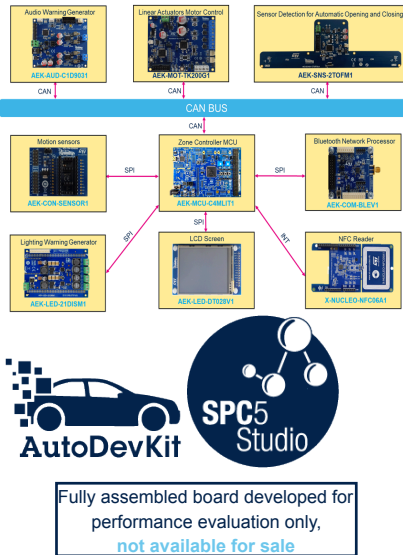


## Power liftgate zonal ECU implemented with model-based design approach



### Features

- Control of two linear DC motor actuators to open and close the trunk
- Motion detection to prevent accidental trunk opening/closing
- Trunk locking and unlocking
- Visual alert through turning lights blinking at the beginning of the trunk opening/closing phase
- Acoustic alert through a beeper at the beginning of the trunk opening/closing phases
- Trunk opening/closing with an NFC tag key
- Trunk opening/closing via mobile phone app via Bluetooth® Low Energy
- Mini-infotainment touch display showing trunk state
- Self-calibration of the system motors
- Trunk opening/closing jam detection
- Trunk opening height adjustment

### Description

The power liftgate system installed in commercial cars requires a foot movement, which is not always successful in opening the trunk. This limit is due to the type of sensor used, to its position under the car bumper, and to the required 'kick' gesture. Moreover, the sensor used has no alternative redundant system (excluding an internal fail-safe button) to open the trunk if it is not working because covered with mud or the street is flooded.

The **AEKD-TRUNKL1** has been designed to address all these issues while increasing the system safety. Based on the newest zonal approach paradigm, this ST power liftgate system controls seven subsystems in parallel: acoustic and visual alerts, NFC and Bluetooth® Low Energy communication, motion and foot detection sensors, and linear actuator control. An LCD screen and a fail-safe button control are also available.

The first core function of the application is the precise control of the linear actuators that open and close the liftgate. This control has been developed with a model-based design. The code has been generated with MathWorks Embedded Coder. The model includes all the control and safety mechanisms for the actuation based on the dual feedback coming from the Hall sensors and from the current sense.

The second core function lies in the Time-of-Flight sensors placed under the bumper to recognize a specific foot movement designed to deliver a stable performance for the user and to avoid unwanted activations. Another great advantage is represented by the huge cost saving of the Time-of-Flight sensors compared to the normally used ones, like sonars.

The NFC tag in the mobile phone is a valid alternative to the sensor under the bumper because, even with hands full of bags, it is possible to approach the phone in the jacket pocket to the NFC reader placed in the power liftgate system.

A dedicated Android mobile phone app allows controlling the power liftgate system.

You can open the tailgate even few meters away before getting loaded of bags and packages. The app uses a token exchange with the power liftgate system to secure the communication and identification of the car owner. In addition, the car owner's app can temporarily or permanently elect other mobile phones running the same app as secondary phones having the car trunk access.

Product summary	
Power liftgate zonal ECU implemented with model-based design approach	<b>AEKD-TRUNKL1</b>
Connector board for SPC5 MCU discovery boards and MEMS sensor boards in DIL 24 socket	<b>AEK-CON-SENSOR1</b>
AVAS solution based on SPC582B60E1 Chorus family MCU	<b>AEK-AUD-C1D9031</b>
Power liftgate controller board based on L99DZ200G multi output driver and SPC582B Chorus 1M microcontroller	<b>AEK-MOT-TK200G1</b>
Predefined gesture detection system based on FlightSense technology sensors	<b>AEK-SNS-2TOFM1</b>
MCU discovery board for SPC5 Chorus	<b>AEK-MCU-C4MLIT1</b>
Bluetooth communication board based on BlueNRG-1	<b>AEK-COM-BLEV1</b>
Digitally controlled LED driver board	<b>AEK-LED-21DISM1</b>

Product summary	
for automotive lighting applications	
Display expansion board with resistive touch for Chorus family	<a href="#">AEK-LCD-DT028V1</a>
NFC card reader expansion board based on ST25R3916	<a href="#">X-NUCLEO-NFC06A1</a>
AutoDevKit library plugin for SPC5-STUDIO	<a href="#">STSW-AUTODEVKIT</a>
Code generator, quick resource configurator and Eclipse development environment for SPC5 MCUs	<a href="#">SPC5-Studio</a>
Application	<a href="#">Transportation Solution Eval Boards</a>

The motion safety subsystem is the last remaining block. It is based on a MEMS motion sensor to detect an eventual car motion during the liftgate actuations both at engine on and off. The detected motion stops the liftgate and generates an error.

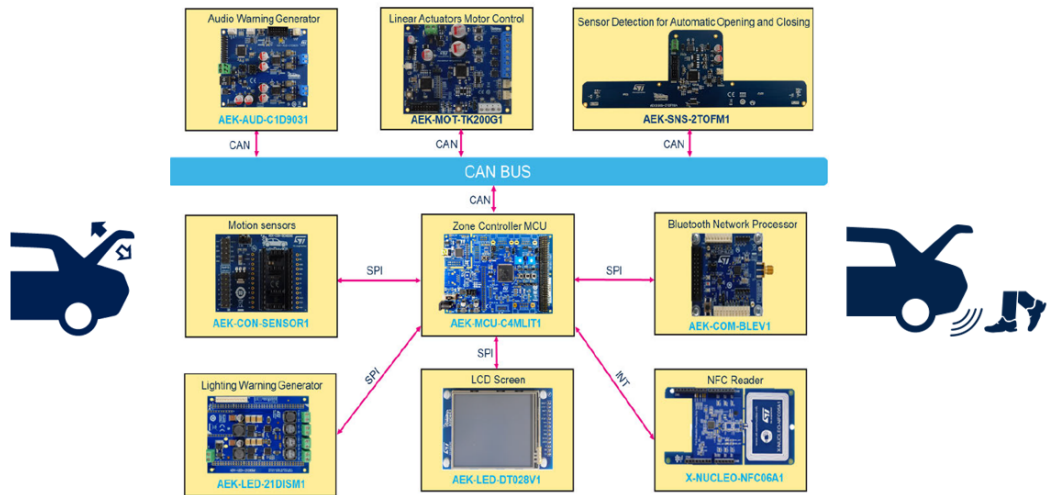
The acoustic and visual alerts are activated at the beginning of all liftgate actuations and when a safety concern occurs (for example, the tailgate getting stuck by an obstacle).

For demo purposes, an LCD display has been added to illustrate the different states and errors of the power liftgate system. An external fail-safe button is also present to open or close the trunk.

The [AEKD-TRUNKL1](#) is a fully assembled kit developed for performance evaluation only, not available for sale.

# 1 Block diagram

Figure 1. AEKD-TRUNKL1 block diagram



## 2 Schematic diagrams

---

**Note:** *The AEKD-TRUNKL1 kit consists of the following demo boards: AEK-MCU-C4MLIT1, AEK-MOT-TK200G1, AEK-SNS-2TOFM1, X-NUCLEO-NFC06A1, AEK-CON-SENSOR1, AEK-LCD-DT028V1, AEK-LED-21DISM1 and AEK-AUD-C1D9031. You can find their detailed schematic diagrams at the related web pages:*

- [\*AEK-MCU-C4MLIT1 schematic diagrams\*](#)
- [\*AEK-MOT-TK200G1 schematic diagrams\*](#)
- [\*AEK-SNS-2TOFM1 schematic diagrams\*](#)
- [\*X-NUCLEO-NFC06A1 schematic diagrams\*](#)
- [\*AEK-CON-SENSOR1 schematic diagrams\*](#)
- [\*AEK-LCD-DT028V1 schematic diagrams\*](#)
- [\*AEK-LED-21DISM1 schematic diagrams\*](#)
- [\*AEK-AUD-C1D9031 schematic diagrams\*](#)

## Revision history

**Table 1. Document revision history**

Date	Revision	Changes
16-Jun-2022	1	Initial release.

**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2022 STMicroelectronics – All rights reserved