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Report

on the

Certificate

Z10 084071 0021 Rev. 00

of the Safety MCU

TMS320F2807x, TMS320F2837xS and TMS320F2837xD

Applicant

Texas Instruments Incorporated

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Report no. TS93688C

Revision 1.0 of 2019-04-17

Test Body

TÜV SÜD Rail GmbH
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Certification Body

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Revision history

Revision	Date	Author	Status	Modifications
1.0	2019-04-17	Axel Köhnen	active	

Table 1: Revision

1 Target of Evaluation (ToE)

In 2019-04-17 the company Texas Instruments Incorporated assigned TÜV SÜD for testing and certification of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD up to SIL 2 according to IEC 61508 series and up to ASIL B according to ISO 26262. Additionally, the systematic capability for SIL 3 according to IEC 61508 series and for ASIL D according to ISO 26262 was requested to be tested. The project number related to these activities was 717514093.

2 System overview

2.1 Test specimen

The target of evaluation are generic safety microcontroller devices based on the C2000 platform architecture (TMS320F2807x, TMS320F2837xS and TMS320F2837xD) together with a self-test library for the Control Law Accelerator (CLA-STL) hardware part, which is part of all three devices.
The assessment is based on a tailored safety lifecycle for safety elements out of context (SEooC) according to ISO 26262:2018 and compliant items according to IEC 61508:2010. The certificate report gives an overview of the results of the certification process and the general safety relevant conditions and restrictions related to the use of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD in safety-related systems.

2.2 Nomenclature of TMS320F2807x, TMS320F2837xS and TMS320F2837xD including CLA-STL

2.2.1 Nomenclature of TMS320F2807x, TMS320F2837xS and TMS320F2837xD

This report is valid for the silicon revision C of TMS320F2837xS, TMS320F2837xD and TMS320F2807x. The models covered by the certificate are listed in the following tables:

TMS320F2807x Part Numbers			
Orderable Device	**Package Drawing**	**Pins**	**Datasheet**
TMS320F28075PTPQ	PTP	176	tms320f28076.pdf
TMS320F28075PTPS	PTP	176	
TMS320F28075PTPT	PTP	176	
TMS320F28075PZPQ	PZP	100	
TMS320F28075PZPS	PZP	100	
TMS320F28075PZPT	PZP	100	
TMS320F28076PTPS	PTP	176	
TMS320F28076PZPS	PZP	100	

Table 1: Identification of TMS320F2807x part numbers

TMS320F2837xS Part Numbers			
Orderable Device	**Package Drawing**	**Pins**	**Datasheet**
TMS320F28374SPTPS	PTP	176	tms320f28379s.pdf
TMS320F28374SPTPT	PTP	176	
TMS320F28374SPZPS	PZP	100	
TMS320F28374SPZPT	PZP	100	
TMS320F28374SZWTS	ZWT	337	
TMS320F28374SZWTT	ZWT	337	
TMS320F28374SZWTTR	ZWT	337	
TMS320F28375SPTPS	PTP	176	
TMS320F28375SPTPT	PTP	176	
TMS320F28375SPZPQ	PZP	100	
TMS320F28375SPZPQR	PZP	100	
TMS320F28375SPZPS	PZP	100	
TMS320F28375SPZPT	PZP	100	
TMS320F28375SZWTS	ZWT	337	
TMS320F28375SZWTT	ZWT	337	
TMS320F28376SPTPS	PTP	176	
TMS320F28376SPTPT	PTP	176	
TMS320F28376SPZPS	PZP	100	
TMS320F28376SPZPT	PZP	100	
TMS320F28376SZWTS	ZWT	337	
TMS320F28376SZWTT	ZWT	337	
TMS320F28377SPTPQ	PTP	176	
TMS320F28377SPTPS	PTP	176	
TMS320F28377SPTPT	PTP	176	
TMS320F28377SPZPQ	PZP	100	
TMS320F28377SPZPS	PZP	100	
TMS320F28377SPZPT	PZP	100	
TMS320F28377SZWTQ	ZWT	337	
TMS320F28377SZWTS	ZWT	337	
TMS320F28377SZWTT	ZWT	337	
TMS320F28378SPTPS	PTP	176	
TMS320F28378SPZPS	PZP	100	
TMS320F28379SPTPS	PTP	176	
TMS320F28379SPTPT	PTP	176	
TMS320F28379SPZPS	PZP	100	
TMS320F28379SPZPT	PZP	100	
TMS320F28379SZWTS	ZWT	337	
TMS320F28379SZWTT	ZWT	337	

Table 2: Identification of TMS320F2837xS part numbers

TMS320F2837xD Part Numbers			
Orderable Device	**Package Drawing**	**Pins**	**Datasheet**
TMS320F28374DPTPS	PTP	176	
TMS320F28374DPTPT	PTP	176	
TMS320F28374DZWTS	ZWT	337	
TMS320F28374DZWTT	ZWT	337	
TMS320F28375DPTPS	PTP	176	
TMS320F28375DPTPT	PTP	176	
TMS320F28375DPZPS	PZP	100	
TMS320F28375DZWTS	ZWT	337	
TMS320F28375DZWTT	ZWT	337	
TMS320F28376DPTPS	PTP	176	
TMS320F28376DPTPT	PTP	176	
TMS320F28376DZWTS	ZWT	337	
TMS320F28376DZWTT	ZWT	337	tms320f28379d.pdf
TMS320F28377DPTPQ	PTP	176	
TMS320F28377DPTPS	PTP	176	
TMS320F28377DPTPT	PTP	176	
TMS320F28377DZWTQ	ZWT	337	
TMS320F28377DZWTQR	ZWT	337	
TMS320F28377DZWTS	ZWT	337	
TMS320F28377DZWTT	ZWT	337	
TMS320F28378DPTPS	PTP	176	
TMS320F28379DPTPS	PTP	176	
TMS320F28379DPTPT	PTP	176	
TMS320F28379DZWTS	ZWT	337	
TMS320F28379DZWTT	ZWT	337	

Table 3: Identification of TMS320F2837xD part numbers

2.2.2 Nomenclature of CLA-STL

This report is valid for CLA-STL version as identified in the following table:

Version	C2000-SAFETI-CLA-STL _1-00-00	
Tag	CLA_STL (branch) /CLA_STL_1_00_00_00 (Tag)	
MD5 Signature	stl_cla.c	7DA1E5EF5A8CF3A4B2D42FC28D46986A
	stl_cla_s.asm	EC44D61CDEF1498D9927E2842771B858
	stl_claswbist_s.asm	194928E8575E506A629D93163CC318EF
	stl_cla.h	8F892F620D69E9E9FD3E4193015CCD48

Table 4: Identification of the CLA-STL

3 Certification Requirements

3.1 Basis of Certification

The certification of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD were assessed as Safety Element out of Context (SEooC) according to the regulations and standards listed in clause 3.3 of this document. This will certify the successful completion of the following test segments:

I. Functional safety
   - Functional Safety management (FSM) and safety life-cycle
   - Avoidance of systematic faults / Systematic capability
   - Hardware safety requirements (including assumptions of use)
   - Analysis of the device structure (IP/Element FMAs)
   - Software Safety Requirements
   - Analysis of the device structure (IP FMAs)
   - Dependent Failure Analysis (DFA)
   - Criteria for coexistence of elements
   - Quantitative analysis of the hardware (FMEDA)
   - Fault injection and simulation
   - Hardware functional test and design verification
   - Hardware qualification
   - Software functional test and design verification
   - Development tool qualification

II. Safety information in the product documentation (safety manual, operating instructions)

III. Product-related Quality Management in manufacturing and product care.

Certification is dependent on successful completion of all above listed test segments. The testing follows the basic certification scheme for Safety Components of TÜV SÜD Rail GmbH.

3.2 Certification Documentation

Following test reports were issued by TÜV SÜD Rail GmbH:

- Technical Report by TÜV SÜD Rail GmbH for TMS320F2807x, TMS320F2837xS and TMS320F2837x MCUs
  Report No. TS93686T Rev. 1.0 of 2019-04-10
- Technical Report by TÜV SÜD Rail GmbH for the CLA-STL used in TMS320F2807x, TMS320F2837xS and TMS320F2837x MCUs
  Report No. TS93687T Rev. 1.0 of 2019-04-10

Based on the specified purpose of use of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD in safety critical process applications, the certification is based on the following set of standards. The issuance of the certificate states compliance with these references unless specifically noted otherwise.

3.3 Functional Safety

The testing for functional safety is to be performed using the following standards and guidelines:

No.	Reference	Description
/N1/	IEC 61508-1:2010 (SIL 2, Systematic Capability 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N2/	IEC 61508-2:2010 (SIL 2, Systematic Capability 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/ programmable electronic safety-related systems
/N3/	IEC 61508-3:2010 (SIL 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements
/N4/	ISO 26262-2:2018 (ASIL B, Systematic Capability ASIL D)	Road vehicles — Functional safety — Part 2: Management of functional safety
/N5/	ISO 26262-5:2018 (ASIL B, Systematic Capability ASIL D)	Road vehicles — Functional safety — Part 5: Product development at the hardware level
/N6/	ISO 26262-6:2018 (ASIL D)	Road vehicles — Functional safety — Part 6: Product development at the software level
/N7/	ISO 26262-7:2018 (ASIL B, Systematic Capability ASIL D)	Road vehicles — Functional safety — Part 7: Production and operation
/N8/	ISO 26262-8:2018 (ASIL B, Systematic Capability ASIL D)	Road vehicles — Functional safety — Part 8: Supporting processes
/N9/	ISO 26262-9:2018 (ASIL B, Systematic Capability ASIL D)	Road vehicles — Functional safety — Part 9: Automotive Safety Integrity Level (ASIL)-oriented and safety-oriented analyses

Note: The term "Systematic Capability ASIL D" doesn't exist in context of ISO 26262. It is used in context of this report to state that the processes and methods according ASIL D were applied.

4 Results

4.1 Functional Safety

The tests performed have shown that the TMS320F2807x, TMS320F2837xS and TMS320F2837xD comply with the tailored testing criteria specified in clause 3 subject to the conditions defined in clause 5 and its subsections. The TMS320F2807x, TMS320F2837xS and TMS320F2837xD MCUs were proven to meet the systematic capability for SIL 3 according to IEC 61508 and for ASIL D according to ISO 26262. The TMS320F2807x, TMS320F2837xS and TMS320F2837xD provide different safety mechanisms implemented on-chip. By using the different safety mechanisms, the Safety MCUs can be used to support safety functions up to SIL 2 in accordance with IEC 61508 and up to ASIL B in accordance with ISO 26262.

5 Implementation Conditions and Restrictions

The use of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD in a safety related application shall comply with the current version of the safety manual, and the following implementation and installation requirements have to be followed if the TMS320F2807x, TMS320F2837xS and TMS320F2837xD are used in safety-related systems:

- The guidelines and requirements specified in the user documentation shall be followed. Especially the requirements of the system integration section of the safety manual have to be regarded.
- The impact on the overall safety concept and the safety function has to be well understood and analyzed if a safety mechanism described in the safety manual is not used.
- All safety mechanisms implemented by the system integrator have to be developed and verified according to the targeted safety standards.
- All specific characteristics and behaviors of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD required by the final safety function have to be developed and verified according to the targeted safety standards. This includes also timing aspects like reaction times, test intervals or test execution times.
- The system integrator has to understand the conditions and restrictions defined in the documentation of the TMS320F2807x, TMS320F2837xS and TMS320F2837xD.

6 Certificate Number

This report specifies technical details and implementation conditions required for the application of TMS320F2807x, TMS320F2837xS and TMS320F2837xD to the certificate:

Z10 084071 0021 Rev. 00

Munich, 2019-04-17

TÜV SÜD Rail GmbH
Rail Automation

Technical Certifier as on certificate
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