VDE Prüf- und Zertifizierungsinstitut

VDE

VDE Prüf- und Zertifizierungsinstitut GmbH • Merianstraße 28 • D-63069 Offenbach

Texas Instruments, C2000 MCU Group
12203 S.W Freeway, Stafford,
Texas, 77477
USA

mehr als 90 Jahre VDE Kompetenz

Offenbach, 2013-09-06

Your ref.	Your letter	Our ref. – please indicate	Contact
	2011-11-15	5014898-4970-0001/160391 AS6/swa-kat	Mr Schwab Tel (069) 83 06-607 Fax (069) 83 06-606 ralf.schwab@vde.com

PRÜFBERICHT
zur Information des Auftraggebers

Test Report for the Information of the applicant

Manufacturer : **Texas Instruments, C2000 MCU Group**
12203 S.W Freeway, Stafford, Texas, 77477

Typ / *Type :* **Version 1.0**

Software Klasse: **B / R1**
Software class

Sehr geehrte Damen und Herren,

dieser Prüfbericht enthält das Ergebnis einer einmaligen Untersuchung an dem zur Prüfung vorgelegten Erzeugnis. Ein Muster dieses Erzeugnisses wurde geprüft, um die Übereinstimmung mit den nachfolgend aufgeführten Normen bzw. Abschnitten von Normen festzustellen.
Die Prüfung wurde durchgeführt vom 2011-11-21 bis 2012-01-30.

This test report contains the result of a singular investigation carried out on the product submitted. A sample of this product was tested to found the accordance with the thereafter listed standards or clauses of standards resp. The testing was carried out from 2011-11-21 to 2012-01-30.

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The test report does not entitle for the use of a VDE Certification Mark and considers solely the requirements of the specifications mentioned below.

Wenn gegenüber Dritten auf diesen Prüfbericht Bezug genommen wird, muss dieser Prüfbericht in voller Länge an gleicher Stelle verfügbar gemacht werden.

Whenever reference is made to this test report towards third party, this test report shall be made available on the very spot in full length.

I Beschreibung / *Description*

Gegenstand / *Object*: SW-Module zum Aufbau einer Selbstdiagnose-Library für Mikrokontroller
SW-Modules to setup a self-diagnostic library for micro controllers

Familie / *family:*

Texas Instruments	**C2000 MCU Family**
Family	Subtypes
Piccolo MCU	TMS320F2806x/5x/3x/2x
Delfino MCU	TMS320F28335/F28235

Hersteller / *Manufacturer:* Texas Instruments, C2000 MCU Group
12203 S.W Freeway, Stafford, Texas, 77477

II Prüfbestimmungen / *Test Specifications*

Standard	EN/IEC 60335-1 (5.Ed) Anhang R	Tabelle R1
	EN/IEC 60335-1 (5.Ed) Annex R	*Table R1*
Zusätzlich abgedeckt	EN/IEC 60335-1 (5.Ed) Anhang R	*R.3 Maßnahmen zur Fehlervermeidung*
Additional coverage	*EN/IEC 60335-1 (5.Ed) Annex R*	*R.3 Measures to avoid errors*
Standard	EN/IEC 60730-1 (4.Ed) Anhang H	Tabelle H.1
	EN/IEC 60730-1 (4.Ed) Annex H	*Table H.1*
Zusätzlich abgedeckt	EN/IEC 60730-1 (4.Ed) Anhang H	*H.11.12.3 Maßbahmen zur Fehlervermeidung*
	EN/IEC 60730-1 (4.Ed) Annex H	*H.11.12.3*

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Additional coverage *Measures to avoid errors*

III Anmerkungen / Remarks

Die zur Prüfung vorgelegten SW-Module für die Mikrokontroller internen Selbstdiagnosen wurden hinsichtlich Ihrer Fehlerabdeckung nach Standard überprüft.

The shown SW modules for micro controller internal self-diagnostics have been tested for standard conform failure coverage.

Die Prüfungen wurden an einem Versuchsboard mit dem Mikrokontroller Typ TMS320F2806x stellvertretend für die Familien TMS320F2806x/5x/3x/2x & TMS320F28335/F28235 durchgeführt.

The testing have been performed on a evaluation board with the microcontroller type TMS320F2806x *representative for the families* TMS320F2806x/5x/3x/2x & TMS320F28335/F28235.

Die Module sind zur Einbindung in ein übergeordnetes Selbstdiagnoseprogramm vorgesehen, welches vom Hersteller der Steuerung zur Prüfung vorzulegen ist.

The modules are intended to be included in a supervisory self-diagnostic program which has to be presented for approval by the manufacturer of the electronic control.

Die geprüften Module wurden zur Referenz beim VDE hinterlegt.

The tested modules are deposited at the VDE as reference files.

IV Ergebnis / *Result*

Die geprüften Module erfüllen die Anforderungen gemäß der unter II genannten Prüfbestimmungen für Software-Klasse B/R1
Die Einbindung der Module ist in der jeweiligen Applikation zu prüfen.

The tested modules fulfil the requirements according the test specifications referred in chapter II for software class B/R1
The implementation of the modules has to be tested in the final application.

Die applikations-spezifische Fehlerbehandlung ist innerhalb der finalen Applikation zu realisieren.

The application specific failure handling has to be implemented in the final application.

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List of TI safety library functions (English only)

	C2000 MCU	***IEC60730_STL_Library_v4_00_00_00***
	File name	*Source Description*
1	*STL_cpu_test.asm*	*CPU core, FPU and VCU register tests.*
2	*STL_march_test.asm*	*Volatile memory tests using March test.*
3	*STL_crc_test.asm*	*CRC based memory tests.*
4	*STL_interrupt_test.c*	*Interrupt functionality test.*
5	*STL_isr.c*	*Interrupt service routines used by the library.*
6	*STL_pc_test.c*	*Program counter register test.*
7	*STL_oscillator_test.c*	*Internal oscillator test.*
8	*STL_watchdog_test.c*	*Watchdog test.*
9	*STL_timer_test.c*	*CPU timers test.*
10	*STL_clock_fail_detect.c*	*Initializes missing clock detection logic.*
11	*STL_pll_lock_check.c*	*PLL lock check test.*
12	*STL_spc_detect.c*	*Initializes stack corruption detection.*
13	*STL_gpio_test.c*	*GPIO and AIO tests.*
14	*STL_type3_adc_test.c*	*ADC tests.*
15	*STL_type0_comp_test.c*	*Comparator test.*
16	*STL_type0_ecap_test.c*	*eCAP APWM mode test.*
17	*STL_type1_epwm_test.c*	*ePWM test.*
18	*STL_type0_ecan_test.c*	*eCAN internal loop back test.*
19	*STL_type0_i2c_test.c*	*I2C internal loop back test.*
20	*STL_type0_sci_test.c*	*SCI internal loop back test.*
21	*STL_type1_spi_test.c*	*SPI internal loop bacl test.*
22	*STL_type0_cla_functional_test.c*	*CLA functional test.*
23	*STL_type0_cla_test.asm*	*CLA registers and CLA related RAM tests.*
24	*STL_part_id_test.asm*	*Silicon part id test.*
25	*STL_register_test.c*	*Peripheral registers stuck at test.*
26	*STL_register_test_patterns.c*	*Peripheral registers stuck at test masks.*
27	*STL_system_config.h*	*Contains macros used by the library.*
28	*STL_device.h*	*Contains device dependent include files.*
29	*STL_type.h*	*Standard data types.*
30	*STL_user_config.h*	*Contains all the user selectable configurations.*
31	*STL_utility.asm*	*Helper functions used by the IEC60730 Safety library*

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Measures to avoid errors

- Development methodology
- Test process
- Document structure

Are following the requirements of EN/IEC 60335-1 & EN/IEC 60730-1 as far as possible.

Static analysis has been performed using LDRA testbed.

TI uses MISRA rules with some logical exceptions.

Special features (English only)

The C2000 MCUs include a special hardware element – parallel signature analysis (PSA) – that allows for a 40-bit cyclic redundancy check (CRC) of the data bus on a cycle-by-cycle basis for additional safety without affecting the main CPU or software application.

Clock measurement is done on-chip using hi-resolution PWM calibration based logic, which is common on in most of the C2000 MCUs. A special function call to calculate the scale factor that is measure of system clock is called to compare the variation of system clock. If the system clock varies abnormally due to system conditions, it can be detected easily.

The internal watchdog has a separate oscillator and can create an interrupt or reset, the watchdog has to be enabled after boot sequence, once enabled it cannot be easily disabled (several steps necessary)

The MCU's features a "missing clock" detection.

Best regards

VDE Prüf- und Zertifizierungsinstitut GmbH
VDE Testing and Certification Institute
Washing, Dishwashing, Drying

Ingo Schälter Christoph Türk

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