# OPTIREG™ PMIC TLF35585QUS01

## Functional safety PMIC

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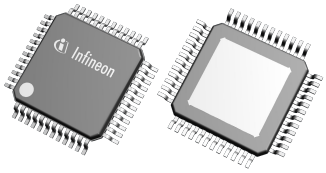
AEC Qualified | RoHS | ISO 26262 compliant

## Features



- High efficient power management integrated circuit (PMIC)
- Serial step up and step down pre-regulator for wide input voltage range from 3.0 V to 40 V with full performance and low overall power loss
- Low drop post regulator 5.0 V/600 mA for microcontroller main supply (QUC)
- Low drop post regulator 5.0 V/200 mA for communication supply (QCO)
- Voltage reference (±1%) 5.0 V/150 mA for ADC supply (QVR)
- Two trackers for sensor supply following voltage reference 150 mA current capability each (QT1 and QT2)
- Standby regulator 5.0 V/10 mA (QST)
- Enable, sync out signal and voltage monitoring of an optional external post regulator for core supply
- Independent voltage monitoring block and error pin monitoring
- Configurable window watchdog and functional watchdog
- Safe State Control with two safe state signals with programmable delay
- 16-bit SPI, interrupt and reset function
- High junction temperature operation up to 175°C
- PRO-SIL™ Features:
  - ISO 26262 Safety Element out of Context for requirements up to ASIL D
  - Safety documentation for ISO 26262 compliant system integration
- Green Product (RoHS compliant)

## Potential applications

- Electric power steering
- Battery management
- Engine management
- Domain control
- Traction inverter

## Product validation

Qualified for automotive applications with higher temperature requirements. Product validation according to AEC-Q100, Grade 0.

# Description

The OPTIREG™ PMIC TLF35585QUS01 is a highly efficient Functional Safety PMIC (Power management integrated circuit) for safety-relevant applications.

The power supply includes a boost-buck pre-regulator supplying post regulator rails for microcontroller supply, communication supply and a precise voltage reference. In addition, two trackers following the voltage reference are available to supply off-board sensors.

The OPTIREG™ PMIC TLF35585QUS01 comes with a configurable window watchdog (time based trigger) and functional watchdog (question and answer based trigger), error pin monitoring and voltage monitoring functions as major supervision functions. For microcontroller interaction a 16-bit SPI, interrupt and reset function are provided.

The device has been developed according to ISO 26262 targeting systems up to ASIL D and supports an extended junction temperature range of up to 175°C.

| Type | Package | Marking (Line1 / Line2) |
|---|---|---|
| TLF35585QUS01 | PG-TQFP-48-10 | TLF35585 / S01 R0 |

# Table of contents

# 1 General product characteristics

## 1.1 Absolute maximum ratings

**Table 1 Absolute maximum ratings**[1)]

$T_j$ = -40°C to 175°C, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

| Parameter | Symbol | Values | | | Unit | Note or condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| **Voltages** | | | | | | | |
| Boost driver ground | $V_{BSG}$ | -0.3 | – | 0.3 | V | – | P_4.1.1 |
| Input standby supply | $V_{VST}$ | -0.3 | – | 40 | V | 2) 3) | P_4.1.2 |
| Input voltage pin 1 (pre-regulator) | $V_{VS1}$ | -0.3 | – | 40 | V | 2) 3) Exception for SLEEP state: $V_{VS1}$ is limited to max. 20 V) | P_4.1.3 |
| External step up power stage, gate | $V_{DRG}$ | -0.3 | – | 40 | V | 2) | P_4.1.4 |
| External power stage, sense resistor high | $V_{RSH}$ | -0.3 | – | 40 | V | 2) | P_4.1.5 |
| External power stage, sense resistor low | $V_{RSL}$ | -0.3 | – | 2.5 | V | – | P_4.1.6 |
| Enable input | $V_{ENA}$ | -0.3 | – | 40 | V | 2) | P_4.1.7 |
| Enable input | $I_{ENA}$ | -5 | – | – | mA | 4) | P_4.1.8 |
| Wake input | $V_{WAK}$ | -0.3 | – | 40 | V | 2) | P_4.1.9 |
| Wake input | $I_{WAK}$ | -5 | – | – | mA | 4) | P_4.1.10 |
| Reset output | $V_{ROT}$ | -0.3 | – | 40.0 | V | – | P_4.1.11 |
| SPI chip select input | $V_{SCS}$ | -0.3 | – | 40.0 | V | – | P_4.1.12 |
| SPI clock input | $V_{SCL}$ | -0.3 | – | 40.0 | V | – | P_4.1.13 |
| SPI data in (MOSI) input | $V_{SDI}$ | -0.3 | – | 40.0 | V | – | P_4.1.14 |
| SPI data out (MISO output) | $V_{SDO}$ | -0.3 | – | 40.0 | V | – | P_4.1.15 |
| Interrupt output | $V_{INT}$ | -0.3 | – | 40.0 | V | – | P_4.1.16 |
| Window watchdog trigger input | $V_{WDI}$ | -0.3 | – | 40.0 | V | – | P_4.1.17 |
| Error pin input | $V_{ERR}$ | -0.3 | – | 40.0 | V | – | P_4.1.18 |
| Safe state 1 output | $V_{SS1}$ | -0.3 | – | 40.0 | V | – | P_4.1.19 |
| Safe state 2 output | $V_{SS2}$ | -0.3 | – | 40.0 | V | – | P_4.1.20 |
| Output voltage reference supply | $V_{QVR}$ | -0.3 | – | 6.0 | V | – | P_4.1.21 |

**(table continues...)**

**Table 1 (continued) Absolute maximum ratings**[1)]

$T_j$ = -40°C to 175°C, all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

| Parameter | Symbol | Values | | | Unit | Note or condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| Output tracker 2 | $V_{QT2}$ | -1.0 | – | 40 | V | – | P_4.1.22 |
| Output tracker 1 | $V_{QT1}$ | -1.0 | – | 40 | V | – | P_4.1.23 |
| Output communication supply | $V_{QCO}$ | -0.3 | – | 6.0 | V | – | P_4.1.24 |
| Output microcontroller main supply | $V_{QUC}$ | -0.3 | – | 6.0 | V | – | P_4.1.25 |
| External core voltage monitor input | $V_{VCI}$ | -0.3 | – | 6.0 | V | – | P_4.1.26 |
| HW config: ext. core voltage monitor | $V_{SEC}$ | -0.3 | – | 6.0 | V | – | P_4.1.27 |
| Synchronization output | $V_{SYN}$ | -0.3 | – | 40.0 | V | – | P_4.1.28 |
| Enable output for ext. core supply | $V_{EVC}$ | -0.3 | – | 40.0 | V | – | P_4.1.29 |
| Step down feedback input 2 | $V_{FB2}$ | -0.3 | – | 8.0 | V | – | P_4.1.30 |
| Step down feedback input 1 | $V_{FB1}$ | -0.3 | – | 8.0 | V | – | P_4.1.31 |
| Step down power ground 2 | $V_{PG2}$ | -0.3 | – | 0.3 | V | – | P_4.1.32 |
| Step down power ground 1 | $V_{PG1}$ | -0.3 | – | 0.3 | V | – | P_4.1.33 |
| Step down switching node | $V_{SW1}$ | -0.3 | – | 40 | V | [3)] | P_4.1.34 |
| HW config: step up pre-regulator | $V_{STU}$ | -0.3 | – | 6.0 | V | – | P_4.1.35 |
| HW config: step down frequency | $V_{FRE}$ | -0.3 | – | 6.0 | V | – | P_4.1.36 |
| Output standby supply | $V_{QST}$ | -0.3 | – | 6.0 | V | – | P_4.1.37 |
| Input MPS | $V_{MPS}$ | -0.3 | – | 20 | V | – | P_4.1.38 |
| **Temperatures** | | | | | | | |
| Junction temperature | $T_j$ | -40 | – | 175 | °C | – | P_4.1.39 |
| Storage temperature | $T_{stg}$ | -55 | – | 175 | °C | – | P_4.1.40 |
| **ESD susceptibility** | | | | | | | |
| ESD robustness to GND | $V_{ESD}$ | -2 | – | 2 | kV | HBM [5)] | P_4.1.41 |
| ESD robustness to GND | $V_{ESD}$ | -500 | – | 500 | V | CDM [6)] | P_4.1.42 |
| ESD robustness (corner pins) to GND | $V_{ESD,Corner}$ | -750 | – | 750 | V | CDM [6)] | P_4.1.43 |

1) Not subject to production test, specified by design.
2) Maximum rating is 60 V, if rising slewrate of voltage at the pin is lower than 6 V/ms , for an overall time of 1 hour during the lifetime of the product

*3)* Maximum rating is 43.5 V, for an overall time of 10 s (in the range of 40 V to 43.5 V) during the lifetime of the product independent from the rise time.
*4)* Consider external series resistor for negative voltages < -0.3 V to ensure maximum rating of current
*5)* Human body model (HBM) robustness according to ANSI/ESDA/JEDEC JS-001 (1.5 kΩ, 100 pF).
*6)* Charged device model (CDM) robustness according to ESDA STM5.3.1 or ANSI/ESD S.5.3.1.

*Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information visit* www.jedec.org.

# 2 Application information

The following figure describes how the IC is used in its environment.

*Note: The following information is given as an example for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.*

- Please contact us for additional supportive documentation.
- For further information you may contact http://www.infineon.com/

*Note: This figure is a simplified example of an application circuit. The function must be verified in the application.*

## 2 Application information

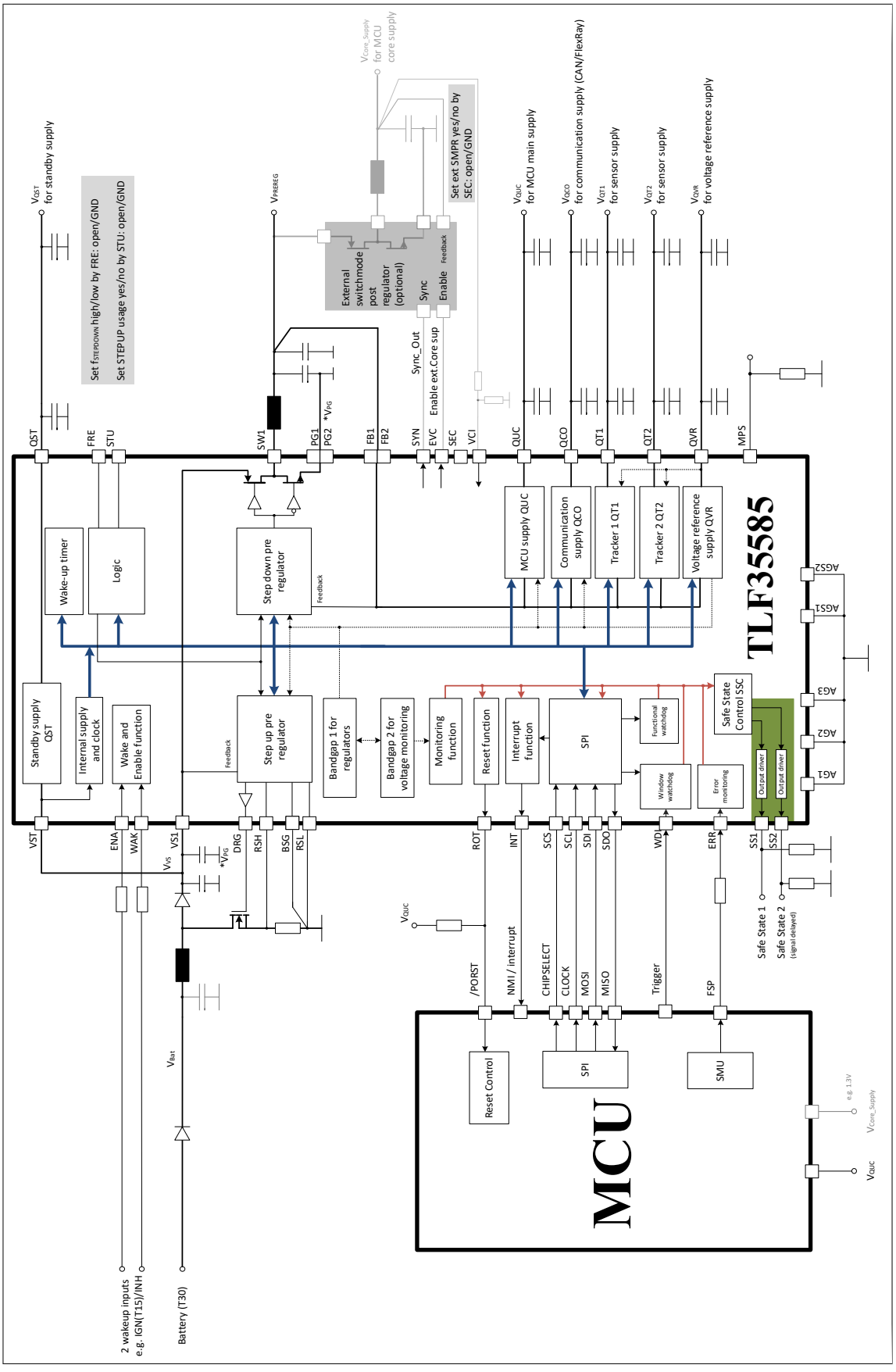



**Figure 1 Application diagram**

# 3 Package information

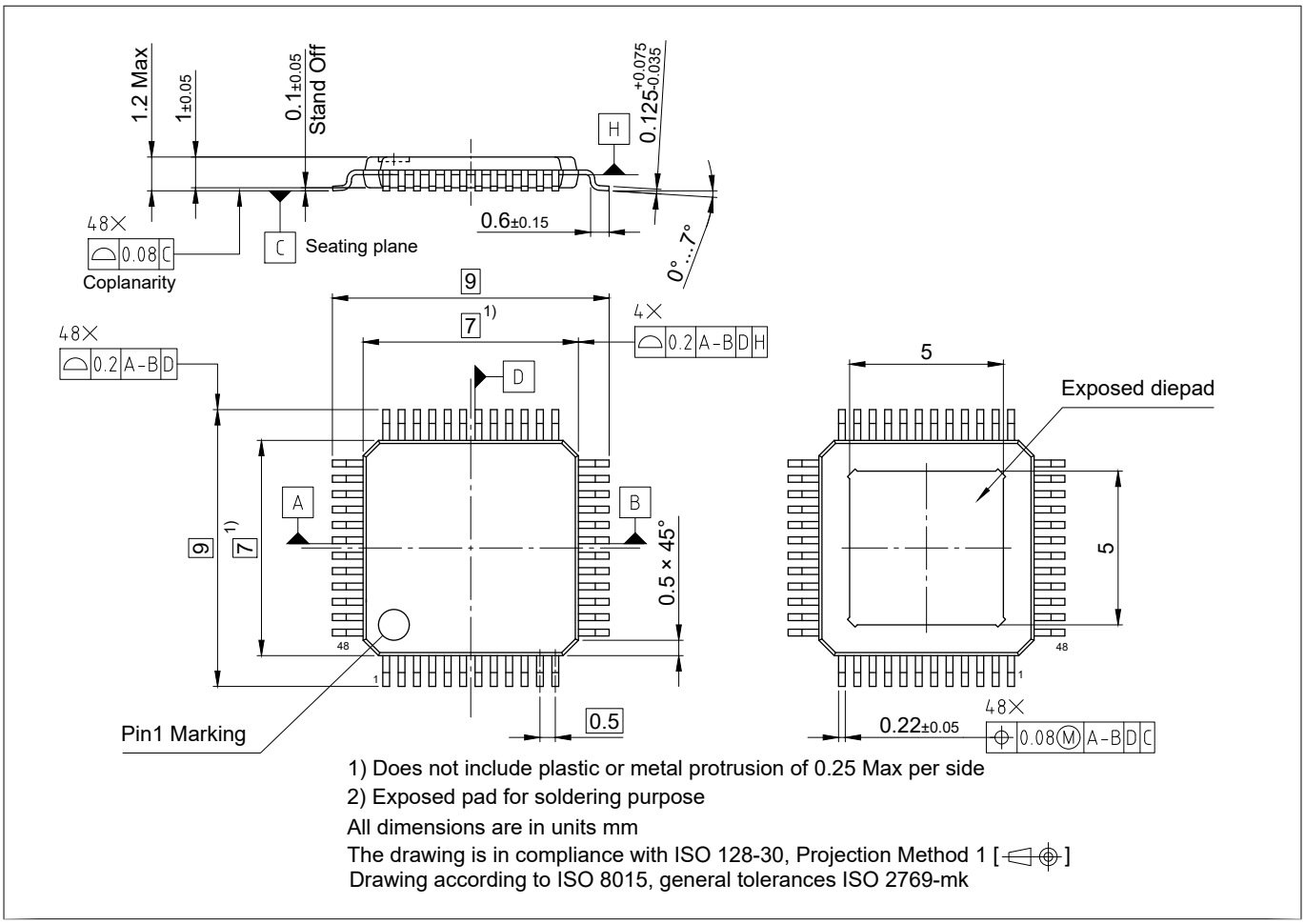



**Figure 2 PG-TQFP-48-10**

### Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a Green Product. Green Products are RoHS compliant (Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

### Information on alternative packages

Please visit www.infineon.com/packages.

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