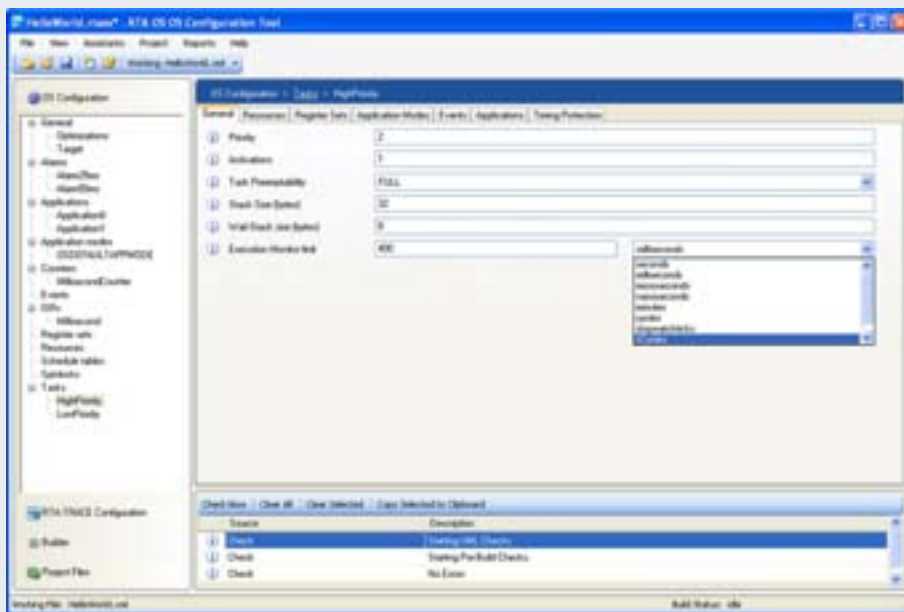


## RTA-OS

### Renesas RH850 with the CS+ Compiler



#### RTA-OS

RTA-OS is the new generation operating system from ETAS that conforms to the AUTOSAR OS specification and builds on the benefits of the successful RTA-OSEK product. It provides a toolsuite that includes a PC-based graphical configuration tool and adaptive OS generation capabilities to deliver flexible, fast solutions for a wide range of automotive microcontrollers.

The graphical configuration tool allows all OS objects to be configured, and creates AUTOSAR conformant XML files describing the OS configuration. In addition, it provides automatic verification against the AUTOSAR XML schema and allows users to create projects for easy management of multiple files.

RTA-OS improves on RTA-OSEK in several areas, including better runtime performance and smaller memory footprint,

support for multiple processor environments, and automatic support for up to 1024 tasks. The powerful performance analysis tools developed for RTA-OSEK have been updated for RTA-OS to allow hard real-time requirements to be met.

#### RTA Product Family

RTA-OS integrates seamlessly with other tools in the RTA product family, including:

- RTA-RTE – a mature, robust production quality AUTOSAR RTE Generator.
- RTA-TRACE – a software logic analyser that allows the runtime behaviour of RTA-OS to be observed.

#### Microcontroller Support

RTA-OS supports all variants of the Renesas RH850 family of microcontrollers. Release testing has taken place using the F1L and R1L variants.

#### Features at a Glance

AUTOSAR R4.0 compliant OS

Supports all scalability classes

MISRA-C:2012 compliant

RTOS overhead:  
69 bytes RAM  
0 bytes ROM

Category 2 ISR latency:  
84 CPU cycles

## Compiler

RTA-OS for the Renesas RH850 has been developed with the CS+ v1.02.00 compiler toolchain, part of the Renesas CS+ IDE.

Due to the adaptive code generation of RTA-OS, it is possible to use other versions of this compiler to build applications.

## ORTI Debugger Support

RTA-OS can generate OSEK Runtime Interface information for the Lauterbach Trace32 debugger.

## Interrupt Model

RTA-OS supports a nested interrupt model on the Renesas RH850. Devices based on a G3K core may use up to 8 interrupt priority levels, whereas devices based on a G3M core may use up to 16 interrupt priority levels.

## Memory Model

RTA-OS supports the standard 32-bit EABI memory model provided by the CS+ compiler.

## Maximum Number of OS Objects Allowed by RTA-OS

	BCC1	BCC2	ECC1	ECC2
Max. no. of tasks		Up to 1024		
Max. tasks per priority		Up to 1024		
Max. queued activations	1	$2^{32}-1$	1	$2^{32}-1$
Max. events per task	n/a	n/a	32	32
Max. alarms		$2^{32}-1$		
Max. software counters		$2^{32}-1$		
Max. hardware counters		$2^{32}-1$		
Max. nested resources		$2^{32}-1$		
Max. standard resources		$2^{32}-1$		
Max. internal resources		Not limited by RTA-OS		
Max. application modes		$2^{32}-1$		
Max. schedule tables		$2^{32}-1$		
Max. expiry points per schedule table		$2^{32}-1$		

## Memory Overhead of RTA-OS

Memory Type	Overhead (bytes)
RAM	0
ROM/Flash	69

In addition to the OS overhead, each object used by an application has the following memory requirements:

Object	RAM (bytes)	ROM (bytes)
Task	0	20
Category 2 ISR	0	8
Resource	4	8
Alarm	12	2
Counter	4	20
Schedule Table	16	16
Expiry Point	0	4

## Performance

The following table gives the key RTA-OS kernel performance data measured in CPU cycles. All measurements were taken on a Renesas RH850 F1L with an 80 MHz clock speed.

Task Type	Execution Time	Ref.
Pre-emption	110	A
Normal Termination	66	B
Task Switch	74	C
ChainTask	130	D
WaitEvent	444	E
SetEvent	528	F
Schedule	104	G
ReleaseResource	98	H
Category 2 ISR Entry Latency	84	I
Category 2 ISR Exit Latency resuming interrupted task	102	J
Category 2 ISR Exit Latency with task switch	110	K
Category 1 ISR Latency	50	L

The following figures illustrate how the RTA-OS kernel overheads are allocated during the operations given in the above table:

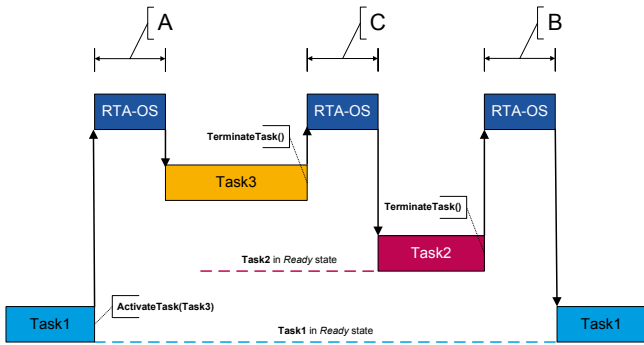


Figure 1 - Task1 is preempted by Task3, followed by a task switch and then normal termination of Task2

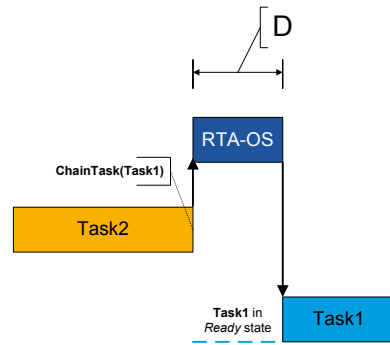


Figure 2 - Task2 chains Task1

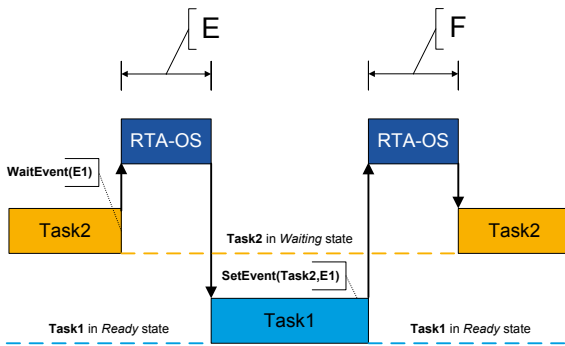


Figure 3 - Task2 waits for an event set by Task1

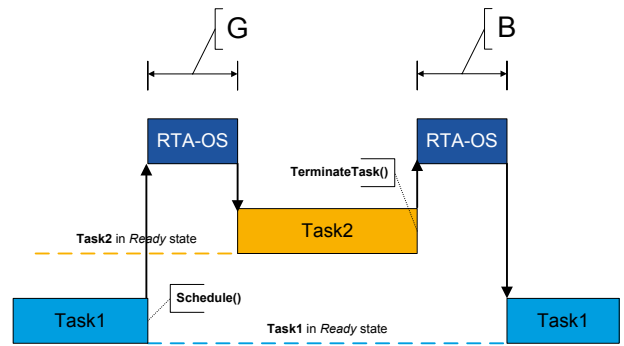


Figure 4 - Task1 allows cooperative scheduling by Task2

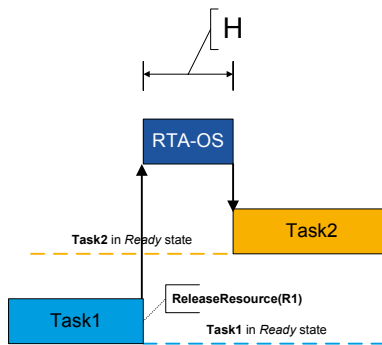


Figure 5 - Task1 releases a resource

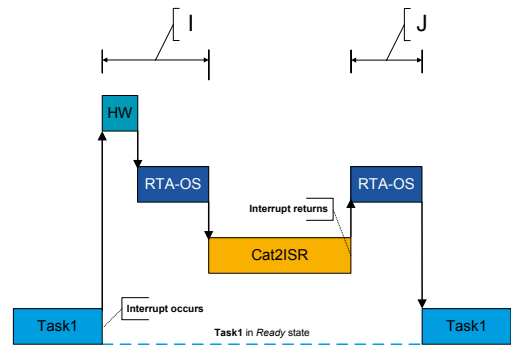


Figure 6 - Category2 ISR entry and exit latency

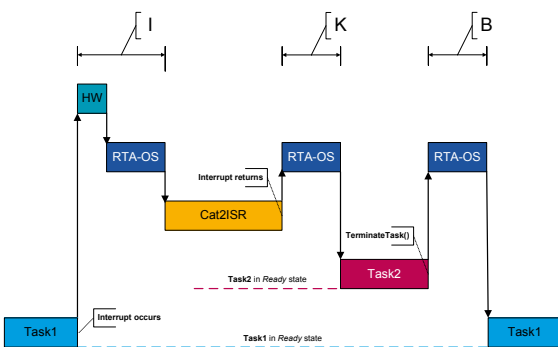


Figure 7 - Category2 ISR switches to Task2

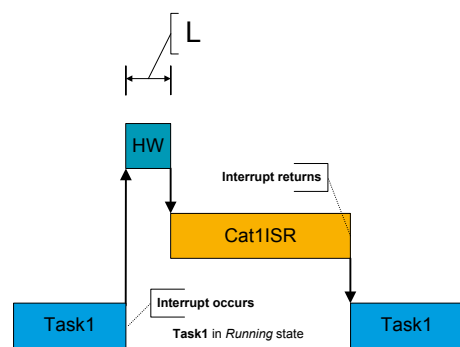


Figure 8 - Category1 ISR entry latency

## Order Information

To use RTA-OS it is necessary to purchase a development license for the tools together with an add-on license for the Renesas RH850 port. Machine-named, user-named and floating licenses are available.

To use any operating system code generated by RTA-OS in ECU applications, a valid production license is required. Please contact your local ETAS Sales Office for details of production licenses for RTA-OS.

## RTA-OS Tools Order Information

Item	Characteristics	Object
F 00K 107 119	Machine-named license for RTA-OS for Windows PC	LD_RTA-OS_VRTA_SC34_LIC-MP
F 00K 107 120	User-named license for RTA-OS for Windows PC	LD_RTA-OS_VRTA_SC34_LIC-UP
F 00K 107 121	Floating license for RTA-OS for Windows PC	LD_RTA-OS_VRTA_SC34_LIC-CP
F 00K 107 136	Product CD for RTA-OS	LD_RTA-OS_VRTA_SC34_PROD

## RTA-OS Renesas RH850 Port Order Information

Item	Characteristics	Object
F 00K 110 173	Machine-named license for RTA-OS for Renesas RH850 Scalability Classes 1 & 2	ES_RTA-OS_RH850CS_SC12_LIC-MP
F 00K 110 174	User-named license for RTA-OS for Renesas RH850 Scalability Classes 1 & 2	ES_RTA-OS_RH850CS_SC12_LIC-UP
F 00K 110 175	Floating license for RTA-OS for Renesas RH850 Scalability Classes 1 & 2	ES_RTA-OS_RH850CS_SC12_LIC-CP
F 00K 110 180	Machine-named license for RTA-OS for Renesas RH850 Scalability Classes 1 to 4	ES_RTA-OS_RH850CS_SC34_LIC-MP
F 00K 110 181	User-named license for RTA-OS for Renesas RH850 Scalability Classes 1 to 4	ES_RTA-OS_RH850CS_SC34_LIC-UP
F 00K 110 182	Floating license for RTA-OS for Renesas RH850 Scalability Classes 1 to 4	ES_RTA-OS_RH850CS_SC34_LIC-CP
F 00K 110 176	Product CD for RTA-OS for Renesas RH850	ES_RTA-OS_RH850CS_PROD

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