RENESAS

FUNCTIONAL SAFETY FOR INDUSTRIAL AUTOMATION

BIG IDEAS
FOR EVERY SPACE

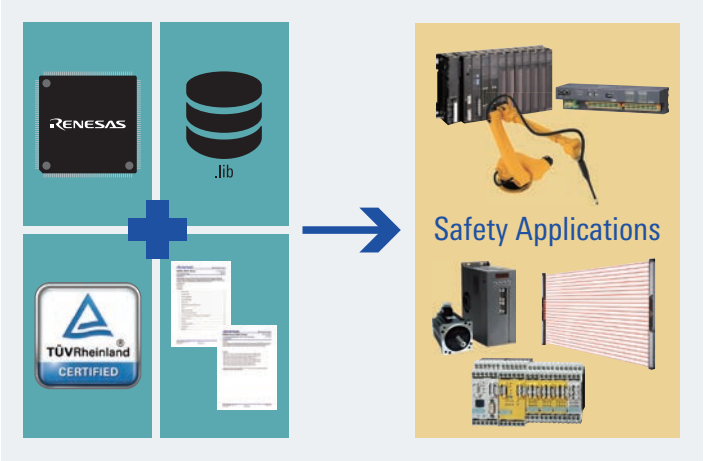
2017.11

The term Functional Safety has become a topic of great interest. Functional Safety generally means that malfunctions of the operating systems or applications that lead to any kind of thread or even accident have to be avoided. Of course this basically includes human health and environment, but also material integrity can be of high interest. In other words functional safety is that part of the overall safety that depends on failure free operation of a system. Functional Safety saves human lifes, saves a lot of money and enables innovation and market advantages for our customers.

Key for Industry 4.0

Industry 4.0 moves factories to intelligent and flexible production clusters. Separation and encapsulation of safety critical workflow steps is continuously being reduced. Man and machine are working side by side or even hand in hand. Autonomous systems in decentralized real-time production require build-in safety functionality to allow such safe human-machine collaborations to reduce physical safety barriers like safety locks or safety fences. All this leads to an increase in functional safety related applications.

To enable a seamless integration into safety applications, Renesas provides certification packages for different microcontroller series. From low to high-end performances Renesas offers Safety Solution for its RX MCU family and for its Synergy MCU platform.
They include a safety manual containing the results from a comprehensive analysis based on each function part of the microcontroller, and all relevant information and procedures related to functional safety. A diagnostic software library contains all necessary self-tests for the CPU core, for RAM and ROM and depending on the solution even more.
Since the diagnostic coverage of the CPU core is already proven by fault simulation tests, an effective system integration is enabled and system development time is shortened.



Proven Coverage and TÜV Certification

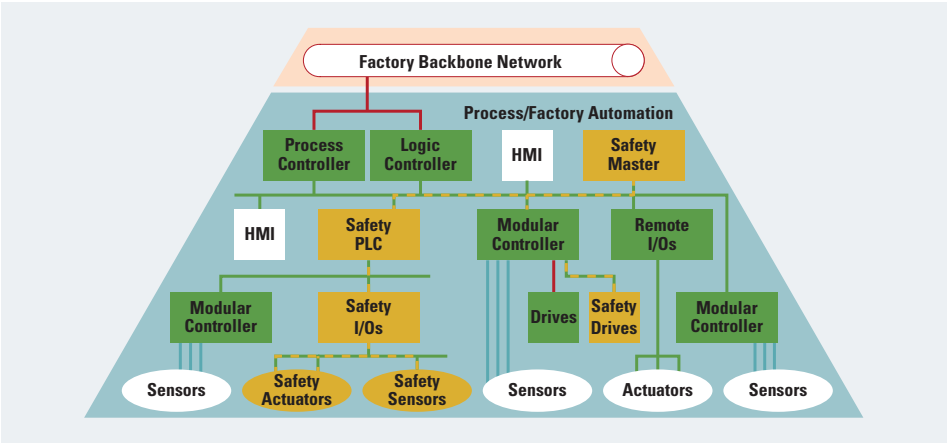
To prove the diagnostic coverage of the CPU core test Renesas developed its own simulation environment. Renesas is the 1st vendor that did this kind of verification for a core self-test.
Renesas Safety Packages are certified compliant to IEC 61508 by TÜV Rheinland.

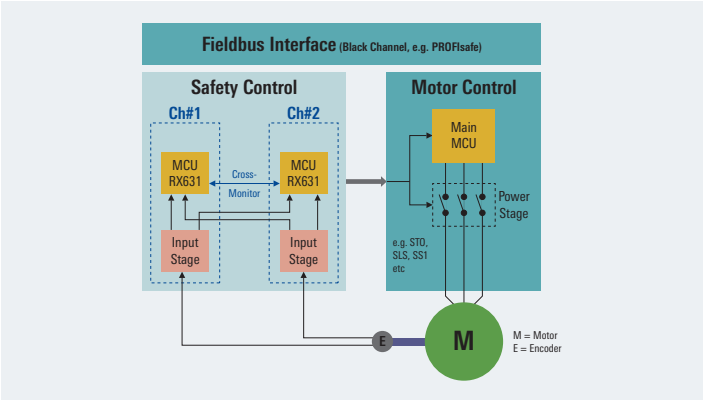
Pre-Certified SW and Tools

Safety system development is very complex. Therefore it will be very important to build up an application piece by piece with prepared functional safety considering hard- and software modules. Ideally the parts come with a certification. Though every application is different the usage of modular safety components, hard- as well as software, is less extensive workload for safety developers.

Typical Target Applications

- Industrial Motor Drives
- Safety Controllers
- Programmable Logic Controllers
- Safety Sensors





Example: Safe Motor Control

- Application and safety functionality separated
- Two-channel concept (1oo2 architecture)
- Cross-Monitoring
- Standard compliance
- IEC61508 SIL3
- ISO13849 PLe Cat4
- IEC62061 SILCL3
- Safety functions according to IEC61800-5-2(like STO, SLS, etc)

Certify it! Functional Safety IEC 61508

Key Features

- Solution compliant to the safety standard IEC61508:2010
- Certified by TÜV Rheinland
- Safety Manual with relevant information and procedures related to functional safety
- Diagnostic SW library containing test routines for CPU core, RAM, and ROM
- High quality CPU core self-test, diagnostic coverage proven by fault simulation tests
- Diagnostic SW developed for SIL3 using IEC61508 compliant IAR Embedded Workbench® for RX or Arm® or CC-RX compiler for e² studio
- Certified by TÜV Rheinland

TÜVRheinland® CERTIFIED
Functional Safety Type Approved
www.tuv.com
ID 0600000000

Key Benefits

- Best in-class self test with proven coverage
- Certified tool suite enables safety application development
- Reduced risks for system certification
- Saves development effort, limits TÜV discussions and enables faster time-to-market

The RX family of 32-bit microcontrollers are built around Renesas' exclusive RXv1/RXv2 CPU core and combine excellent operation performance with superior power efficiency.

It consists of four product series: the flagship RX700 series, with the fastest performance and most advanced functions; the standard RX600 series; the RX200 series, which delivers an optimal balance of power efficiency and high performance; and the entry-level RX100 series, with extremely low power consumption. These four series encompass a range of products that provide seamless scalability from small-scale to large-scale applications.

Safety Solutions for RXv1 Cores available for RX63N, RX631 and RX111

Safety Solutions for all RXv2 Core devices coming 2018

Functional Safety Production License

- Diagnostics library for CPU, RAM, and ROM (Source Code)
- Diagnostics Software User Guide
- Safety Manual Full Version
- Certificate & Test Report from TÜV Rheinland

TÜVRheinland® CERTIFIED — Functional Safety Type Approved — www.tuv.com ID 0600000000

Certified Tools

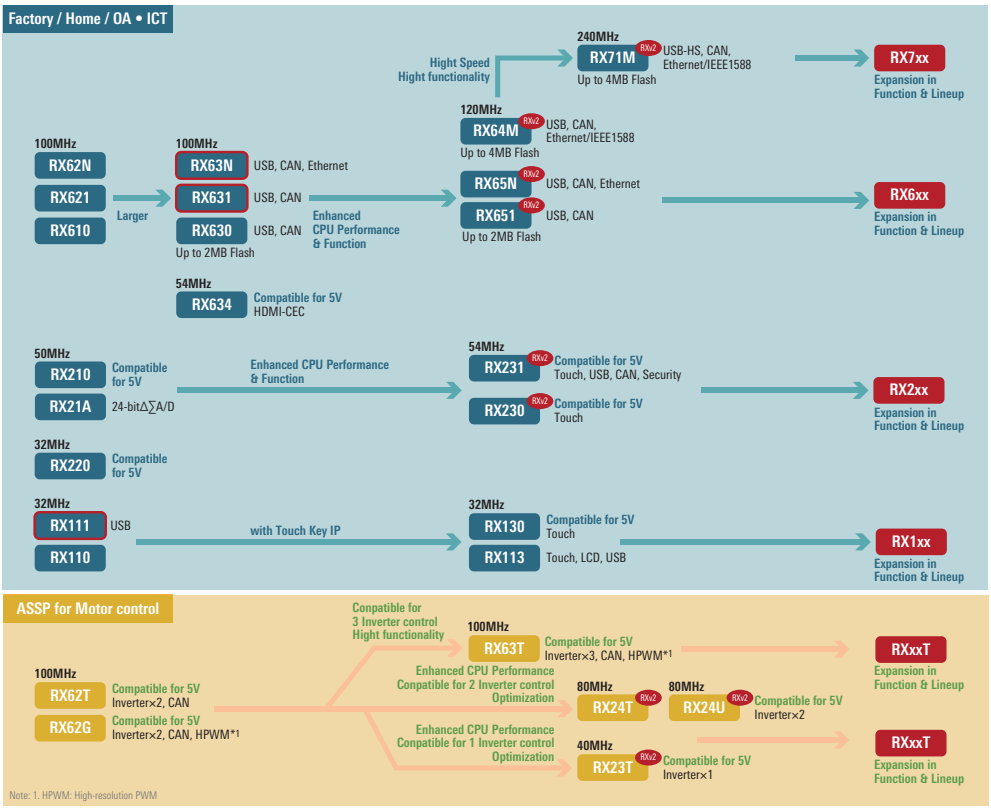
- Renesas CC-RX Compiler
- IAR Embedded Workbench® for RX

Renesas CC-RX Compiler V2.03.00IEC61508 SIL3 Certified

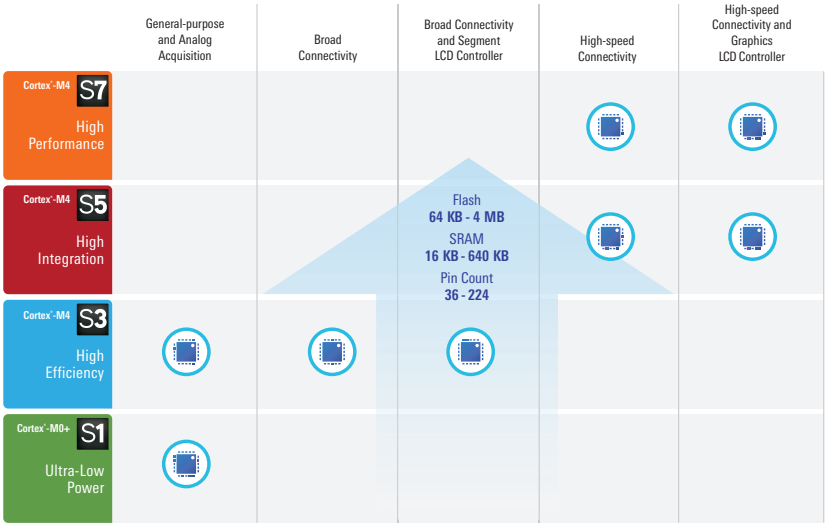
Functional Safety Evaluation Kit (including Evaluation License)

- Renesas Starter Kit+ for RX63N or Starter Kit for RX111
- Diagnostics library for CPU, RAM, and ROM
- Diagnostics Software User Guide
- Safety Manual Evaluation Version
- IAR Installer EWRX-FS v2.42.4 (Evaluation Version)
- Quick Start Guide
- Video

Road Map



RENESAS synergy™ S7 S5 S3



Synergy is the industry's first IoT platform for embedded developers which enables namely faster time to market, reducing total cost of ownership, and lowering barriers to entry. To enable the Synergy platform for Functional Safety applications Renesas developed its own Functional Safety Packages. The IEC61508 Package is available for S3, S5 and S7 an covers a wide Range of Performance from 48MHz up to 240MHz.

Functional Safety Package for Synergy

- Self-Test Software Library:
  - Self-Test for CPU, RAM, ROM
  - CAC Configuration SW
  - IWDT Management SW
  - LVD Configuration SW
  - ADC12 Comparator SW
  - TSN Management SW
- User's Guide
- Safety Manual
- Assessment report
- TÜV certificates
- Safety Application Note*

*not included in certification

Certified Tools

- IAR Embedded Workbench® for Arm®

Functional Safety Relevant Hardware Functions

- ECC in SRAM
- SRAM Parity
- Flash Area Protection
- ADC Diagnostics
- Clock Frequency Accuracy Measurement Circuit
- CRC Calculator
- Data Operation Circuit
- Port Output Enable for GPT
- IWDT

Express Logic Certification Packs

THREADX NETX Duo FILEX

SGS TÜV SAAR FUNKTIONALE SICHERHEIT GEPRÜFT FUNCTIONAL SAFETY APPROVED

- Express Logic ThreadX, NetX Duo and FileX are certification ready for IEC61508
- Contents
- Complete testing and documented results for all ThreadX services
- Process, design methodology & documentation Planning, Development, Verification, Configuration management, Quality assurance
- Test Source code of all tests, Test results, Code coverage and analysis, Unit/white-box, integration/black-box, acceptance testing, Plan for tool usage
- Results Unit & integration test reports
- Requirements trace matrix
- Safety Manual

Safety Application Development Support

Renesas Safety Reference for SIL3 Motor Control for RX631 or RX111

Safety Reference Hardware Package

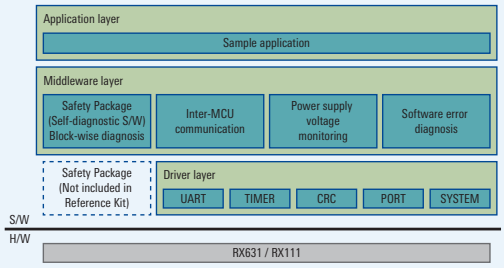
- Evaluation Board
- Manual
- BOM

Safety Reference Software Package

Various diagnostic SW for RX MCU peripherals

– Sample Source Code
  - Evaluation application
  - Middleware fro MCU peripherals
  - Peripheral driver

– API Specification



Safety Reference Documentation Package (18 documents)

Documents & guideline for the concept phase
- Safety plan (SP)
- Verification and validation plan (V&V)
- Safety requirements specification (SRS)
- Safety concept (SC)

Documents for diagnostic method
- Inter-MCU communication
- Software error diagnosis
- Power supply voltage diagnosis
- Other circuits diagnosis

Documents for safety validation
- FMEA, coverage computation and more

Safety Design Partner

GET EXPERT KNOWLEDGE WITH SAFETY DESIGN PACKAGES

APPLICATION AREAS

SAFE DRIVES — Design Package — SIL

SAFE I/O MODULES — Design Package — SIL

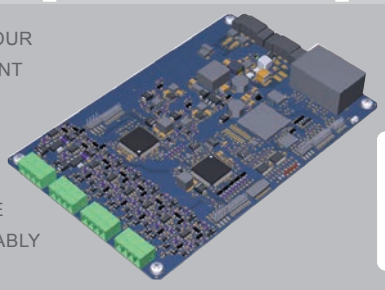
SAFE SENSORS — Design Package — EX SIL

DESIGN PACKAGES

DESIGN PACKAGES SPEED UP YOUR SAFETY PRODUCT DEVELOPMENT

&

DESIGN SERVICES COMPLETE YOUR SPECIFIC SOLUTIONS RELIABLY



CERTIFICATION

REDUCE SIL CERTIFICATION TIME WITH OUR TUV APPROVED DEVELOPMENT PROCESSES

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RX63N RX631 Production License IAR RX63N RX631 Production License CC-RX RX63N RX631 Evaluation Kit (IAR)	YCERTIFY-IT-RX63N-PR RTK0EF0040F01001SJ YCERTIFY-IT-RX63N-EV
RX111 Production License IAR RX111 Production License CC-RX RX111 Evaluation Kit (IAR)	YCERTIFY-IT-RX111-PR RTK0EF0041F01001SJ YCERTIFY-IT-RX111-EV
IEC61508 Certification Kit for RX Compilers	RTCRX0000TC02ZNR
RX631 Reference Kit Hardware RX631 Reference Kit Software	RTK0EF0002D01001BJ RTK0EF0004F01001SJ
RX111 Reference Kit Hardware RX111 Reference Kit Software	RTK0EF0011D01001BJ RTK0EF0017F01001SJ
RX111/RX631 Reference Kit Documentation	RTK0EF0005Z01001ZJ

S3 Safety Solution + EL certification packs	RTM0SY0000XFSP0T30UP
S5 Safety Solution + EL certification packs	RTM0SY0000XFSP0T50UP
S7 Safety Solution + EL certification packs	RTM0SY0000XFSP0T70UP

www.renesas.eu/safety

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(Rev.3.0-1 November 2016)

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Document No. R30CA0177EJ0100