siliXcon

MANUFACTURER'S DECLARATION

Safe Torque Off (STO) Capability

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Uncertified manufacturer's claim. This document describes a design property declared by the manufacturer. It has not been assessed or certified by any third party or notified body and it is not a safety certificate.

1. Manufacturer

siliXcon s.r.o., Czech Republic — www.silixcon.com

2. Product identification

siliXcon electronic motor controllers of the product families **SC, SL, SX, TX, AX and AM**, in hardware variants ordered **without the internal fuse** option. The applicability to a specific unit is determined by its ordering code — see the product documentation at doc.silixcon.com.

3. Declaration

The manufacturer declares that, for the products identified above and under the conditions stated in section 5, the generation of motor torque can be prevented by hardware means equivalent in effect to the *Safe Torque Off (STO)* function defined in IEC 61800-5-2:

When the supply of the **KEY input** is interrupted, the internal gate-drive power supply of the power stage collapses and all power transistors of the three-phase bridge enter a high-impedance state. No torque can be generated, irrespective of the state of the microcontroller, the firmware, or any communication interface. A rotating motor coasts freely to standstill, corresponding to stop category 0 according to EN/IEC 60204-1.

4. Principle of operation — technical basis

In hardware variants without the internal fuse, the complete supply of the control electronics enters the controller exclusively through the KEY pin. The KEY voltage feeds the internal switched-mode power supply, which generates all internal rails, including the supply of the power-stage gate drivers.

The power stage uses N-channel enhancement-mode MOSFETs. These devices require a positive gate-source voltage to conduct. With the gate-drive supply removed, no control path — hardware or software, faulty or intact — can turn the transistors on. Torque removal therefore does not rely on the microcontroller or firmware; it is an inherent property of the powering architecture.

5. Conditions and limitations of validity

1. **Hardware variant.** Valid only for controller variants without the internal fuse. Variants with the internal fuse are internally supplied from the BATT+ terminal and are not covered by this declaration.

2. **Field weakening must be disabled.** With field weakening enabled, the motor may operate above base speed, where its back-EMF exceeds the DC-bus voltage. After removal of the gate drive, the back-EMF rectifies through the MOSFET body diodes: the machine is not torque-free (uncontrolled generative braking) and the DC-bus voltage may rise above its rating. Field weakening and the declared behaviour are mutually exclusive.

3. **Power-semiconductor failure.** A failed (short-circuited) power MOSFET can short-circuit motor phases and produce braking or pulsating torque. Removing the gate-drive supply cannot mitigate this failure mode. In accordance with IEC 61800-5-2, this residual risk is inherent to any STO implementation and must be considered in the machine risk assessment.

4. **No electrical isolation.** The described behaviour does not disconnect the DC bus. Hazardous voltage remains present at the power terminals and inside the controller. It does not replace the main disconnect device or lockout/tagout procedures.

5. **No braking, no holding.** The motor coasts. Where coasting is hazardous, additional measures (e.g. a mechanical brake) are required.

6. **Single channel, no diagnostics.** The KEY path is a single-channel energy removal without internal diagnostics. The reaction time, determined by the discharge of the internal supply rails, has not been formally characterized.

6. Certification status

The described capability is a **design property, declared by the manufacturer**. It has **not** been assessed or certified by any third party or notified body. No safety integrity level (SIL, IEC 61508 / IEC 62061) and no performance level (PL, EN ISO 13849-1) is claimed or implied. This document is not a safety certificate.

7. Achieving a certified safety function

A certifiable STO safety function can be realized at machine level by routing the KEY supply through a **certified safety relay or safety contactor** controlled by a certified safety circuit (e.g. an emergency-stop relay with forcibly guided contacts). The certified element then performs the safe energy removal, with the controller acting as an actuator that inherently cannot produce torque without its KEY supply. The complete safety function (sensing element — safety logic — relay — KEY path) can be assessed by the machine integrator according to EN ISO 13849-1 or IEC 62061. The manufacturer provides the necessary technical documentation of the powering architecture on request.

8. Note on disconnection of the main battery circuit under load

Interrupting the **main battery circuit** (instead of the KEY signal path) while phase current is flowing causes a voltage overshoot on the DC link: the energy stored in the motor inductance, $W = ¾ \cdot L \cdot I^2$, transfers through the transistor body diodes into the DC-link capacitance C, raising the DC voltage to $V_{peak} = \sqrt{(V_{DC}^2 + 1.5 \cdot L \cdot I^2/C)}$. This overshoot must be verified against the maximum permissible controller voltage. An interactive calculator is available in the product documentation. Interrupting the KEY signal path (a low-current circuit) removes torque without this energy transfer and is the recommended implementation.

Place, date	Name, function	Signature