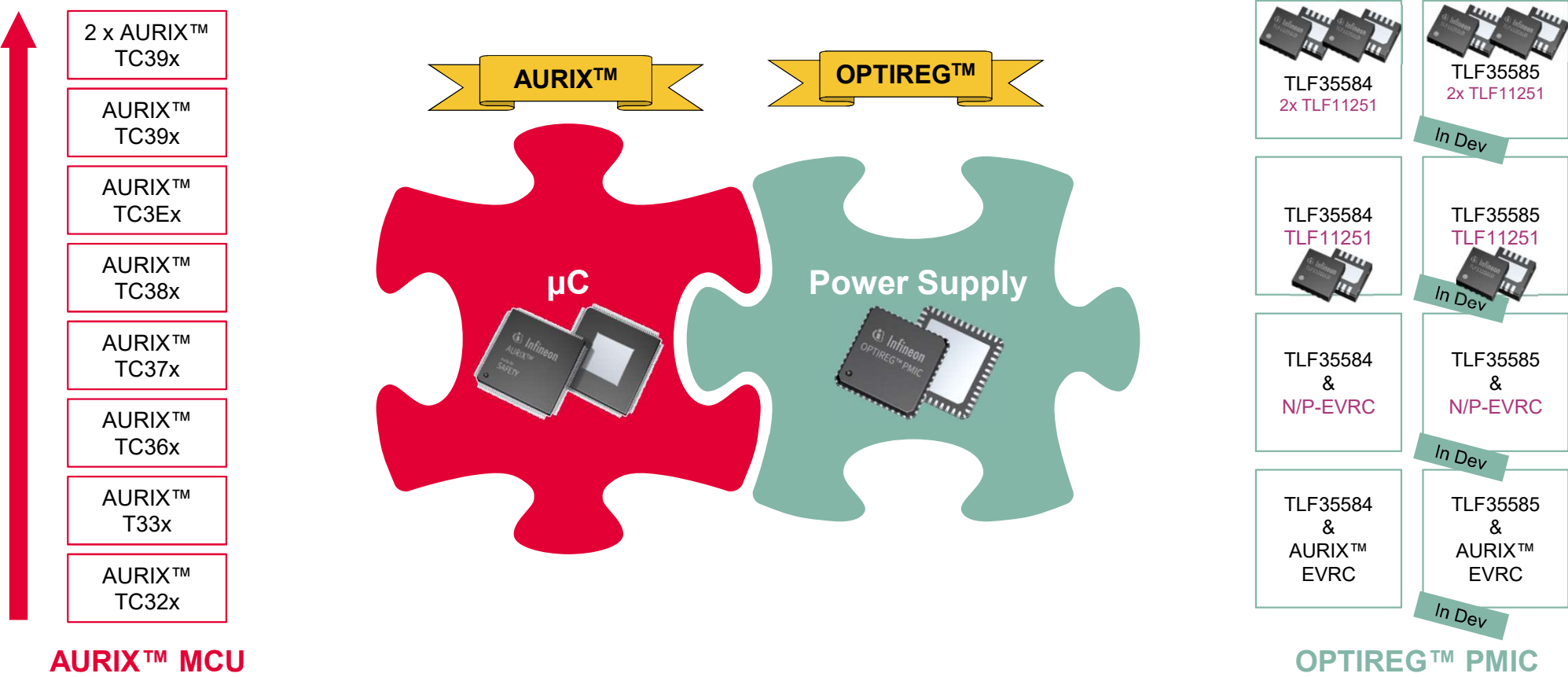
EES (A step)	Available
ES (B-step)	Available
FES (B-step)	06/2022
QS (B-step)	11/2022
DR/PPAP	02/2023



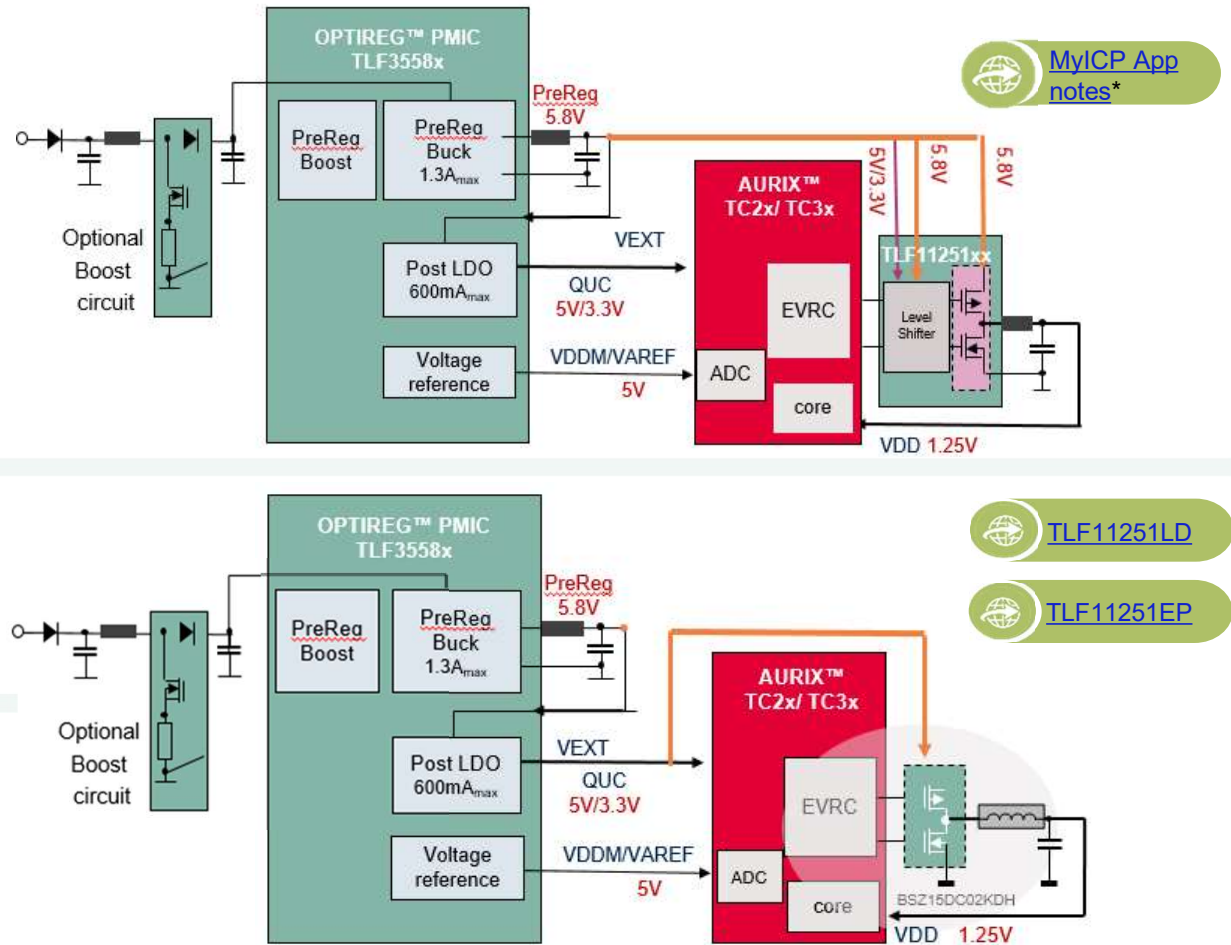
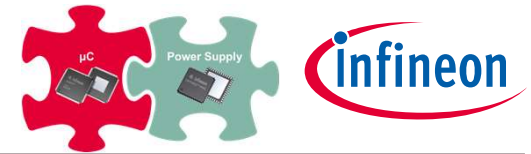
# OPTIREG™ PMIC together with OPTIREG™ TLF11251 for a safe and optimized multi-channel power supply of Infineon µC families



IFX offers a scalable PMIC portfolio which can cover the complete AURIX™ TC2x/TC3x portfolio



# Multi-Channel Power Supply IC interoperability across the entire AURIX™ microcontroller family

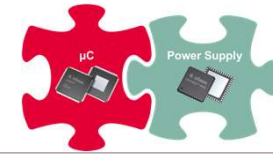


[MyICP App notes\\*](#)

[TLF11251LD](#)

[TLF11251EP](#)

# TLF11251LD/EP - Integrated Half-Bridge for Embedded Voltage Regulator Core Controller (EVRC)



## Key Features

- › Integrated PMOS and NMOS complementary output bridge with 2.5 A current capability
- › Integrated gate drivers
- › Integrated level shifter
- › Single control input with an integrated dead-time logic allows for optimized control and high efficiency
- › Output current sensing and limitation
- › Over-temperature protection
- › Low quiescent current
- › No external dead-time adjustment required

## Package

Grade 1



PG-TSON-10

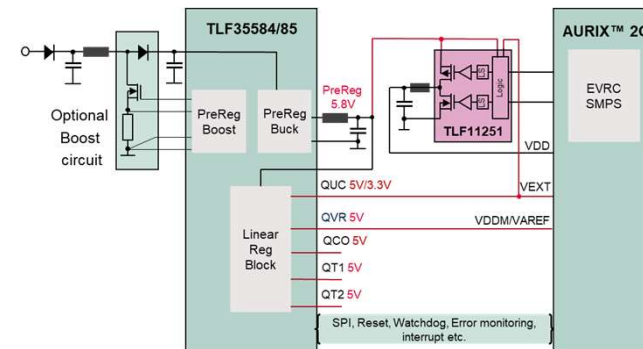
Grade 0



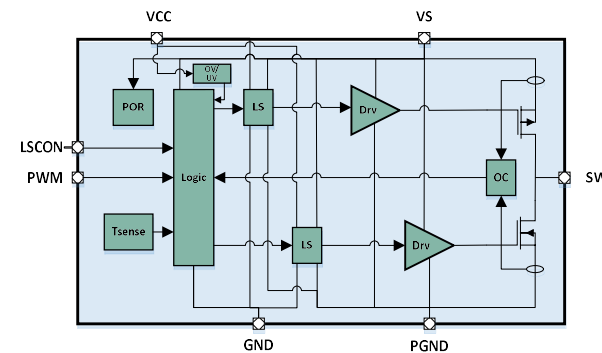
PG-TSDSO-14



## Application Diagram

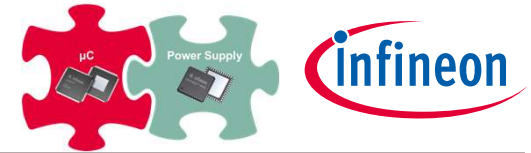


## Block Diagram



# OPTIREG™ PMIC TLF35x Family

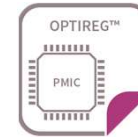
## AURIX™ TC2x/TC3x Supply Domain and Interface mapping



	PMIC supply rails			
Description	5V0 main supply		3V3 main supply	
<b>AURIX™ TC2x/TX3x Supply Domains</b>	UC1-mainstream	UC1-alternatives	UC2-mainstream	UC2-alternatives
VEVRSB	QST (5V0)	QUC (5V0)	QST (3V3)	QUC (3V3)
VEXT	QUC (5V0)		QUC (3V3)	
VDDP3	<int. EVR33>		QUC (3V3)	
VFLEXx	QUC (5V0)	<int. EVR33>	QUC (3V3)	
VEBU	QUC (5V0)	<int. EVR33>	QUC (3V3)	
VDD	<int. EVRC13> (using discrete pass element or TLF11251)	QCORE	<int. EVRC13> (using discrete pass element or TLF11251)	QCORE
VDDM	QVR	QUC (5V0)	QVR (only combined here)	QUC (3V3)
VAREFx	QVR	QUC (5V0)		

	PMIC interface	
Additional Signal Interfaces	UseCase mainstream	UseCase alternatives
/PORST	ROT	-
/ESR0	-	ROT
/ESR1 (non maskable interrupt)	INT	-
FSP[0]	ERR	
FSP[1]	-	ERR2
GPIO(maskable interrupt)	-	INT
QSPI-Port (CS, CLK, MOSI,MISO)	SCS, SCL, SDI, SDO	

# OPTIREG™ PMIC TLF35x Family Tools & Software



Learn how to integrate AURIX™ TC3xx microcontrollers with Infineon system power supplies of the TLF family and check out existing HW

 [TLF35584 Application Note\\*](#)

 [TLF35585 Application Note\\*](#)

 [Triboard Manuals\\*](#)



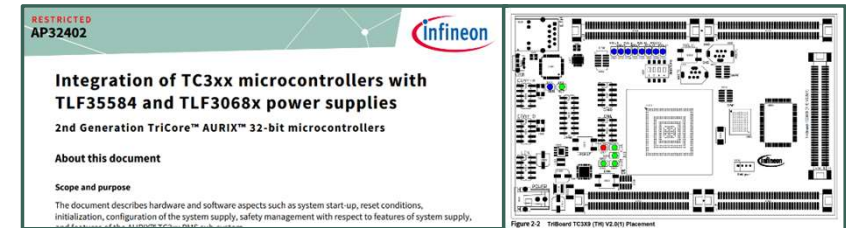
Get software support from the wide partners ecosystem of Infineon


 [Hitex SafeTpack TC3x](#)

 [Vector vSBC](#)

 [AURIX™ SafeTlibTC2x\\*](#)

\* myICP Access required



 [Find](#) out more on AURIX™ support



 More info on the power supply [partners](#)

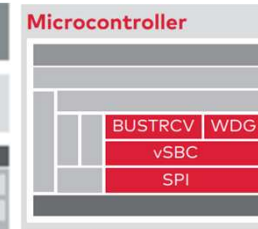
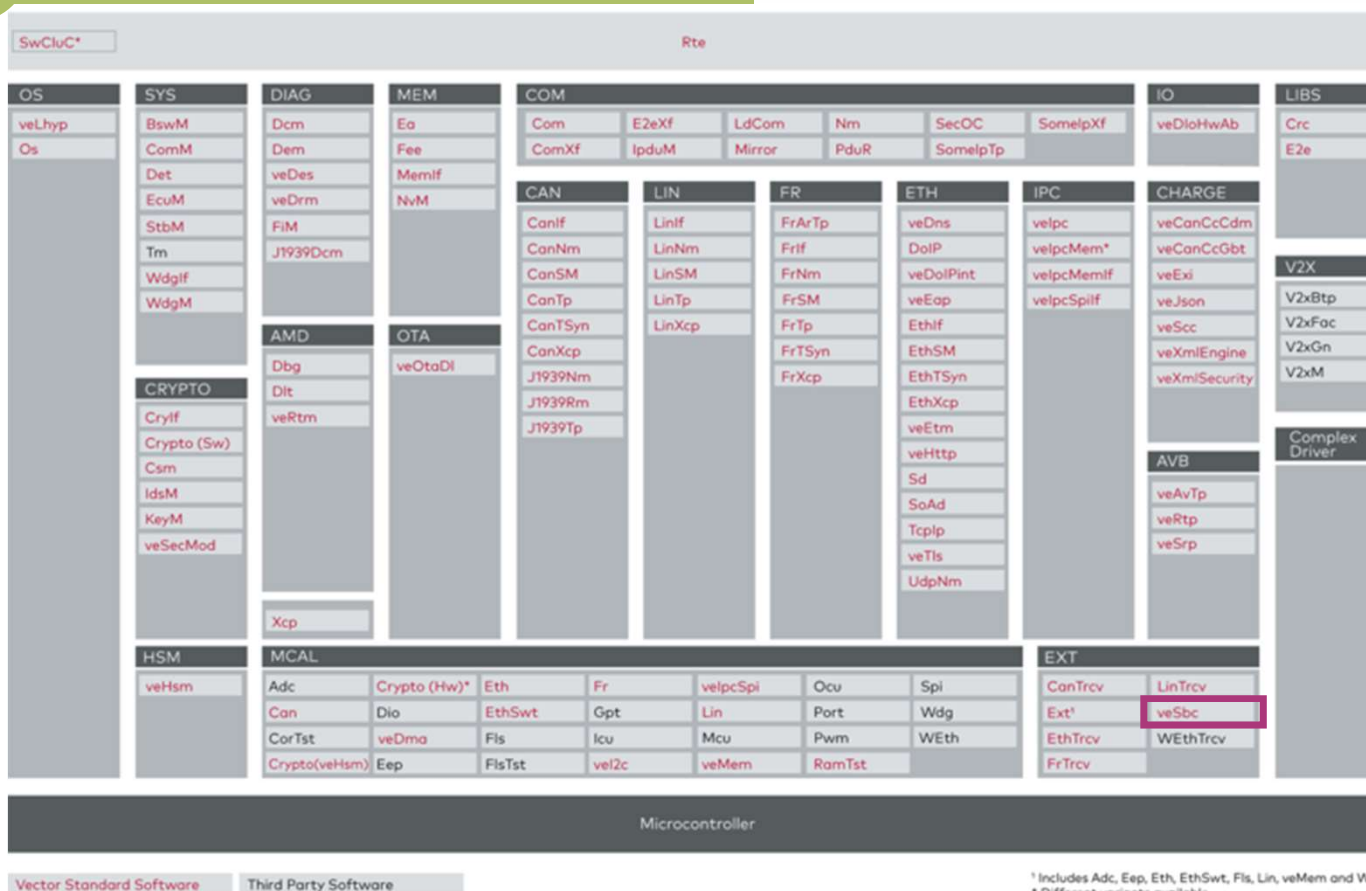


# OPTIREG™ PMIC TLF35x Family

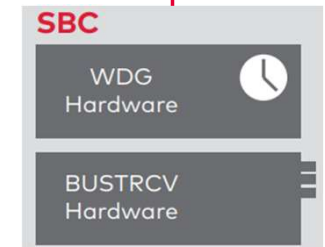
## Software from the partner Vector



Find out more on [Vector](#) offering



Serial Bus Interface



- AUTOSAR 4 basic software fulfills the requirements of ISO 26262 up to the ASIL D level
- Registers can be handled through the RAW-API
- Virtual developing and testing AUTOSAR software through DaVinci Configurator Pro
- Independent of MCUs and compilers

# OPTIREG™ PMIC TLF35x Family

## Learn more about OPTIREG™ PMICs support material



### Collaterals and Brochures

- › Product briefs
- › Selection guides
- › Application brochures
- › Presentations
- › Press releases



[TLF35584QKVS1 Webpage](#)



[TLF35584QVHS1 Webpage](#)



[TLF35584QVVS1 Webpage](#)



[TLF35584QKVS2 Webpage](#)



[TLF35584QVHS2 Webpage](#)



[TLF35584QVVS2 Webpage](#)

### Technical Material

- › Application notes
- › Technical articles
- › Simulation models
- › Datasheets, MCDS Files
- › PCB Design Data



[TLF35584 Datasheet\\*](#)



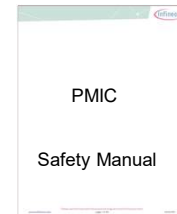
[TLF35584QVHSx Datasheet\\*](#)



[TLF35584 Technical Material\\*](#)



[TLF35584QVHSx Technical Material\\*](#)



### Evaluation Boards

- › Evaluation boards
- › Demoboards
- › Reference designs



[TLF35584 MC Board](#)



[PMIC Boards](#)



[TLF35584QVVS1 Board](#)



[TLF35584QVVS2 Board](#)

Evaluation Board Companion Board



AURIX™

### Further Info

- › Technical videos
- › Product videos

- › [Why Infineon's OPTIREG™ PMIC family is relevant for safety-related automotive applications \(E1\)](#)
- › [ATV: OPTIREG™ PMIC - Technical safety requirements and goals \(E2\)](#)



\* Accessible only via myICP



# Infineon OPTIREG™ and Infineon MCUs best chipset solutions for preferred applications presented to Infineon colleagues and distribution



## FAST2022

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### › All [FAST Trainings](#)

- › [ATV: OPTIREG™ TLF35x PMIC integration with AURIX™ Microcontrollers \(E2\)?](#)
- › [FAST2022 Teaser: OPTIREG™ - the perfect fit to supply AURIX™, Traveo™ & PSoC™ Microcontrollers \(S\)](#)

# Multi-Channel Power Supply IC optimized for Infineon $\mu$ C families

## Mapping OPTIREG™ PMIC with AURIX™ 2G Microcontroller



Infineon AURIX™ Family		Maximum Current Consumption (real power pattern)	OPTIREG™ PMIC			
			ISO 26262 compliant	ISO 26262 compliant		ISO 26262 compliant
			TLF35584/5Q*	TLF35584/5Q* w/ TLF11251	TLF30682QV	TLE9243QK
2nd Gen	TC33 series	200mA @ 3.3V 132mA @ 5V	√	√	√	√
	TC33 series (ADAS variant)	381mA @ 3.3V 252mA @ 5V	√	√	√	√
	TC35 series	576mA @ 3.3V 380mA @ 5V	√	√	√	√
	TC36 series	333mA @ 3.3V 240mA @ 5V	√	√	√	√
	TC37 series	370mA @ 3.3V 244mA @ 5V	√	√	√	√
	TC38 series	515mA @ 3.3V 340mA @ 5V	√ <sup>2)</sup>	√	√	√
	TC39 series	758mA @ 3.3V 500mA @ 5V	√ <sup>2)</sup>	√	√	√
	TC39 series (ADAS variant)	679 mA @ 3.3V (T <sub>J</sub> = 125°C) 448 mA @ 5V (T <sub>J</sub> = 125°C)	√ <sup>2)</sup>	√	√	√

### Note:

√<sup>1)</sup> Supply feasible in combination with load sharing on VCC3

√<sup>2)</sup> Supply feasible depending on the use case of the  $\mu$ C

Based on **Maximum Power Dissipation** (at real power pattern) see datasheet parameter PD SR (T<sub>J</sub> = 150°C);  
Current Value = Power Dissipation / Voltage Level;

Further support and calculation tools [www.infineon.com/OPTIREG™](http://www.infineon.com/OPTIREG™)  
and [www.infineon.com/AURIX™](http://www.infineon.com/AURIX™)

# Multi-Channel Power Supply IC optimized for Infineon $\mu$ C families

## Mapping OPTIREG™ PMIC with Cypress Traveo™ Microcontroller



Cypress Traveo™ Family		Maximum Current Consumption (real power pattern)	OPTIREG™ PMIC			
			ISO 26262 compliant	ISO 26262 compliant		ISO 26262 compliant
			TLF35584QV/QK/QVH	TLF35585QV/QU	TLF30682QV	TLE9243QK
1st Gen	S6J311A/9 series	5V / 200mA (T <sub>A</sub> = -40°C to +125°C)	√	√	√	√
	S6J311E/D series	5V / 343mA (T <sub>A</sub> = -40°C to +105°C)	√	√	√	√
	S6J3120 series	5V / 255mA (T <sub>A</sub> = -40°C to +105°C)	√	√	√	√
	S6J3360 series	5V / 174mA (T <sub>A</sub> = -40°C to +105°C)	√	√	√	√
	S6J3370 series	5V / 158mA (T <sub>A</sub> = -40°C to +105°C)	√	√	√	√
	S6J3400 series	5V / 150mA (T <sub>A</sub> = -40°C to +125°C)	√	√	√	√
	S6J3510 series	5V / 158mA (T <sub>A</sub> = -40°C to +125°C)	√	√	√	√

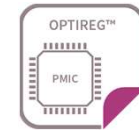
**Note:** √<sup>1)</sup> Supply feasible in combination with load sharing on VCC3  
 √<sup>2)</sup> Supply feasible depending on the use case of the  $\mu$ C

Based on **Power Supply Current Flash max.**, see datasheet parameter I<sub>CC5</sub>

Further support and calculation tools under [www.infineon.com/OPTIREG](http://www.infineon.com/OPTIREG)

# Multi-Channel Power Supply IC optimized for Infineon $\mu$ C families

## Mapping OPTIREG™ PMIC with Cypress Traveo™ II Microcontroller



Cypress Traveo™ II Family		Maximum Current Consumption (real power pattern)	Need of external core supply	OPTIREG™ PMIC				OPTIREG™ Linear & Switcher
				ISO 26262 compliant	ISO 26262 compliant		ISO 26262 compliant	Core Voltage
				TLF35584QV/QK/QVH	TLF35585QV/QU	TLF30682QV	TLE9243QK	1.15V
2 <sup>nd</sup> Gen.	TVII-B-E-512K CYT2B6	IDDD = 102mA @ 3.3V / 5V	No	√	√	√	√	
	TVII-B-E-1M CYT2B7	IIO = 2 x 15mA @ 3.3V / 5V						
	TVII-B-E-2M CYT2B9	IDDD = 110mA @ 3.3V / 5V	No	√	√	√	√	
	TVII-B-E-4M CYT2BL	IIO = 2 x 15mA @ 3.3V / 5V						
	TVII-B-H-4M CYT3BB/4BB	IDDD = 249mA @ 3.3V / 5V IIO = 2 x 15mA @ 3.3V / 5V	No	√	√	√	√	
		ICCD = 240mA @ 1.15V IDDD = 9mA @ 3.3V / 5V IIO = 2 x 15mA @ 3.3V / 5V IIOHS = 1 x 20mA @ 3.3V		√	√	√ <sup>1)</sup>	√	Post LDO TLS208 800mA
	TVII-B-H-8M CYT4BF	ICCD = 431mA @ 1.15V IDDD = 9.3mA @ 3.3V / 5V IIO = 2 x 15mA @ 3.3V / 5V IIOHS = 2 x 20mA @ 3.3V	Yes	√	√	√ <sup>1)</sup>	√	Post LDO TLS208 800mA
	TVII-C-2D-6M CYT4D	ICCD = 1300mA @ 1.15V (with VIDEOSS) IIO = 2 x 15mA @ 3.3V / 5V IIOHS = 2 x 20mA @ 3.3V	Yes	√	√	√ <sup>1)</sup>	√	DCDC TLE8366EV 1A

**Note:** √<sup>1)</sup> 0.9-1.3V, 2A

# Multi-Channel Power Supply IC optimized for Infineon $\mu$ C families

## Mapping OPTIREG™ PMIC with TI Piccolo™/Delfino™ Microcontroller



Texas Instrument C2000™ Family		Maximum Current Consumption	OPTIREG™ PMIC			
			ISO 26262 compliant	ISO 26262 compliant		ISO 26262 compliant
			TLF35584QV/QK/ QVH	TLF35585QV/QU	TLF30682QV	TLE9243QK
Piccolo™ generation	TMS320F28004x series	143mA@ 3.3V	√	√	√	-
	TMS320F2802x series	98mA@ 3.3V	√	√	√	-
	TMS320F2802x series	153mA@ 3.3V	√	√	√	-
	TMS320F2805x series	192mA@ 3.3V	√	√	√	-
	TMS320F2806x series	307mA@ 3.3V	√	√	√	-
	TMS320F2807x series	405mA@ 3.3V	√	√	√	-
Delfino™ generation*	TMS320F2833x series*	92mA @ 3.3V 350mA @ 1.8V	√ <sup>(3)</sup>	√ <sup>(3)</sup>	√ <sup>(4)</sup>	-
	TMS320F2834x series*	80mA @ 3.3V 45mA @ 1.8V 740mA @ 1.2V	√ <sup>(3)</sup>	√ <sup>(3)</sup>	√ <sup>(3)</sup>	-
	TMS320F2837xD series*	90mA @ 3.3V 495mA @ 1.8V	√ <sup>(3)</sup>	√ <sup>(3)</sup>	√ <sup>(4)</sup>	-
	TMS320F2837xD series*	90mA @ 3.3V 400mA @ 1.2V	√ <sup>(3)</sup>	√ <sup>(3)</sup>	√ <sup>(4)</sup>	-

**Note:** √<sup>(1)</sup> Supply feasible in combination with load sharing on VCC3  
 √<sup>(2)</sup> Supply feasible depending on the use case of the  $\mu$ C  
 √<sup>(3)</sup> Additional supply domain(s) required  
 √<sup>(4)</sup> Special variant required

\*Device without internal VREG. Infineon's SBC can only be used to supply 3.3V ( $I_{DDIO} + I_{DD3VFL} + I_{DDA33}$ ) from Vcc1 to as well as the 5V on Vcc2 to supply the CAN transceiver or off-board supply, e.g. for sensor. The core supply  $I_{DD}$  and  $I_{DDA18}$  needs to come from a separate source.




Based on **Power Consumption Operational (flash) max.**, see datasheet parameter  $I_{DDIO} + I_{DDA} (+I_{DD3VFL} + I_{DDA33})$  if VREG enabled ( $T_J = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ),  $V_{IN}$  (3.3 V)

Further support and calculation tools under [www.infineon.com/OPTIREG](http://www.infineon.com/OPTIREG)

# Multi-Channel Power Supply IC optimized for Infineon $\mu$ C families

## Mapping OPTIREG™ PMIC with NXP S32K Microcontroller



NXP S32K1xx Family		Maximum Current Consumption	OPTIREG™ PMIC			
			 ISO 26262 compliant	 ISO 26262 compliant		 ISO 26262 compliant
			TLF35584QV/QK/QVH	TLF35585QV/QU	TLF30682QV	TLE9243QK
S32K	S32K116 <sub>1</sub>	24.1mA @ 5V	√	√	√	√
	S32K118 <sub>1</sub>	25.9mA @ 5V	√	√	√	√
	S32K142 <sub>2</sub>	57.4mA @ 5V	√	√	√	√
	S32K144 <sub>2</sub>	61.3mA @ 5V	√	√	√	√
	S32K146 <sub>2</sub>	82.8mA @ 5V	√	√	√	√
	S32K148 <sub>2</sub>	97.4mA @ 5V 119mA @ 3.3V	√	√	√	√

<sup>1</sup> Max. 48 MHz @ T<sub>A</sub> = 125°C

<sup>2</sup> Max. 112 MHz @ T<sub>A</sub> = 105°C

Based on **Power Consumption Run max.**, see datasheet parameter „Run @ max MHz“

Further support and calculation tools under [www.infineon.com/OPTIREG™](http://www.infineon.com/OPTIREG™)



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