# MOTIX™ TLE984xQX

## Microcontroller with LIN and Power Switches for Automotive Applications

## Overview

This document lists the deviations and application hints of the TLE984xQX “Microcontroller with LIN and Power Switches for Automotive Applications“.

It is strongly recommended that the device behavior and possible proposed workarounds are considered for the application.

**Table 1 Reference documents**

| Document type | Document reference | Issue date |
|---|---|---|
| Datasheet | See Table 2 | |
| User manual | Infineon-TLE984xQX-UM-v01_60-EN.pdf | 2025-09-15 |

**Table 2 List of affected products**

| Device | Reference datasheet | Issue date |
|---|---|---|
| TLE9842-2QX | Infineon-TLE9842-2QX-DS-v01_30-EN.pdf | 2025-09-15 |
| TLE9842QX | Infineon-TLE9842QX-DS-v01_30-EN.pdf | 2025-09-15 |
| TLE9843-2QX | Infineon-TLE9843-2QX-DS-v01_30-EN.pdf | 2025-09-15 |
| TLE9843QX | Infineon-TLE9843QX-DS-v01_30-EN.pdf | 2025-09-15 |
| TLE9844-2QX | Infineon-TLE9844-2QX-DS-v01_30-EN.pdf | 2025-09-15 |
| TLE9844QX | Infineon-TLE9844QX-DS-v01_30-EN.pdf | 2025-09-15 |

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# 1 Product errata

This chapter lists the errata of the referenced products and documentation.

## 1.1 Temperature sensor selector not behaving as specified

### Introduction

The TLE984x device contains two temperature sensors:

- Low-side switch temperature sensor, measured at ADC2 - channel 5
- System/central temperature sensor, measured at ADC2 - channel 6

In normal operation, both temperature sensors show similar values.

The low-side switch temperature sensor (located near the two low-side switches) has the purpose to act as additional protection against temperature cycling (e.g. multiple switch off relays, higher low-side currents in short time).

### Description of the behavior

A selector is used to select the temperature sensor to be measured. This selector does not behave as specified.

The measurement is done on the previously selected temperature sensor, not on the intended currently selected one.

The sequence of measurements in ADC2 is defined in the registers ADC2_SQ1_4 and ADC2_SQ5_8 (SQ1 up to SQ7, SQ8 is not used).

With the predefined sequences (which cannot be changed by the user), channel 5 and channel 6 are measured as follows:

- Channel 5 (low-side) is measured in SQ1, SQ3, SQ5, SQ7
- Channel 6 (system/central) is measured in SQ2, SQ4, SQ6

The scheduler executes the defined measurements in increasing order (SQ1 to SQ7, then wraparound). The measurements of other channels are executed as well of course, but have no influence on the temperature sensor selector.

This means that channel 5 and channel 6 are measured mainly alternately, despite of the wraparound-case, where channel 5 is measured twice in a row.

As a result, the measurement results **appear basically swapped**, only the measurement done in SQ1 shows correctly the channel 5 result, because channel 5 was already measured in SQ7.

### Temperature effects at the low-side switch

Following figures based on measurements make the consequences more visible:

- Figure 1: Low-side clamping, normal case ($V_S$ = 13.5 V, relay, 160 Ω (nom.))
- Figure 2: Low-side clamping, worst case ($V_S$ maximized to reach 2 mJ clamping energy, relay, 160 Ω (nom.))
- Figure 3: Low-side current, normal case ($V_S$ = 13.5 V, relay, 160 Ω (nom.))
- Reaching the max. low-side current (300 mA +-10%) is unrealistic with a standard relay and has not been included in these examples, but the conclusions can be applied for this scenario as well.

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Figure 1 shows the temperature effect of LS1 clamping in normal operating condition. The local heating effect caused by the clamping of the low side can be seen in channel 6 instead of the expected channel 5, as the channels appear swapped. The short temperature increase caused by the clamping is <5 K.

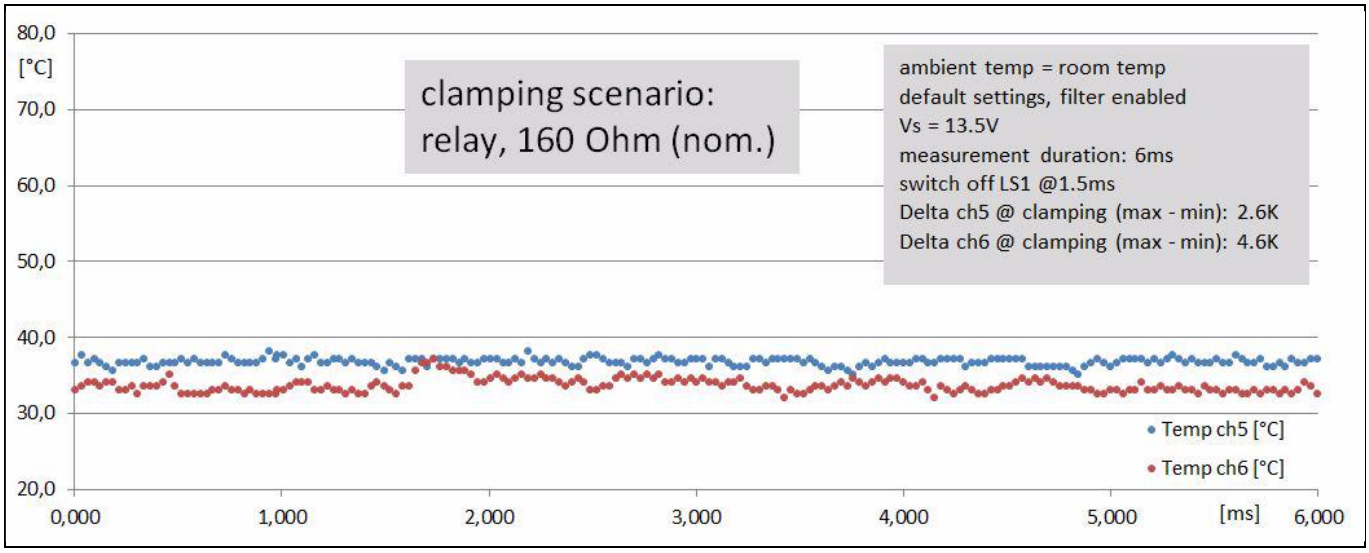


**Figure 1 Low-side clamping, normal case ($V_S$ = 13.5 V, relay, 160 Ω (nom.))**

Figure 2 shows the temperature effect of LS1 clamping at worst case conditions. $V_S$ has been selected intentionally that high to reach 2 mJ clamping energy as specified in P_12.1.17. Again, the short temperature increase can be seen in channel 6 instead of channel 5, and it is <9 K.

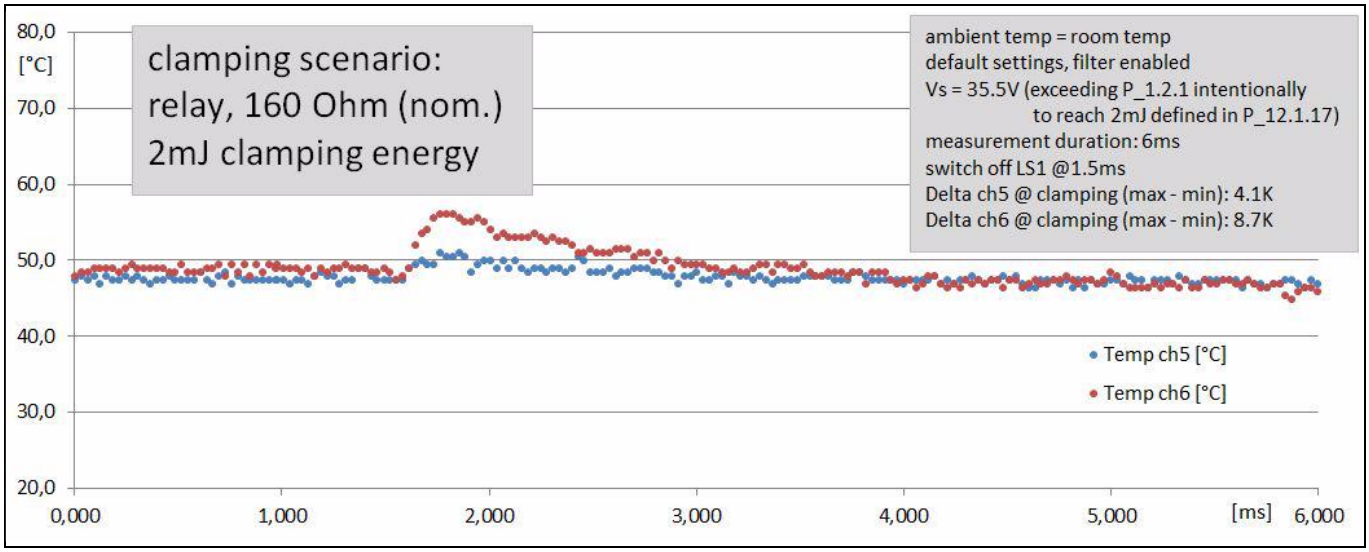


**Figure 2 Low-side clamping, worst case ($V_S$ maximized to reach 2 mJ clamping energy, relay, 160 Ω (nom.))**

Figure 3 shows the temperature effect of a relay current in normal operating condition. The local heating is <6 K.

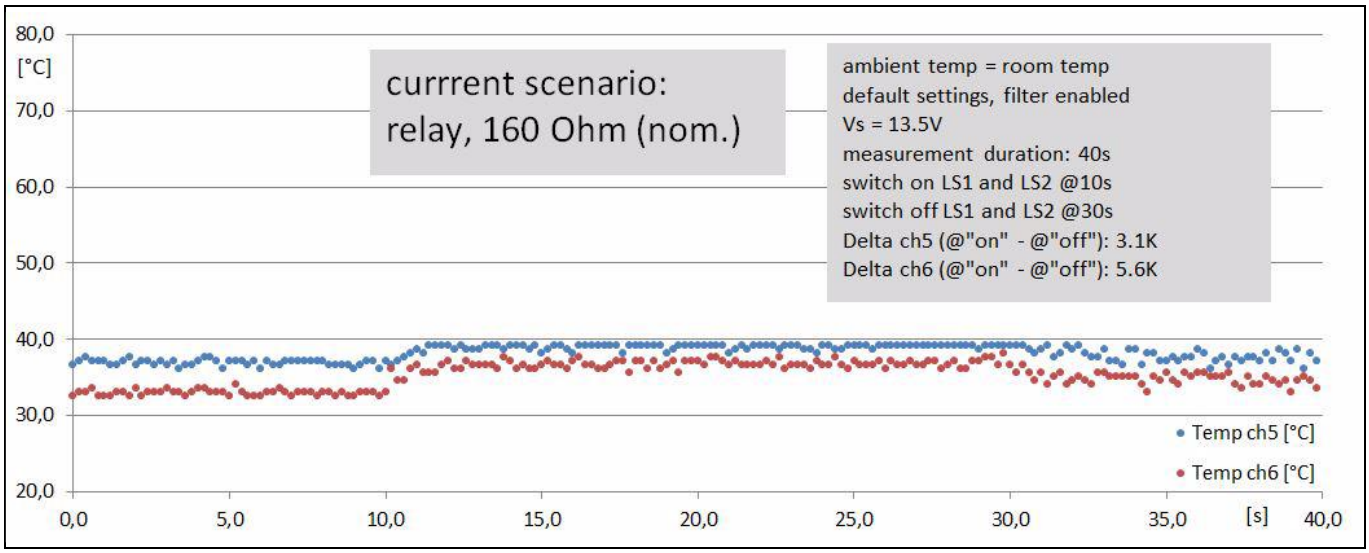


**Figure 3 Low-side current, normal case ($V_S$ = 13.5 V, relay, 160 Ω (nom.))**

For significantly deviating conditions (higher $V_S$, lower relay resistance) or other (non-relay) use-cases a separate application-specific investigation is recommended.

Measurements at higher ambient temperatures have been done as well. The results are shifted up linearly, no additional effect (e.g. bigger delta temperature) has been observed.

**Impact on protection functionality**

The shutoff of the system is based on the low side temperature, and the shutoff of the low side is based on the system temperature, due to the swapping explained above.

System temperature shutoff and low side temperature shutoff are both configured to 180°C (cannot be changed by the user), while $T_j$ (max) is 150°C.

The delta temperature to trigger a wrong shutoff decision is therefore 30 K. This value is never reached as the investigations above show.

Following scenarios and effects have been considered:

| Potential effect | Scenario | Based on | Potential trigger |
|---|---|---|---|
| Potential violation of operating range up to 150°C | System shutoff too early (below 150°C) | Low-side temperature | Low-side temperature more than 30 K above system temperature, cannot happen (see measurements) |
| Potential violation of operating range up to 150°C | Low-side shutoff too early (below 150°C) | System temperature | System temperature more than 30 K above low-side temperature, cannot happen (see measurements) |
| Potential destruction | System shutoff too late (above destruction threshold) | Low-side temperature | Low-side temperature more than 30 K below system temperature, cannot happen (see measurements) |
| Potential destruction | Low-side shutoff too late (above destruction threshold) | System temperature | System temperature more than 30 K below low-side temperature, cannot happen (see measurements) |

By default, the decision of a shutoff is made on filtered results of the temperature measurement. This means, a single outlier result (as caused by the wraparound from SQ7 to SQ1) crossing the threshold has no immediate

effect. The filtering can be configured in the registers ADC2_FILT_UP_CTRL, ADC2_CNT4_7_UPPER.CNT_UP_CH5 and ...CH6. It is recommended to leave the default settings unchanged.

**Impact on readout of temperature values in user software**

Additionally to the automated protection functions, the temperature values can also be read out by software.

This temperature readout feature has been used to generate the plots shown in “Temperature effects at the low-side switch”.

The user software might make decisions based on these values. As mentioned above, the read values **appear basically swapped**. Again, in normal operation (no local low side heating), both temperature sensors show similar values, as the plots in “Temperature effects at the low-side switch” show.

By default, the filtering is enabled (register ADC2_CTRL4.FILT_OUT_SEL_6_0). To avoid potential wrong decisions in user software based on single wrong values, it is recommended to leave the filtering enabled. As the values are not completely swapped (wraparound case), the resulting value of the system temperature deviates slightly, because with the default filter setting of 1/4 (configured in ADC2_FILTCOEFF0_7, cannot be changed by the user) sporadically low side-results are mixed in.

If the temperature values are used in the user software, users should consider, dependent on the application, whether a change in software to cope with the swapping and with the additional deviation is necessary.

**Summary**

The temperature sensors for system and low side temperature appear basically swapped.

In normal operation, both temperature sensors show similar values.

The protection functionality is not affected.

About the readout functionality: if the temperature values are used in the user software, the users should consider, depending on the application, whether a change in the software to cope with the swapping and with the additional deviation is necessary.

**Planned fix**

No fix in the silicon is planned.

## 1.2 LIN overcurrent protection not active (0000068704-14) *

### Introduction

The LIN overcurrent protection limits the current flowing into the LIN pin, in case of a short circuit between the LIN bus and the ECU (electronic control unit) supply voltage. This feature is described in the chapter 19 of the TLE984xQX user manual.

### Description of the behavior

The LIN overcurrent protection feature is not active in the TLE984xQX devices.

### Effects

The actual value of the current $I_{BUS,SC}$ (P_6.1.10) is reported in the following table.

**Table 3 Electrical Characteristics LIN Transceiver**

$V_S$= 5.5 V to 28 V, $T_j$= -40°C to +150°C; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

| Parameter | Symbol | Values | | | Unit | Note or Test Condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| Bus short circuit current | $I_{BUS,SC}$ | 170 | 260 | 395 | mA | Current limitation for driver dominant state, driver on, $V_{BUS}$ = 18 V 1) | P_6.1.10 |

1) Not subject to production test, specified by design.

In the unlikely case of a short circuit, the LIN transceiver integrated in the TLE984xQX might trigger the LIN overtemperature protection. Then the transceiver enters receive-only mode, as described in the paragraph 19.3.2.3 of the user manual. The management of the related interrupt flags, listed in the paragraph 19.4 of the user manual, is under the supervision of the user SW. When the short circuit is removed and the LIN_IRQS.OT_STS status bit is reset, the TLE984xQX goes back to its standard operation.

The following paragraphs of the TLE984xQX documentation are affected by this erratum.

#### 19.1 Features (data sheet and user manual)

- LIN transceiver compliant to LIN2.2 standard, backward compatible to LIN2.1, LIN2.0 and LIN1.3

  *Note: the statement is valid, with the exception of parameter 12 of the LIN standard. This parameter (related to the P_6.1.10 of TLE984xQX data sheet) specifies that the maximum current flowing into the node must not exceed 200 mA under DC conditions, when the LIN bus voltage is equal to 18 V (maximum ECU operating voltage specified in the LIN standard)*
- Transceiver port overcurrent limitation and overtemperature protection

  *Note: the feature "transceiver port overcurrent limitation" is not active*

#### 19.3.1.1 Normal mode (user manual)

*Note: since the feature is not active, the LIN_IRQS.OC_IS flag cannot be set to $1_B$*

#### 19.3.1.2 Receive-Only mode (user manual)

*Note: since the feature is not active, the LIN_IRQS.OC_IS flag cannot be set to $1_B$*

#### 19.3.1.4 High voltage input/output (LHVIO) (user manual)

*Note: since the feature is not active, the LIN_IRQS.OC_IS flag cannot be set to $1_B$*

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### 19.3.2.2 Overcurrent protection (user manual)

*Note: The LIN overcurrent protection is not active in the device, therefore: the short circuit current $I_{BUS,SC}$ (P_6.1.10) is limited to the value specified in the table 8 of the errata sheet; although the LIN overcurrent interrupt is enabled (LIN_IRQEN.OC_IEN bit is set to $1_B$), the LIN_IRQS.OC_IS flag is not set to $1_B$ in case an overcurrent event occurs*

### 19.5 LIN Transceiver Interrupts

*Note: since the overcurrent feature is not active, an overcurrent event cannot be signaled*

### Figure 62 (user manual)

*Note: the LIN_IRQS.OC_IS flag is not set to $1_B$ in case an overcurrent event occurs*

### Table 68 (user manual)

*Note: the service request LIN OC is not triggered in case an overcurrent event occurs*

**Workaround**

No workaround is possible to activate the LIN overcurrent protection.

**Planned fix**

The fix is going to be implemented via FW update. The fix does not modify the silicon die of the device and it will be notified with a related customer communication. Full traceability is ensured by Infineon Technologies.

Additional information is available from Infineon Technologies on request.

*** Not valid for UD-step**

# Revision history

| Document revision | Date | Description of changes |
|---|---|---|
| 4.1 | 2025-09-15 | Updated revision numbers and dates for datasheets with added package option “VQFN-48-37”<br>Updated revision number and date for user manual |
| 4.0 | 2024-01-15 | Removed: ADC1 accuracy. Changes have been implemented in the datasheet<br>Removed: ADC1 error (INL, Gain, TUE) and noise specification. Changes have been implemented in the datasheet<br>Removed: Sleep-exit time. Changes have been implemented in the datasheet<br>Removed: ADC1 (HV-channel) sampling switch activation. Changes have been implemented in the datasheet.<br>Updated: Table 1 and Table 2<br>Added: Footnote for chapter LIN overcurrent protection not active |
| 3.0 | 2022-09-30 | Added: LIN overcurrent protection not active<br>Added: Sleep-exit time<br>Removed: High-side switch (wrong OT_STS after wake from Stop mode without reset) since the TLE984xQX user manual has been updated including the SW workaround (rev. 1.30)<br>Editorial changes |
| 2.0 | 2020-04-20 | Added: High-Side switch: Wrong OT_STS after wake from Stop mode without reset (0000048511-52)<br>Added: ADC1 (HV-Channel) sampling switch activation |
| 1.0 | 2017-05-26 | Initial release |

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