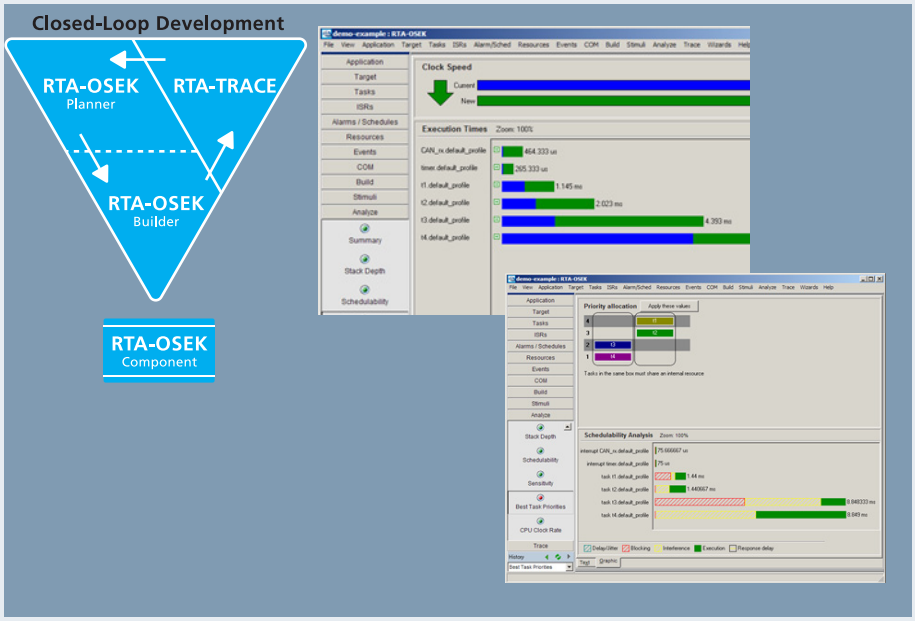
RTA-OSEK

Freescale MPC55xx with the GHS Compiler



RTA-OSEK

RTA-OSEK provides an application design environment that combines the smallest and fastest OSEK RTOS with an unique timing analysis tool.

The kernel element of RTA-OSEK is a fixed priority, pre-emptive real-time operating system that is compliant to the OSEK/VDX OS standard version 2.2 for all four conformance classes (BCC1, BCC2, ECC1 and ECC2) and intra processor communication using OSEK COM Conformance Classes A and B (CCCA and CCCB).

All CPU overheads of the kernel have low worst case bounds and little variability in execution time. The kernel is particularly suited to systems with very tight constraints on hardware costs and where runtime performance must be guaranteed.

The kernel is configured using an offline tool provided with RTA-OSEK. Determining in advance which features are used allows memory requirements to be minimized and API calls to be optimized for greatest efficiency.

All tasks and ISRs in RTA-OSEK run on a single stack – even extended tasks. This allows dramatic reductions in application stack space requirements.

The RTA-OSEK kernel is designed to be scalable. When a task uses queued activation or waits on events, the additional RTOS overhead required to support these features is paid by the task rather than by the system. This means that a basic single activation task uses the same resources in a BCC1 system as it does in an ECC2 system.

Compiler Toolchain

RTA-OSEK supports the GHS v2013.1.4 compiler

Features at a Glance

OSEK/VDX OS v2.2 Certified OS

RTOS overhead: 46 bytes RAM, 158 bytes ROM

Category 2 interrupt latency: 132 CPU cycles

Memory Model

RTA-OSEK supports the BookE memory model. It places a few core variables in the RAM Small Data Area for runtime efficiency, and does not use any ROM SDA.

ORTI Debugger Support

ORTI is the OSEK Run-Time Interface that is supported by RTA-OSEK for the following debuggers:

- Lauterbach Trace32

Hardware Environment

RTA-OSEK supports all variants of the Freescale MPC55xx family, including MPC5534, MPC5553, MPC5554, MPC5561, MPC5565, MPC5566, MPC5567, MPC5514 and MPC5516.

Interrupt Model

RTA-OSEK directly supports Hardware Interrupt Vector Mode and directions are provided for the expert user to tailor the configuration to work in Software Interrupt Vector Mode.

Floating Point Support

The Freescale MPC55xx supports single-precision Floating Point operations and Vector operations by means of the Signal Processing Engine (SPE).

Floating-point or vector context save and restore is through provided floating-point wrappers in RTA-OSEK. The wrappers may be built lean to support FP only, or complete to support vector instructions. Individual tasks are configured to use or not to use the floating point wrappers.

Functionality

The following table outlines the restrictions on the maximum number of operating system objects allowed by RTA-OSEK

The number of alarms, tasksets, schedules and schedule arrival-points is only limited by available hardware resources.

	BCC1	BCC2	ECC1	ECC2
Max. no. of tasks	32 plus an idle task			
Max. tasks per priority	1	32	1	32
Max. queued activations	1	255	1	255
Max. events per task	N/A	N/A	32	32
Max. nested resources	255			
Max. alarms	Not limited by RTA-OSEK			
Max. standard resources	255			
Max. internal resources	Not limited by RTA-OSEK			
Max. application modes	2^{32}-1			

Memory Usage

The memory overhead of the core RTA-OSEK kernel is as follows:

Memory Type	Overhead (bytes)
RAM	46
ROM/Flash	158

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

Object	RAM (bytes)	ROM (bytes)
BCC1 task	0	36
BCC2 task	8	48
ECC1 task	116	60
ECC2 task	118	68
Category 1 ISR	0	0
Category 2 ISR	0	52
Resource	0	20
Internal Resource	0	0
Event	0	4
Alarm	12	52
Counter	4	104
Schedule Table	16	140
Schedule Table Expiry Point	0	12
Taskset (RW)	4	4
Taskset (RO)	0	4
Schedule	16	36
Arrivalpoint (RW)	12	12
Arrivalpoint (RO)	0	12

Performance

The following table gives the key RTA-OSEK kernel timings in CPU cycles

Task Type	Basic	Extended	Ref
Category 1 ISR Latency	71	71	K
Category 2 ISR Entry Latency	132	131	A
Category 2 ISR Exit Latency	202	349	E
Normal Terminations	116	239	D
ChainTask	252	663	J
Pre-emption	193	340	C
Triggered by Alarm	309	446	F
Schedule	179	326	Q
ReleaseResource	178	325	M
SetEvent	N/A	686	S

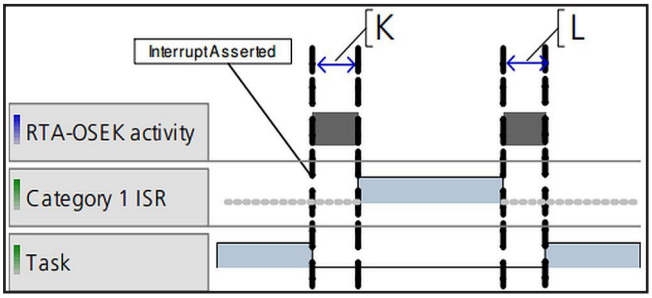


Figure 1 - Category 1 iSR with return to interrupted task

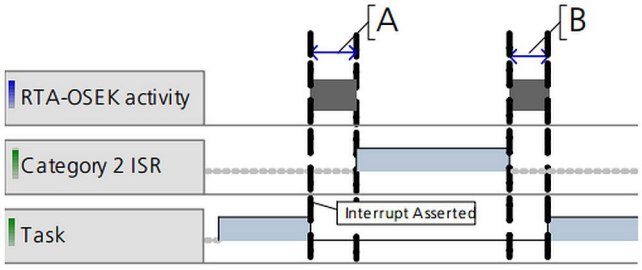


Figure 2 - Category 2 iSR with return to interrupted task

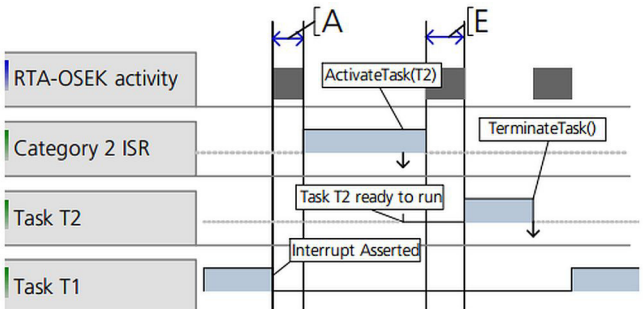


Figure 3 - Category 2 iSR activates a higher priority task

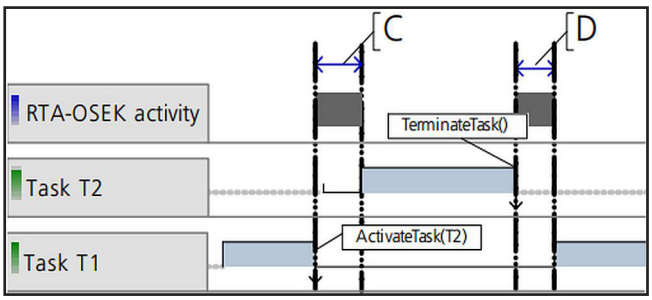


Figure 4 - Task activates a higher priority task

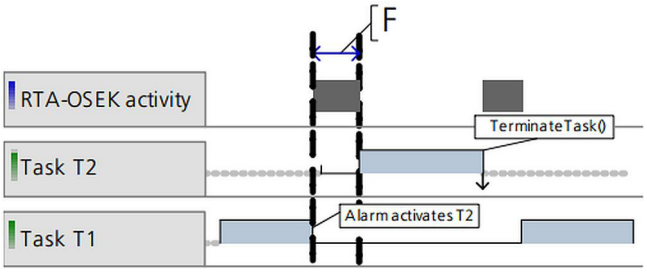


Figure 5 - Alarm activates task

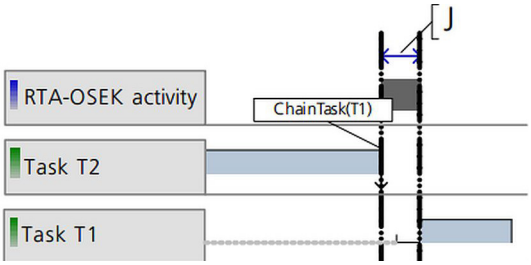


Figure 6 - Task chaining

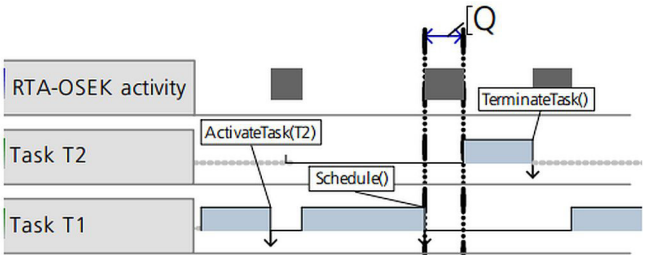


Figure 7 - Schedule() call

The execution time for every RTA-OSEK API call is available on request from ETAS.

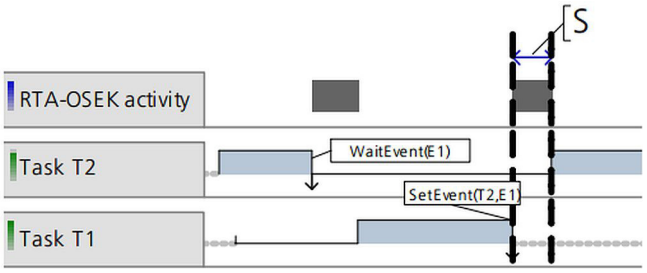


Figure 8 - Activation by SetEvent()

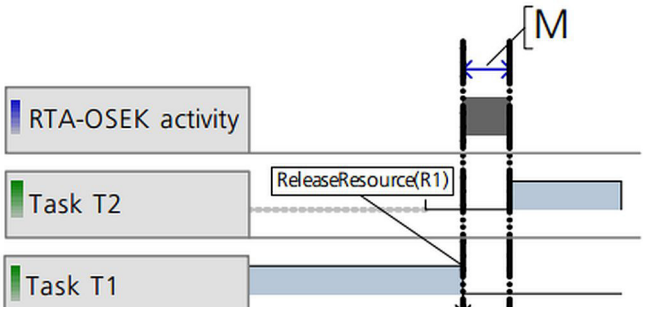


Figure 9 - ReleaseResource()

Order Information

To use RTA-OSEK it is necessary to purchase a development license for the tools together with an add-on license for the Freescale MPC55xx port. Node-locked and floating licenses are avaialble.

To use any operating system code from the RTA-OSEK libraries in ECU applications, a valid production license is required. Please contact your ETAS Sales Office for details of production licenses for RTA-OSEK.

RTA-OSEK Tools Order Information

Item	Characteristics	Object
F 00K 104 189	Node-locked license for RTA-OSEK Tools	LD_RTA-OSEK
F 00K 104 189	Floating license add-on for RTA-OSEK	LD_RTA-OSEK_FLOAT
F 00K 104 189	Product CD for RTA-OSEK Tools	LD_RTA-OSEK_PROD

RTA-OSEK Freescale MPC55xx Port Order Information

Item	Characteristics	Object
F 00K 105 762	Node-locked license for RTA-OSEK Freescale MPC55xx Port	LD_RTA-OSEK_P_5_MPC55XXGHS
F 00K 105 764	Product CD for RTA-OSEK Freescale MPC55xx Port	LD_RTA-OSEK_P_5_MPC55XXGHS_PROD

ETAS GmbH
70469 Stuttgart, Germany
Phone +49 711 89661-0
Fax +49 711 89661-106
sales.de@etas.com

ETAS S.A.S.
93404 Saint-Ouen Cedex
France
Phone +33 1 75 34 50-50
Fax +33 1 40 10 11-64
sales.fr@etas.com

ETAS Ltd.
Derby DE21 4SU
United Kingdom
Phone +44 1332 253770
Fax +44 1332 253779
sales.uk@etas.com

ETAS Inc.
Ann Arbor, MI 48103, USA
Phone +1 888 ETAS INC
Fax +1 734 997-9449
sales.us@etas.com

ETAS K.K.
Yokohama 220-6217, Japan
Phone +81 45 222-0900
Fax +81 45 222-0956
sales.jp@etas.com

ETAS Korea Co., Ltd.
Seoul 137-889, Korea
Phone +82 2 5747-016
Fax +82 2 5747-120
sales.kr@etas.com

ETAS (Shanghai) Co., Ltd.
Shanghai 200335, P.R. China
Phone +86 21 5037 2220
Fax +86 21 5037 2221
sales.cn@etas.com

ETAS Automotive India Pvt. Ltd.
Bangalore 560 068, India
Phone +91 80 4191 2585
Fax +91 80 4191 2586
sales.in@etas.com

www.etas.com

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