

TLE9186 start-up guideline

Application note

About this document

Scope and purpose

This document provides additional information to the datasheet of the TLE9186 and to the required start-up procedure of the TLE9186 motor driver *integrated circuit (IC)*:

- Introduction (see [Chapter 1](#))
- *serial peripheral interface (SPI)* configuration procedure (see [Chapter 2.2](#))

Intended audience

This document is intended for experienced engineers who develop motor-drive applications.

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1 Introduction

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The VIO pin supplies the digital core of the device and the digital IO pins. The VSCP pin supplies the charge pump. The default state of the charge pump is turned off at the start of power-up mode. A dedicated *SPI* command turns on the charge pump during power-up mode. To power up the device, set the INH_N pin to "high".

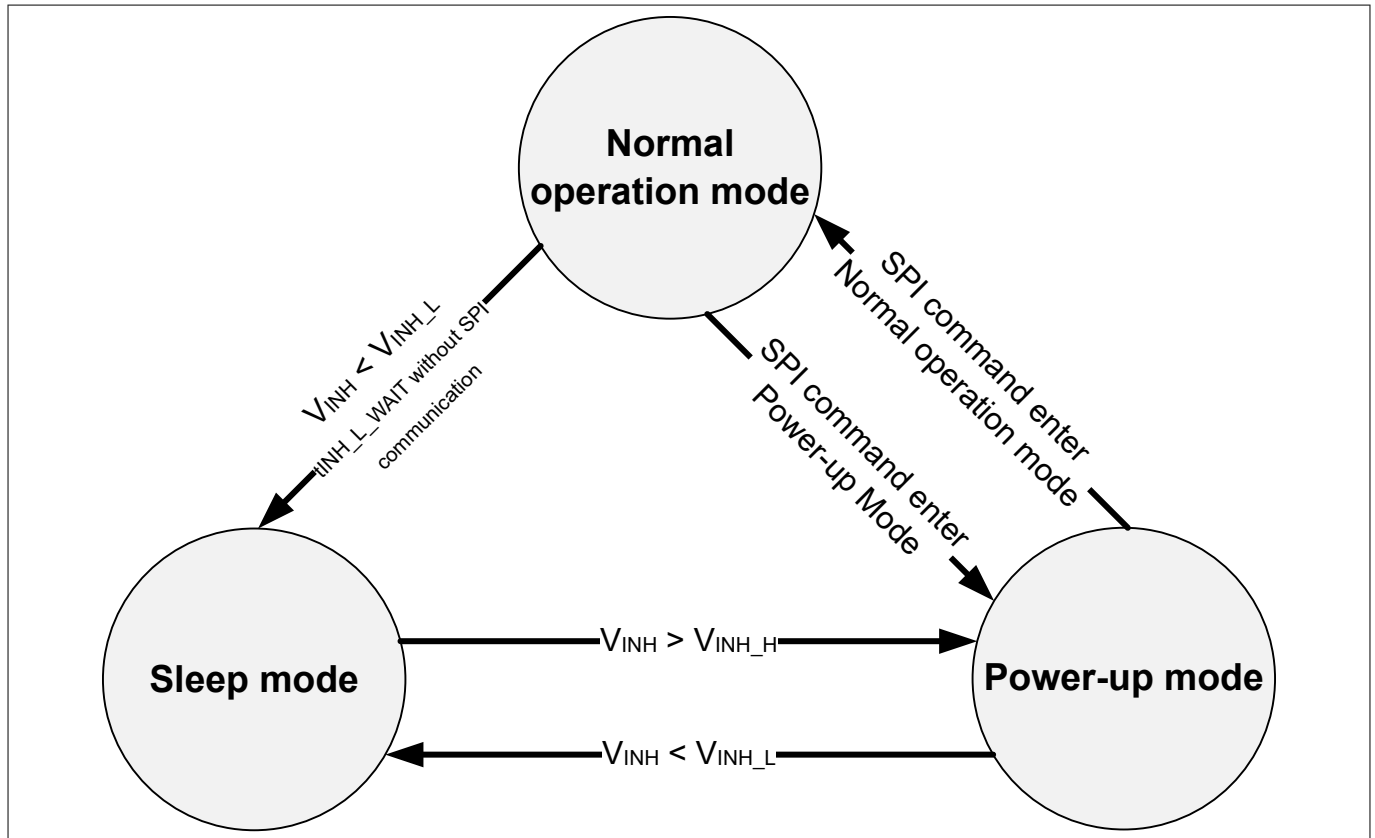


Figure 1 Simplified state diagram for TLE9186

To exit the sleep mode and enter the power-up mode the V_{VSCP} and V_{VIO} supplies have to be in the functional range ($V_{VSCP} > V_{VSCP_FR_DC[min]}$ and $V_{VIO} > V_{VIO_FR[min]}$).

Once the INH_N pin is set to "high" and after t_{core_up} the device is ready for configuration with SPI. The ERR_N pin is set to low by the device while in power-up mode, and the charge pump and the watchdog feature are disabled.

To enter normal operation mode from power-up mode, write a valid configuration setting into the register CONFIG_SECURED. Select the required configuration of bits for VIO_CFG before requesting a mode change. If not configured, the device ignores the SPI request to transition to normal operation mode and it stays in power-up mode. After this configuration has been made, normal operation mode can be entered by transmitting a dedicated SPI frame to the driver *IC* using the register bits MODE_CTRL in register PWR_MOD_CFG to configure the normal operation mode.

The following chapters describe the required minimum commands and the procedures to enter normal operation mode through power-up mode.

2 Start-up guideline

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This application note provides additional information to the required start-up procedure of the TLE9186:

- Start-up sequence
- Example of simple *SPI* start-up

2.1 Start-up sequence

The figure below describes the TLE9186 start-up sequence.

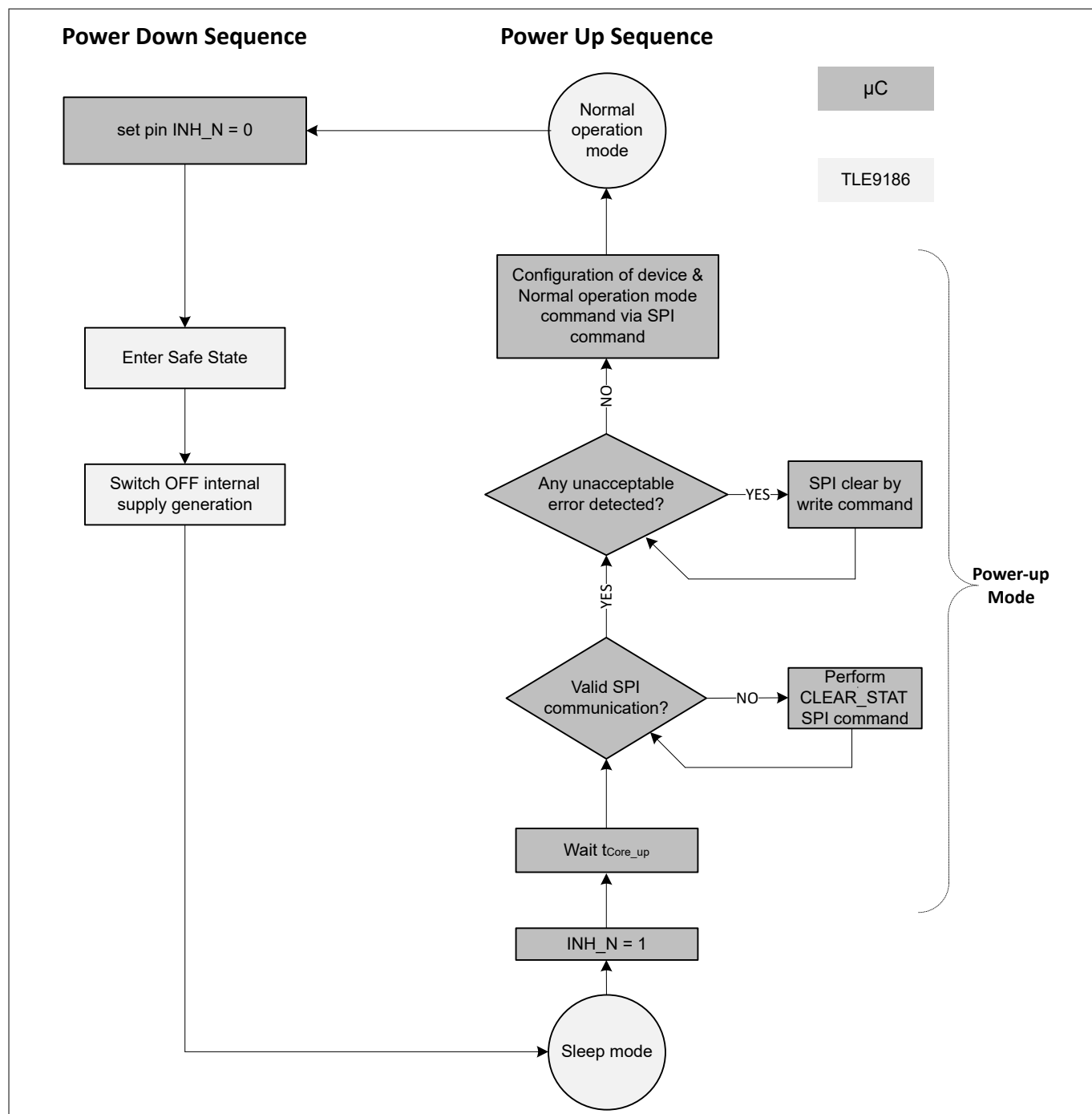


Figure 2 TLE9186 start-up sequence

The sequence consists of the minimum steps, starting from sleep mode and entering in normal mode.

2 Start-up guideline

Only in power-up mode can the SPI command modify the content of the device configuration register CONFIG_SECURED. As soon as the device enters normal mode the CONFIG_SECURED register is read-only. It is essential that the microcontroller writes a valid configuration setting into the register bits VIO_CFG of the CONFIG_SECURED before requesting a mode change from power-up to normal mode.

Any error reported by the device preventing the device to go to normal operation mode or causing safe state entry and preventing to toggle the Gxx output pins is considered an unacceptable error or failure detection. An error is unacceptable depending on:

- application use case
- enabled and used device functions (such as current sense amplifier, window watchdog)
- device failure configuration

It is your responsibility to assess which errors are unacceptable. For guidance and recommendation on acceptable and unacceptable errors, refer to the dedicated chapter in the TLE9186 user manual.

2.2 Example for simple SPI start-up

The easiest way to set the TLE9186 to normal operation mode after start-up is to send three [SPI](#) commands from the microcontroller to the TLE9186.

When the TLE9186 enters power-up mode, the microcontroller starts the SPI register configuration to enter normal operation mode. In [Table 1](#) there is an example of a minimum SPI command to enter normal operation mode.

In general one SPI command consists of a 32-bit frame format.

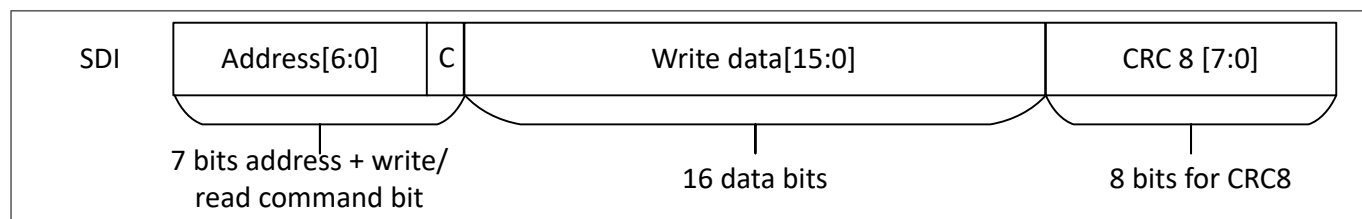


Figure 3 SPI frame format

In [Table 1](#) the different bit fields are represented in a dedicated column.

Table 1 Sequential SPI commands for TLE9186 - simple start-up

SPI command	Register name	Short description	Address	C (write or read command)	Data	CRC8
# 1a (VIO=5V)	CONFIG_SECURED	Set the VIO pin to 5 V supply level. Enable internal SPI in-frame response. The remaining bit settings are set to default state.	0x01 _H	1 _B	0x0050 _H	0xE9 _H
# 1b (VIO= 3.3 V)	CONFIG_SECURED	Set the VIO pin to 3.3 V supply level. Enable SPI in-frame response. The remaining bit settings are set to default state.	0x01 _H	1 _B	0x0060 _H	0xA3 _H

(table continues...)

2 Start-up guideline

Table 1 (continued) Sequential SPI commands for TLE9186 - simple start-up

SPI command	Register name	Short description	Address	C (write or read command)	Data	CRC8
#2	GEN_CFG1	Enable <i>current-sense amplifier (CSA)</i> . Enable HB1, HB2, HB3. Enable charge pump. The remaining bit settings are set to default state.	0x04 _H	1 _B	0xE9EC _H	0x1C _H
#3	PWR_MOD_CFG	Enter normal-operation mode. The remaining bit settings are set to default state.	0x02 _H	1 _B	0x0001 _H	0x65 _H

3 References

3 References

- TLE9186 datasheet
- TLE9186 user manual

Glossary

CSA

current-sense amplifier (CSA)

Special-purpose amplifiers that output a voltage proportional to the current flowing in a power rail. They utilize a "current-sense resistor" to convert the load current in the power rail to a small voltage, which is then amplified by the current-sense amplifiers.

IC

integrated circuit (IC)

A miniature electronic circuit built on the surface of a thin substrate of a semiconductor material.

SPI

serial peripheral interface (SPI)

A synchronous serial communication interface specification used for inter-chip communication, primarily in embedded systems.

Revision history

Document version	Date of release	Description of changes
Rev. 1.00	2026-01-21	Initial document release

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