TLE9185QX/TLE9185QXV33

About this document

Scope and purpose

This application note is intended to provide information about how to use the devices TLE9185QX and TLE9185QXV33.

This document should be used in conjunction with the corresponding datasheet, which contains full technical details on the device specification and operation.

Intended audience

Developers working with the TLE9185QX and TLE9185QXV33.

Table of contents

1 Introduction

The TLE9185QX (5V microcontroller interface) and the TLE9185QXV33 (3.3V microcontroller interface) are multifunctional ICs with integrated power supply and multiple half-bridges, designed for various motor control automotive applications such as auxiliary pumps (fuel, water, etc.), sunroof module, engine cooling fan and transfer case.

To support these applications, the BLDC Driver provides the main functions, such as a 5V/3.3 V low-dropout voltage regulator, three half-bridges for BDLC motor control, one current sense amplifier and one 32 bit serial peripheral interface (SPI).

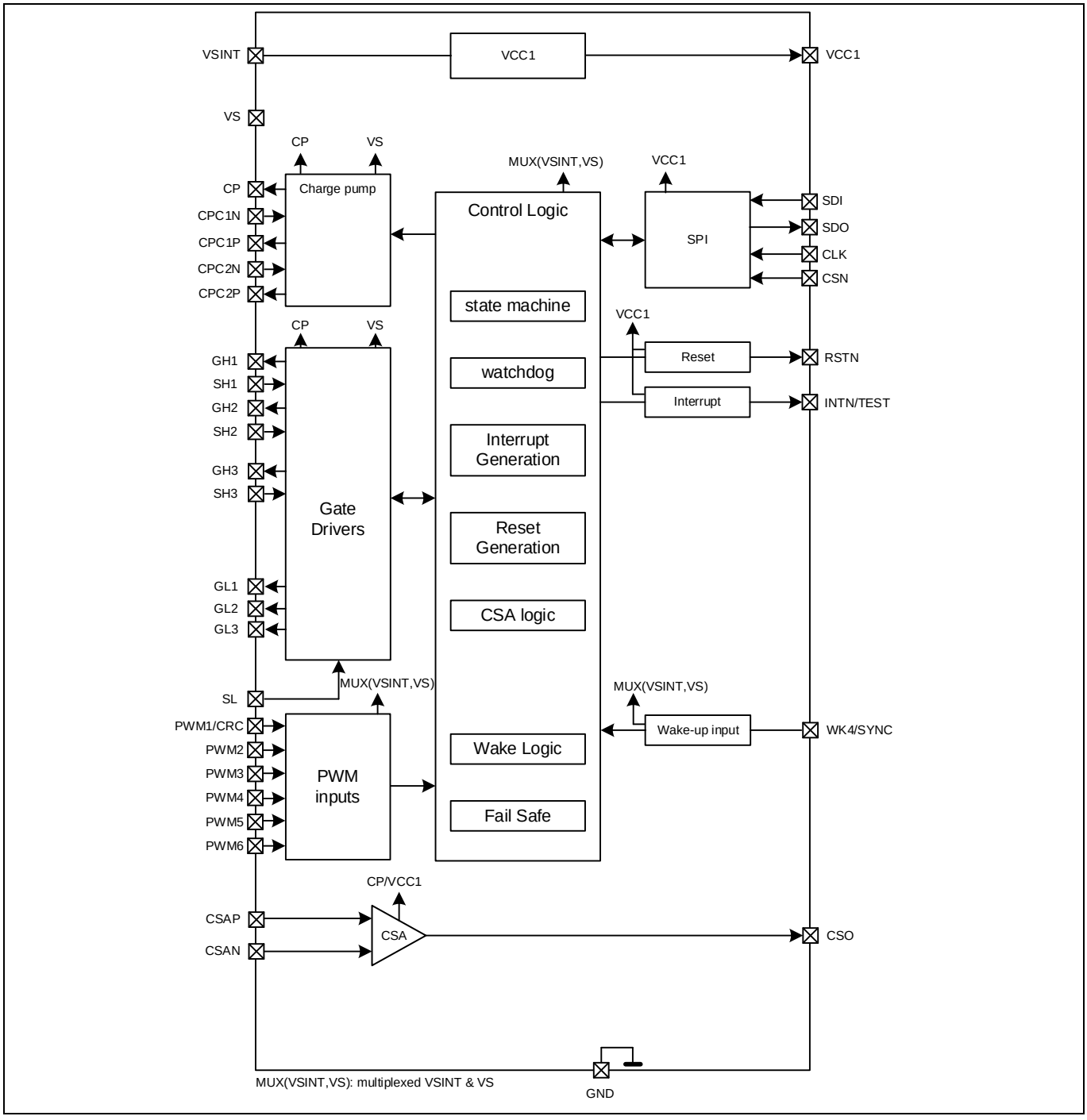

Figure 1 Block diagram

2 Sleep / WAKE-UP procedure

The TLE9185QX and TLE9185QXV33 have two different ways to be woken up. In the following two subchapters the specific procedure is described. After sending the device to Sleep Mode, the microcontroller must wait for at least the configured reset delay time (t_{RD1} or t_{RD2}) before going itself to Sleep Mode.

2.1 How to wake up the TLE9185QX

The TLE9185QX can be woken up upon an edge of the WK4 pin if the wake-up source is enabled before going to Sleep Mode. The Wake-up sequence is described below:

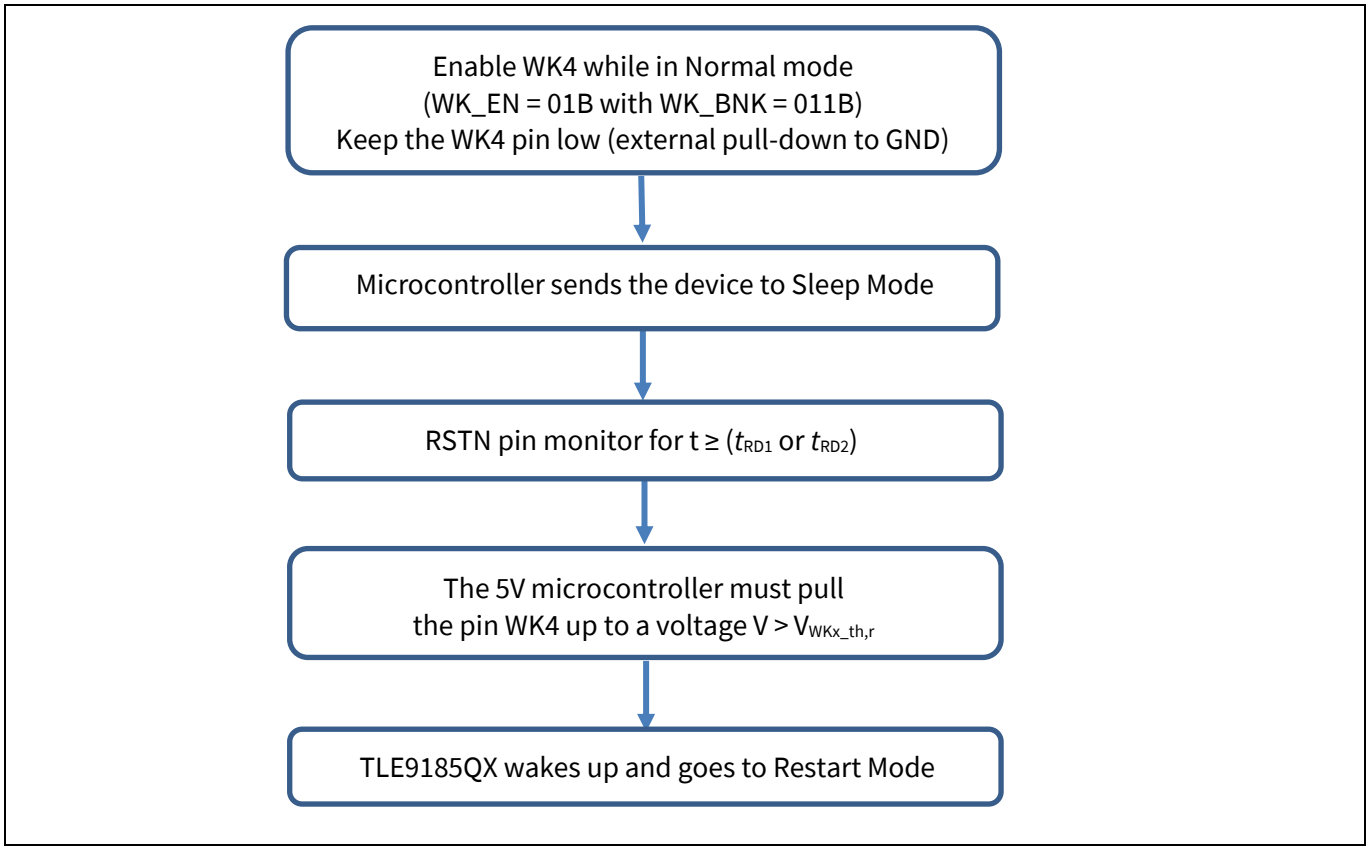

Figure 2 TLE9185QX sleep/wake up procedure

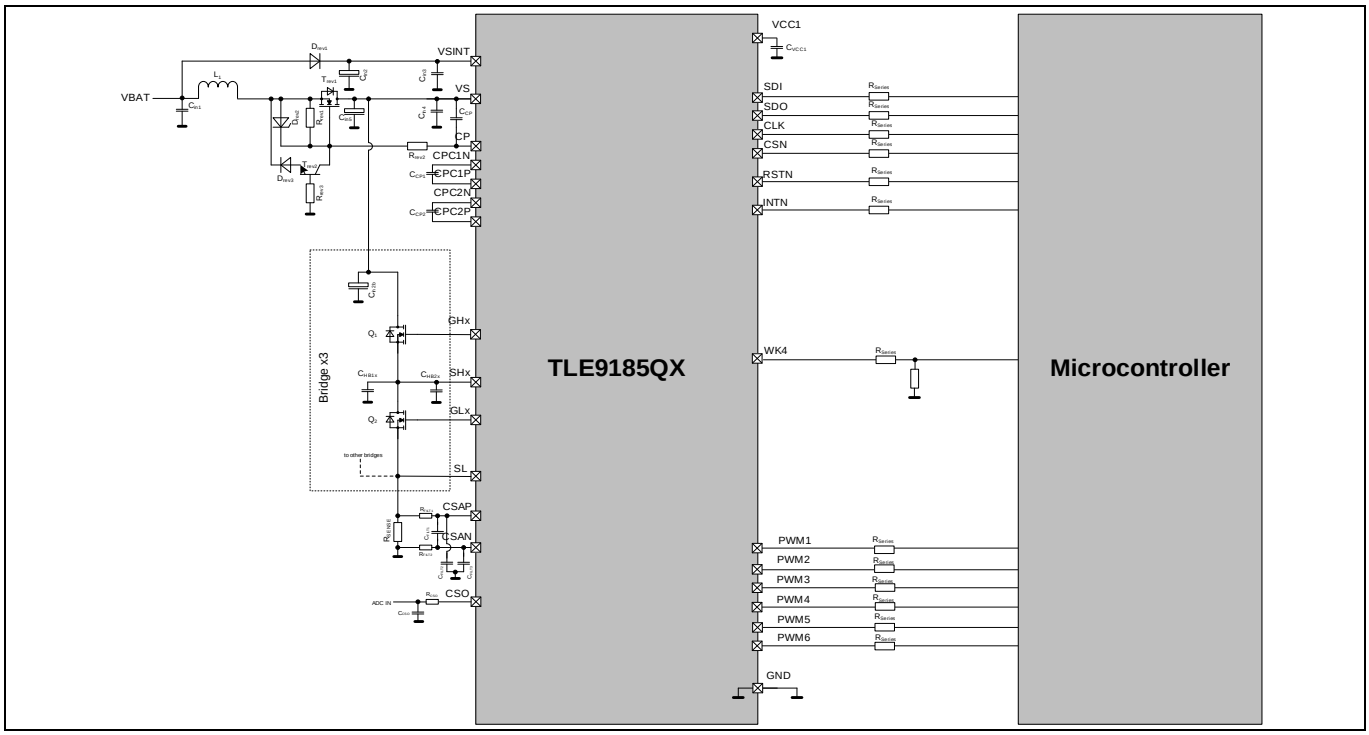

Figure 3 WK4 pin setup for TLE9185QX

2.2 How to wake up the TLE9185QXV33

The TLE9185QXV33 can be woken up upon an edge of the WK4 pin if the wake-up source is enabled before going to Sleep Mode. The Wake-up sequence is described below:

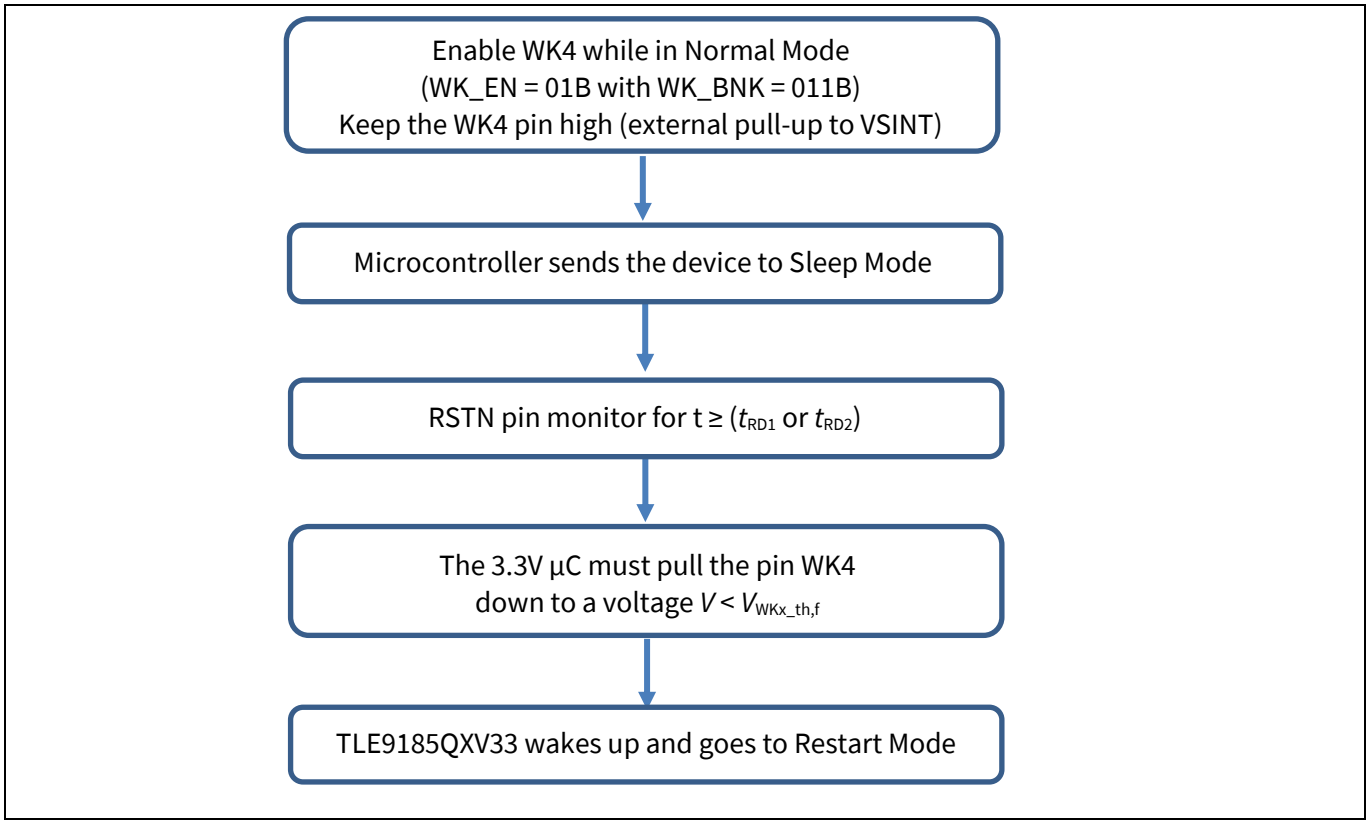

Figure 4 TLE9185QXV33 sleep/wake up procedure

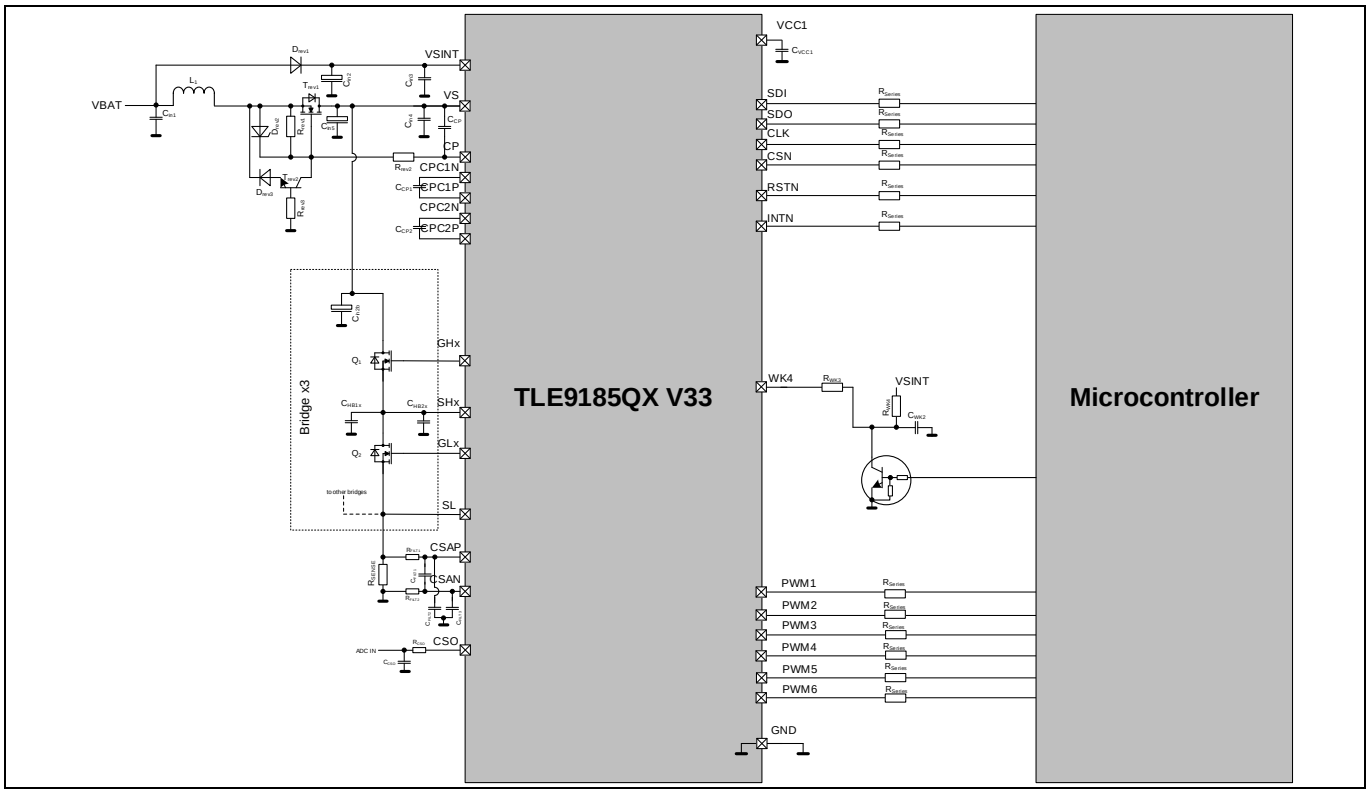

Figure 5 WK4 pin setup for TLE9185QXV33

3 Loss of SPI communication in Fail-Safe / Restart Mode

The device goes to Restart Mode or to Fail-Safe Mode (see Figure 6 and Figure 7) when the following failure occurs:

- VCC1 undervoltage/overvoltage
- VCC1 short to GND
- TSD2 (Thermal Shut Down) event
- 4 consecutive watchdog failures/single watchdog failure
- 4 consecutive VCC1 undervoltage events
- Sleep Mode entry without the wake-up source enabled

In Restart Mode and Fail-Safe Mode the SPI is not available.

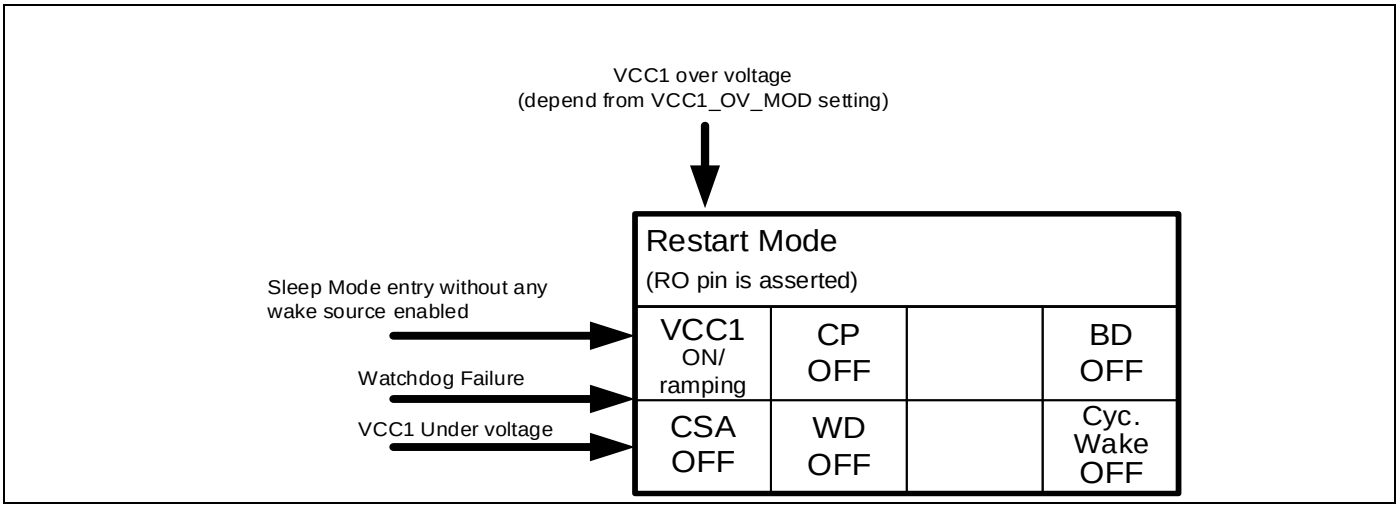

Figure 6 Restart Mode

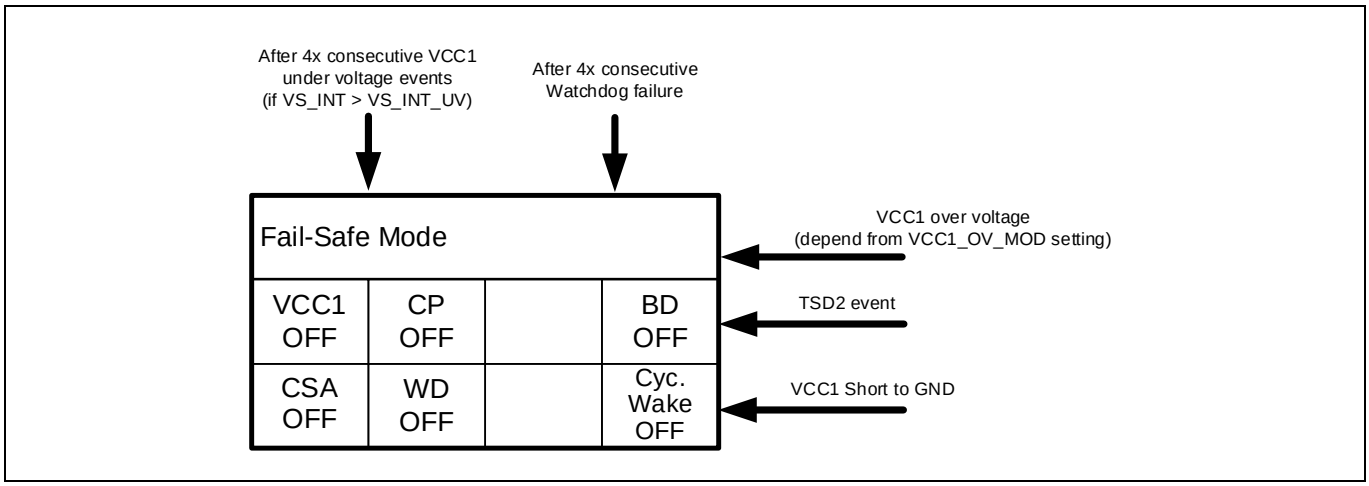

Figure 7 Fail-Safe Mode

The microcontroller input shall be connected to the reset pin RSTN. In this way the microcontroller monitors this pin and realizes that the device cannot receive any SPI frame. A low level on RSTN, while the TLE9185 is supposed to be in normal mode, makes the microcontroller aware that the SPI communication is not possible. If the device is in Fail-Safe Mode the microcontroller can wake it up.

4 Unintended power on reset during Sleep Mode

A drop of the battery voltage while the module is in Sleep Mode leads to a higher device current consumption.

The scenario can be the following:

1. The microcontroller sends the TLE9185xx to Sleep Mode, and goes itself in Sleep Mode
2. VS/VSINT drops below the monitoring threshold voltage $V_{POR,f}$ and rises above the voltage $V_{POR,r}$. The TLE9185xx wakes up autonomously
3. Since the watchdog cannot be served, the microcontroller is still in Sleep Mode, after 4 consecutive watchdog failures, the TLE9185xx goes in Fail Safe Mode with higher device current consumption as expected in Sleep Mode without the microcontroller knowledge.

5 Unintended supply of the microcontroller

The TLE9185xx can supply the microcontroller through the interrupt (INTN) or reset (RSTN) pins in case a voltage drop of the battery voltage occurs while the module is in Sleep Mode:

1. The microcontroller sends the TLE9185xx into Sleep Mode and after it goes itself to Sleep Mode.
2. VS/VSINT drops below the monitoring threshold voltage $V_{POR,f}$ and rises above the voltage $V_{POR,r}$. The TLE9185xx wakes up autonomously
3. The internal power supply VCC1 is turned on, the TLE9185xx starts the long open widow (t_{LW}). During this time (t_{LW}) there is no reset and no interrupt, the pins RSTN and INTN are pulled to high
4. The microcontroller is supplied through those pins. If the power management device does not keep the microcontroller reset low, then the microcontroller would start to operate without external supervision. The microcontroller is now awake and can send the TLE9185xx again into Sleep Mode.

Revision history

Document version	Date of release	Description of changes
1.0	2021-08-11	First release

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Edition 2021-08-11

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about this document?

Email: erratum@infineon.com

Document reference
Z8F80182238

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