

TLE9210x-232QX overvoltage brake

About this document

Scope and purpose

This application note provides information about the brake mode of the TLE92108/4-232QX devices.

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 TLE92108/4-232QX.

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1 Introduction

The TLE92108/4-232QX are multiple MOSFET drivers, designed to control up to sixteen/eight n-channel MOSFETs. The MOSFET drivers contain eight half-bridge drivers (in the case of TLE92108-232QX), or four half-bridge drivers (in the case of TLE92104-232QX) for DC motor control applications such as automotive power seats, power lift gates, cargo cover, sunroof, door lock, and window lifts.

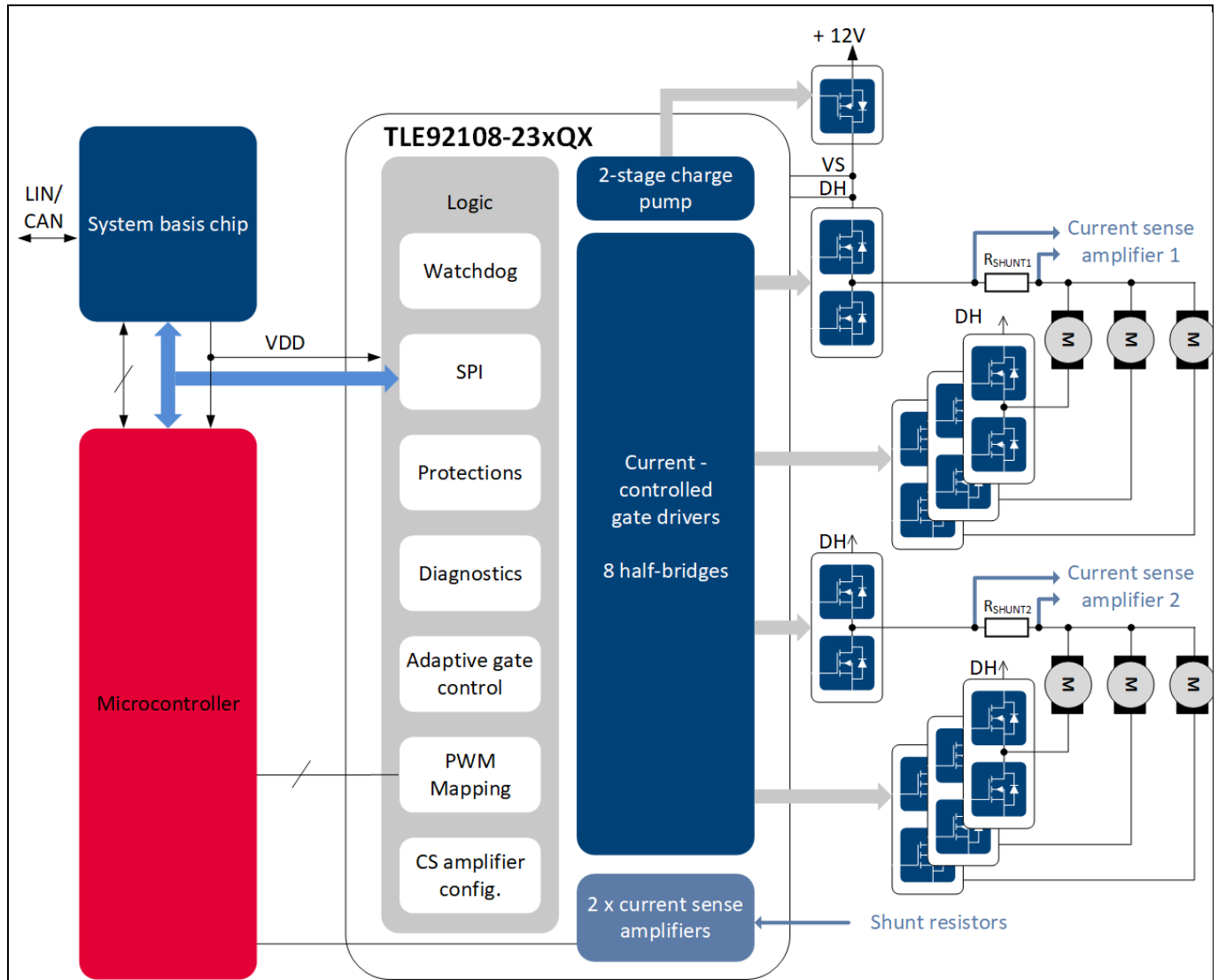


Figure 1 TLE92108 simplified block diagram showing one of the possible half-bridge configurations

2 Concept of overvoltage brake

2.1 Overview of symbols

Symbol	Description
HS	High side
LS	Low side
V_{GLS}	Low side gate voltage
V_S	Supply voltage
$V_{SOV PASS OFF}$	Passive V_S overvoltage

2.2 Overvoltage brake

In some conditions, a motor can operate as a generator. This is the case when the trunk is manually closed while the electronic control module (ECU) of the power lift gate is in sleep mode, as is shown in [Figure 2](#).



Figure 2 Manual closure of power lift gate

As is shown in [Figure 3](#), all MOSFETs are off, and the motor works as a generator. Current flows from ground to battery through body diodes of LS1 and HS2. The generated current charges the DC-link capacitor. If V_S rises too high, devices in the electronic control module can be damaged.

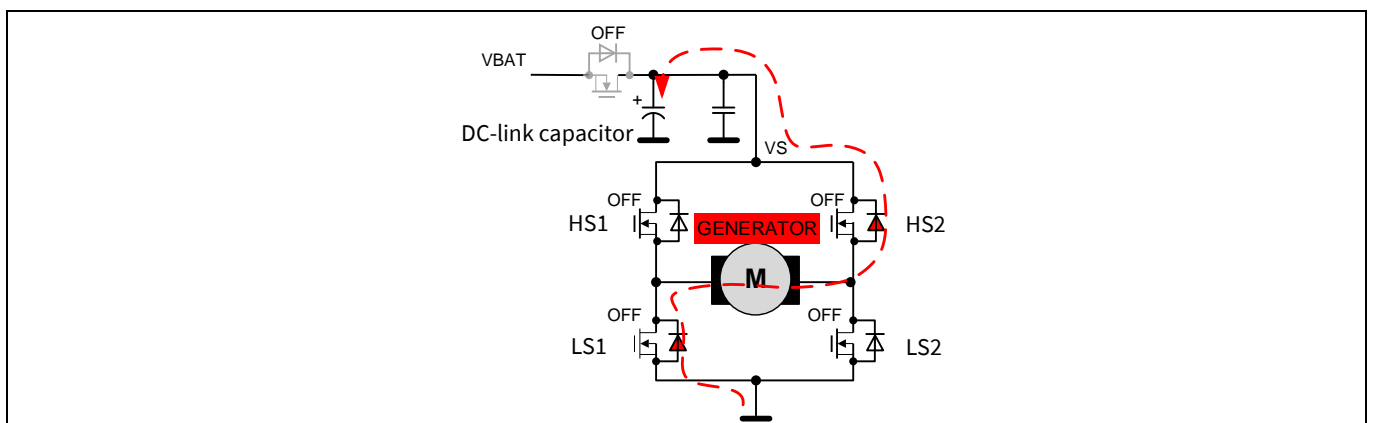


Figure 3 Motor works as a generator

Manually closing the trunk induces a current in the motor, as is shown in [Figure 3](#). This current cannot flow back to the battery because the MOSFET for the reverse battery protection is OFF. This issue can be solved by configuring the low-side 1-4 brake with short-circuit detection in sleep mode and normal mode in TLE92108/4-232QX.

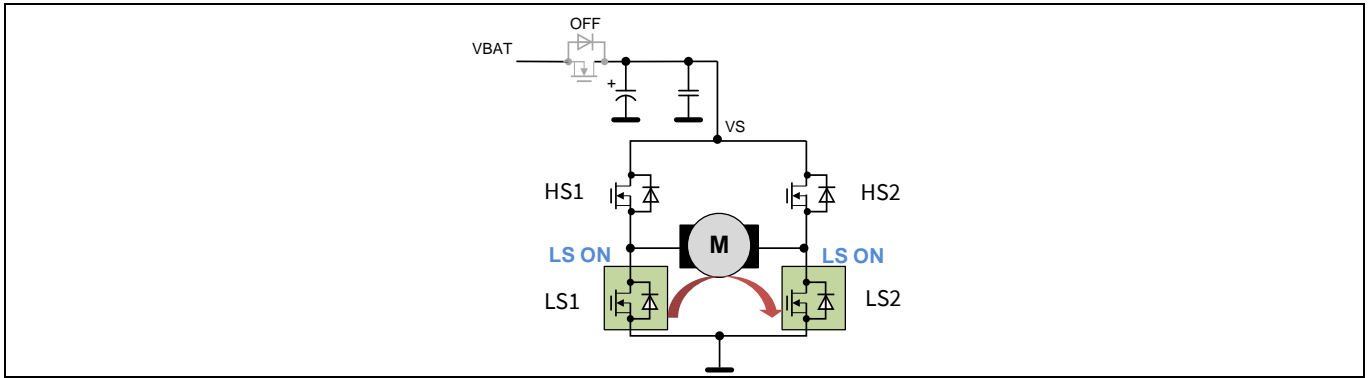


Figure 4 **Brake mode**

When $V_S > V_{SOV_PASS_OFF}$, as is shown in **Figure 4**, LS1 to LS4 MOSFETs are turned on, and the generated current flows through LS MOSFETs. This feature protects the application by preventing V_S from further increasing in normal mode and sleep mode.

When the brake mode is enabled, the additional supply quiescent current (I_{SQ_BRAKE}) is typically 5 μA . So, the power consumption is very low.

3 Overvoltage brake details

3.1 Overvoltage brake in sleep mode

The following test shows the device behavior according to V_S when the overvoltage brake is enabled in sleep mode. V_S is controlled by a voltage source.

As is shown in **Figure 5**:

1. Initially V_S is 12 V and LS1 is OFF
2. V_S steadily increases to 37 V
3. When $V_S > V_{SOV PASS OFF}$, LS1 turns on to turn on the low-side MOSFET
4. Then V_S decreases
5. When $V_S < V_{SOV PASS OFF}$, LS1 switches off

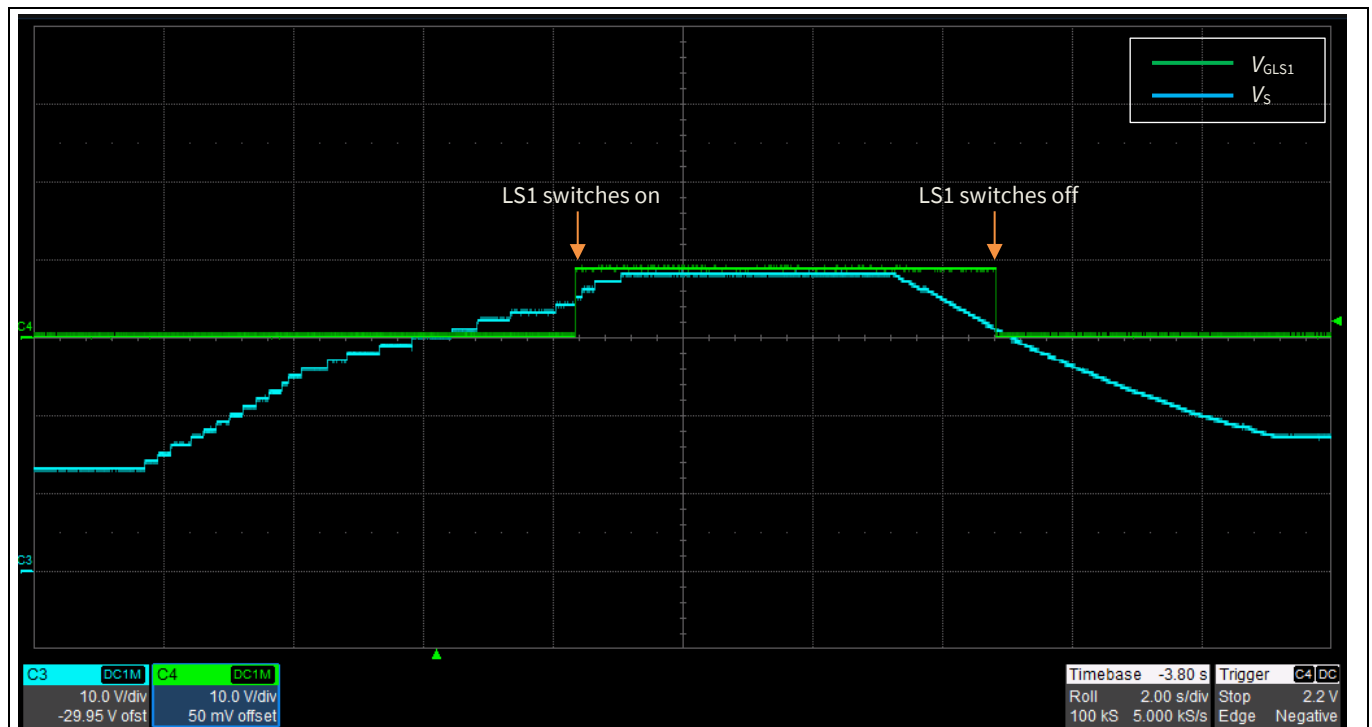


Figure 5 Overvoltage brake in sleep mode

3.2 Overvoltage brake in normal operation mode

Connect the device to a PC using a μ IO stick, and open “Config Wizard for Multi MOSFET Driver”. “LS1/HS2 ON” is selected. All other parameters are by default. The default passive settings are as following:

General	
Frequency Modulation enable	<input checked="" type="checkbox"/>
VS OV Threshold	min. 19 V
CP Undervoltage Threshold	7.5 V
Enable auto. CP single/dual stage operation	<input type="checkbox"/>
Mask TD Regulation	<input checked="" type="checkbox"/>
Bridge driver passive settings	
Mode selection LS1-4	ON if VS > Vsov pass off
VDS mon. ON	<input checked="" type="checkbox"/>

Figure 6 Brake mode default setting in Config Wizard

As shown in **Figure 7**:

- Initially V_S is 12 V, and the LS1 gate voltage is high
- Then V_S steadily increases to 35 V
- When the V_S is bigger than the V_S overvoltage (OV) threshold (19 V by default), LS1 is OFF to protect the device
- When $V_S > V_{SOV PASS OFF}$, LS1 turns ON
- Then V_S decreases
- When the $V_S < V_{SOV PASS OFF}$, LS1 switches OFF

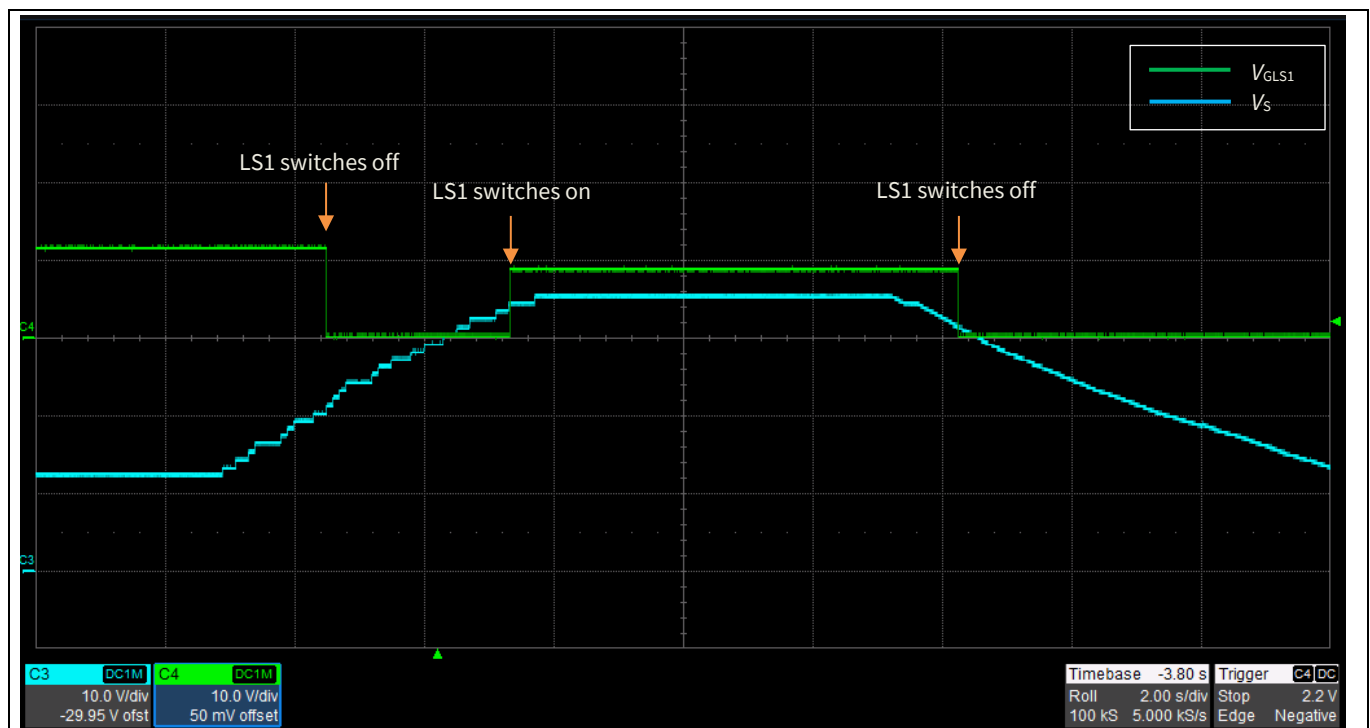


Figure 7 Overvoltage brake in normal operation mode

Revision history

Document version	Date of release	Description of changes
01.00	2022-06-11	Initial document release

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Edition 2022-06-11

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference

Z8F80288068Z8F80186205

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