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05.12.2007	1.2.0	AUTOSAR Administration	• FlexRay, CAN and LIN State manager short name Camelcase adjusted • Complex Device Driver module ID set to 255 • ICC2 clustering updated • Release assignment column updated for R3.0 release • Autosar Service column updated for consistency
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28.04.2006	1.0.0	AUTOSAR Administration	Initial release

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1 Abbreviations used in this document

Item	Explanation
µC	Microcontroller
CHI	Communication Host Interface
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
HAL	Hardware Abstraction Layer
HIS	Hersteller-Initiative Software
LH	Lastenheft
Lld	Low Level Driver
MM	Message Manager
NM	Network Management
NV	Non Volatile
OS	Operating System
PLL	Phase Locked Loop
RB	Robert Bosch
TP	Transport Protocol

2 Cluster Variants

ICC 2 Cluster	Variant	CAN Driver (V2.0.0)	CAN Interface (V1.5.0)	CAN NM (V1.9.0)	CAN Transport Layer (V2.0.1)	CAN State Manager
CAN	VariantPC	VariantPC	Variant1	Variant1	Variant1	Variant1
CAN	VariantLT	VariantPC	Variant2	Variant2	Variant1	Variant1
CAN	VariantPB	VariantPB	Variant3	Variant3	Variant2	Variant2

ICC 2 Cluster	Variant	AUTOSAR COM (V2.0.19)	PDU Router (V2.0.1)
COM services	VariantPC	Variant1	Variant1
COM services	VariantLT	Variant2	
COM services	VariantPB	Variant3	

ICC 2 Cluster	Variant	Function Inhibition Manager (V1.0.5)	Diagnostic Communication Manager (V2.0.5)	Diagnostic Event Manager (V2.0.1)
Diagnostics	VariantPC	Variant1	VariantA	Variant1
Diagnostics	VariantLT	Variant1	VariantB	Variant1
Diagnostics	VariantPB	Variant2	VariantC	Variant2

ICC 2 Cluster	Variant	SPI Handler Driver (V2.0.9)	Port Driver (V2.0.4)	DIO Driver (V2.0.0)	PWM Driver (V2.0.0)	ICU Driver (V2.1.6)	ADC Driver (V2.0.0)	GPT Driver (V2.0.4)	MCU Driver (V2.0.5)	Internal / external Watchdog Driver (V2.0.3)	RAM Test (V1.0.3)	I/O Hardware Abstraction (V1.0.1)	Watchdog Interface (V2.0.2)	FlexRay Tranceiver Driver (V1.0.13)	CAN Tranceiver Driver (V1.0.4)	LIN Transceiver Driver	Internal / External EEPROM Driver (V2.1.5)	Internal / External Flash Driver (V1.1.0)	Flash Check	EEPROM Abstraction (V2.0.6)	CRC Routines (V2.0.0)	Flash EEPROM Emulation (V2.0.6)	Memory Abstraction Interface (V2.0.5)
ECU Firmware	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC			Variant1	Variant1	Variant1	VariantPC						
ECU Firmware	VariantLT	VariantLT	VariantPC	VariantLT	VariantPC	VariantPC	VariantPC	VariantPC	VariantPC	VariantLT	VariantLT			Variant2	Variant2	Variant1	VariantLT						
ECU Firmware	VariantPB	VariantPB	VariantPB	VariantLT	VariantPB	VariantPB	VariantPB	VariantPB	VariantPB	VariantPB	VariantLT			Variant3	Variant3	Variant1							

ICC 2 Cluster	Variant	FlexRay Driver (V1.0.31)	FlexRay Interface (V1.2.8)	FlexRay NM (V1.7.5)	FlexRay Transport Layer (V2.0.6)	FlexRay State Manager
FlexRay	VariantPC			Variant1		Variant1
FlexRay	VariantLT			Variant2		Variant2
FlexRay	VariantPB			Variant3		Variant3

ICC 2 Cluster	Variant	LIN Interface (V1.0.7)	LIN Driver (V1.0.10)	LIN NM	LIN State Manager
LIN	VariantPC	Variant1	Variant1		Variant1
LIN	VariantLT	Variant2	Variant1		Variant2
LIN	VariantPB	Variant3	Variant2		Variant3

ICC 2 Cluster	Variant	Communication Manager (V1.2)	ECU State Manager (V1.4.7)	Generic NM Interface (V.09)
ModeManagement	VariantPB	Variant1		

ICC 3 Module delivery	Variant	NVRAM Manager (V2.0.7)
Memory	VariantPC	Variant1
Memory	VariantLT	Variant1

ICC 3 Module delivery	Variant	Development Error Tracer (V2.0.1)
Debug	VariantPC	N/A
Debug	VariantLT	N/A
Debug	VariantPB	N/A

ICC 3 Module delivery	Variant	Operating System (V2.0.4)
OS	VariantPC	

ICC 3 Module delivery	Variant	BSW Scheduler
SchM	VariantPC	

ICC 3 Module delivery	Variant	Watchdog Manager
WdgM	VariantPC	

ICC 3 Module delivery	Variant	Ipdu Manager
IpduM	VariantPC	

ICC2 Cluster Variant	Description
VariantPC	Precompiletime parameters only
VariantLT	Mixture of Precompiletime and linktime parameters
VariantPB	Mixture of postbuildtime-, linktime- and precompiletime parameters

3 Cluster Overview

AUTOSAR name of function / cluster	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar release	Rationale	AUTOSAR SW Layer	Number of instances	OEM dependency	µC dependency	ECU dependency	Bus dependency	Reason for dependencies
CAN	C2Can	220	Optimised CAN network implementation	3.0	Optimisation of implementation	N/A	1	N/A	High	High	High	Contains Network stack BSW modules.
COM services	C2Com	221	Optimised COM and PDUR implementation	3.0	Optimisation of implementation	N/A	1	N/A	none	medium	medium	Heritage from PduR
Diagnostic	C2Diag	222	Optimised Diagnostic handling implementation	3.0	Optimisation of implementation	N/A	1	N/A	none	medium	none	Heritage from FIM, DCM and DEM
ECU Firmware	C2Fw	223	Optimised Firmware implementation	3.0	Optimisation of implementation	N/A	1	N/A	High	High	N/A	Heritage from SPAL, Watchdog driver, RAM test and I/O HW abstraction
FlexRay	C2Fr	224	Optimised FlexRay network implementation	3.0	Optimisation of implementation	N/A	1	N/A	High	High	High	Contains Network stack BSW modules.
LIN	C2Lin	225	Optimised LIN network implementation	3.0	Optimisation of implementation	N/A	1	N/A	High	none	High	Contains Network stack BSW modules.
ModeManagement	C2MMgt	226	Optimised Mode management implementation	3.0	Optimisation of implementation	N/A	1	N/A	none	High	none	Heritage from Com Manager etc.

AUTOSAR name of function / cluster	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar release	Rationale	AUTOSAR SW Layer	Number of instances	OEM dependency	µC dependency	ECU dependency	Bus dependency	Reason for dependencies
Remaining ICC2 "Clusters" are reflected by the individual ICC3 modules due to a "clustering" of 1 ICC3 module to 1 "ICC2												
Memory	NvM	20	ICC 3 module delivery	3.0	Optimisation of implementation	N/A	1	N/A	High	High	N/A	Heritage from Flash Driver etc.
Debug	Det	15	ICC 3 module delivery	3.0								
OS	OS	1	ICC 3 module delivery	3.0	Optimisation of implementation	N/A	1	N/A	medium	none	N/A	Heritage from OS.
Scheduler	SchM	130	ICC 3 module delivery	3.0	Optimisation of implementation	N/A	1	N/A	medium	none	N/A	Heritage from OS.
Watchdog Manager	WdgM	13	ICC 3 module delivery	3.0	Optimisation of implementation	N/A	1	N/A	medium	none	N/A	Heritage from Watchdof Manager
IPDUM	Idpum	52	ICC 3 module delivery	3.0	Optimisation of implementation	N/A	1	N/A	none	none	N/A	Heritage from IPDUM

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
CAN Driver	Can	80	The CAN Driver provides services for initiating transmissions and callback functions for notifying receive events, independently from the hardware.	3.0	Communication infrastructure is one of the most important aspects for the AUTOSAR RTE. CAN is the most important communication system.	Communication Drivers	1 (indexed) or several (code doubled) possible
FlexRay Driver	Fr	81	The FlexRay Driver is used to abstract the hardware related differences of different FlexRay Communication Controllers. All mandatory features according to the FlexRay Protocol Specification of the Communication Controllers are encapsulated and can only be accessed by a uniform interface. The API provides abstract functional operations that are mapped to a sequence of hardware accesses depending on the actual supported CC	3.0	Communication infrastructure is one of the most important aspects for the AUTOSAR RTE. Upcoming time triggered multi master communication system with high bandwidth.	Communication Drivers	1 (indexed) or several (code doubled) possible
LIN Interface	LinIf	62	LIN Master Communication Stack Communication services for LIN communication: - Schedule table handling - Transmission of LIN frames (confirmation with flag and function interface) - Reception of LIN frames (indication with flag and function interface) - Sleep and wakeup handling - Error handling of protocol errors - Timeout observation of LIN frames - Transport protocol for diagnostic For R2.0 this moduile also includes the LIN NM (not compatible with Autosar NM), LIN TP (with different prefix "LinTp") and LIN transceiver driver.	3.0	Communication infrastructure is one of the most important aspects for the AUTOSAR RTE. State of the art master slave system for low end applications.	Communication HW Abstraction	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
LIN Driver	Lin	82	Low level driver for performing LIN communication via the internal standard asynchronous serial communication interface of the µC (SCI/UART): - Initialization of the SCI hardware - API for generating an original "LIN synch break" On Chip LIN devices are not supported.	3.0	The separation of low level driver and LIN communication stack enhances portability of the LIN communication stack to other microcontrollers.	Communication Drivers	1 (indexed) or several (code doubled) possible
SPI Handler Driver	Spi	83	The SPI Handler/Driver provides services for reading from and writing to devices connected via SPI busses. It provides access to SPI communication to several users (e.g. EEPROM, Watchdog, I/O ASICs). It also provides the required mechanism to configure the onchip SPI peripheral.	3.0		Communication Drivers	1
Internal / External EEPROM Driver	Eep	90	The EEPROM driver provides services for reading, writing, erasing to/from an EEPROM. It also provides a service for comparing a data block in the EEPROM with a data block in the memory (e.g. RAM).	3.0		Memory Drivers	1..*
Internal / External Flash Driver	Fls	92	The flash driver provides services for reading, writing and erasing flash memory and a configuration interface for setting/resetting the write/erase protection if supported by the underlying hardware.	3.0		Memory Drivers	1..*

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
Port Driver	Port	124	This module shall provide the service for initializing the whole PORT structure of the microcontroller.	3.0		I/O Drivers	1
DIO Driver	Dio	120	The DIO Driver provides services for reading and writing to/from • DIO Channels (Pins) • DIO Ports • DIO Channel Groups	3.0		I/O Drivers	1..*
PWM Driver	Pwm	121	The driver provides services for initialization and control of the microcontroller internal PWM stage (pulse width modulation).	3.0		I/O Drivers	1..*

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
ICU Driver	Icu	122	The ICU driver (Release 1) provides services for signal edge and level notification. Furthermore it provides services to control Wake-up interrupts. The ICU driver (Release 2) provides services for periodic signal time measurement, services for Edge timestamping, usable for the acquisition of non-periodic signals and services for Edge counting with or without hardware gating.	3.0		I/O Drivers	1..*
ADC Driver	Adc	123	Driver for initialization and control of the µC internal ADC (analog to digital converter) There are two variants planned: 1. Basic ADC Driver with basic functionality for body applications 2. Enhanced ADC Driver with additional enhanced functionality for PowerTrain applications (e.g. streaming)	3.0		I/O Drivers	1..*
GPT Driver	Gpt	100	Driver for internal general purpose timer Provision of periodic timer interrupts for use in timer services Two modes are provided: - resolution mode (module tries to perform the desired number of alls) - period mode (module tries to maintain the specified period time)	3.0		Microcontroller Drivers	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
MCU Driver	Mcu	101	Driver Responsible to provide the following services: - SW initiated µC reset - selection of µC power mode (STOP, SLEEP, HALT, …) - configuration of Wake-up - Handling of the internal PLL clock unit (Initialization and frequency setting, mode selection, detection of clock disturbance, crystal loss, ...)	3.0		Microcontroller Drivers	1
Internal / external Watchdog Driver	Wdg	102	Mode selection and triggering of µC internal watchdog Contraints: Trigger routine is called by watchdog manager	3.0		Microcontroller Drivers	
RAM Test	RamTst	93	Functional test of µC internal RAM cells - complete test during start-up/shutdown cycle - complete test, triggered by diagnostic command - cyclic test during normal operation mode (block by block or cell by cell)	3.0		Memory Drivers	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
I/O Hardware Abstraction	no prefix (AUTOSAR interface)	254	Abstraction of signal path of the ECU hardware (Layout, µC Pins, µC external devices like I/O ASIC) - Provides signal based interface - static normalization/inversion of values according to their physical representation at the inputs/outputs of the ECU hardware (compensation of static influences caused withing the path between ECU I/O and µC pin, e.g. voltage divider, hardware inversion) Important note: no filtering, debouncing, range checking etc.	3.0	Contributes to the AUTOSAR goal of hardware independency.	I/O HW Abstraction	1
Watchdog Interface	WdgIf	43	The Watchdog Interface provides equal mechanisms to access µC internal and external Watchdog devices. It abstracts from the location of peripheral Watchdog devices (internal or external) and the number of Watchdog devices.	3.0		Onboard Device Abstraction	1
EEPROM Abstraction	Ea	40	The EEPROM Interface provides equal mechanisms to access µC internal and external EEPROM devices. It abstracts from the location of peripheral EEPROM devices (internal or external), the ECU hardware layout and the number of EEPROM devices.	3.0		Memory HW Abstraction	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
CAN Interface	CanIf	60	The CAN Hardware Interface provides equal mechanisms to access a CAN bus channel regardless of it‘s location (µC internal/external). It abstracts from the location of CAN controllers (onchip/onboard), the ECU hardware layout and the number of CAN drivers.	3.0	Contributes to the AUTOSAR goal of hardware independency.	Communication HW Abstraction	1
FlexRay Interface	FrIf	61	The FlexRay Interface provides equal mechanisms to access a FlexRay bus channel regardless of it‘s location (µC internal/external). It abstracts from the location of CAN controllers (onchip/onboard), the ECU hardware layout and the number of CAN drivers.	3.0	Contributes to the AUTOSAR goal of hardware independency.	Communication HW Abstraction	1
CRC Routines	Crc	201	calculation of CRC16, CRC32 etc. Optimized for size (runtime calculation) or speed (table based)	3.0		System Services - Std Lib	1
Operating System	Os	1	OSEK operating system plus extensions: - memory protection - Deadline monitoring - schedule tables - enhanced counter structure	3.0		System Services - OS	1
Communication Manager	ComM	12	Controlls the states of all communication channels attached to the ECU	3.0		System Services	1 (but one state machine for each channel)

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
ECU State Manager	EcuM	10	ECU power and mode Management - e.g. Start-up, Pre-Start, Normal Operation, Limp Home, Pre-Sleep, Shut down - control of network management - control of watchdog manager - control of NVRAM manager - control of power relevant modules (e.g. bus tranceiver drivers) - ... Management of (maybe parallel) ECU states - Global States - Local States (Implementation by User) Activation of software parts dependent on active state(s)	3.0	Different independend applications on one ECU need synchronised mechanisms for mode switches (e.g. ECU shut down). Requirement of WP10.1	System Services	1
Development Error Tracer	Det	15	Supports software debugging. Provides interface for reporting development errors: Dbg_ReportError(Module-ID, API-ID, Error-ID) Behind this API errors can be traced, logged, counted etc.	3.0	Eases finding errors during first SW integration phase.	System Services	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
Function Inhibition Manager	FiM	11	Control of functionality - control (enable/disable) functionalities of SW components based on the following inhibit conditions: - faults - signal qualities - ECU and vehicle states - diagnostic tester commands - EOL configuration (function enabling/disabling in EEPROM) - only in special cases for binary informations that are similar to reaction to faults: driver demands (e.g. ESP on/off) The Function Inhibition Manager shall use the information of dependencies provided by the software components .	3.0	A centralized function inhibit management helps separation between user behaviour and fault reaction. An inhibition matrix forces the configurator to specify the reaction of every function to every fault.	System Services	1
CAN NM	CanNm	31	Network management for CAN in interrupt mode CAN specific synchronisation and monitoring algorithms - synchronised transition to bus sleep - determination of network configuration at start-up - monitoring of network configuration during operation - error recovery after bus-off - provision of network status information - bus diagnostics - one instance per network system required	3.0	Highly important for ECU power management.	Communication Services	1 per connected CAN cluster

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
FlexRay NM	FrNm	32	Network management for FlexRay - synchronised transition to bus sleep - determination of network configuration at start-up - monitoring of network configuration during operation - error recovery after bus-off - provision of network status information - bus diagnostics - one instance per network system required	3.0	Highly important for ECU power management.	Communication Services	1 per connected FlexRay cluster
AUTOSAR COM	Com	50	Management of internal and external messages - Provision of signal oriented data interface for the application - Communication control (start/stop) - Sending of messages according to Transmission type (cyclic, event triggered) - Checking of minimum distances between transmit messages - Monitoring of receive messages (message timeout) - Provision of FirstValue and Changed Flags - Filter mechanisms for incoming and outgoing messages - Byte ordering - Different notification mechanisms	3.0	Provides communication mechanisms for AUTOSAR RTE.	Communication Services	1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
PDU Router	PduR	51	Functionality 1: Deploys IPDUs of OSEK COM to different communication systems. The IPDU identifier decides on the network system type (e.g. CAN, LIN) and if a transport layer has to be used or not. The PDU Router abstracts from different underlying communication layers. Functionality 2: Frame based gateway. Simple routing of complete PDUs between equal (e.g. CAN - CAN) or different (e.g. CAN - LIN) vehicle network systems. - mapping of event triggered and cyclic frames - queueing of frames - sending of default values This functionality is optional if there is no gateway required on an ECU (e.g. ECU is connected only to 1 CAN bus)	3.0	Use OSEK COM on an ECU with more than one communication system. Use OSEK COM with transport layer	Communication Services	1
CAN Tranceiver Driver	CanTrcv	70	Driver for external CAN transceiver - Control of wake-Up/sleep - Network diagnostic (short circuit, open line, ...) - ...	3.0	Implementation cannot be standardized, only basic interface	Communication HW Abstraction	1 per connected CAN cluster
FlexRay Tranceiver Driver	FrTrcv	71	Driver for external FlexRay transceiver - Control of wake-Up/sleep - Network diagnostic (short circuit, open line, ...) - ...	3.0	Implementation cannot be standardized, only basic interface	Communication HW Abstraction	1 per connected FlexRay cluster

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
CAN Transport Layer	CanTp	35	Transport protocol on CAN according to ISO 15765-2 TPL - segmentation of data in transmit direction - collection of data in receive direction	3.0	Communication infrastructure is one of the most important aspects for the AUTOSAR RTE.	Communication Services	1 per connected CAN cluster
FlexRay Transport Layer	FrTp	36	Transport protocol on FlexRay using the dynamic part of the communication round - segmentation of data in transmit direction - collection of data in receive direction	3.0	Communication infrastructure is one of the most important aspects for the AUTOSAR RTE.	Communication Services	1 per connected FlexRay cluster
Diagnostic Communication Manager	Dcm	53	Diagnostic communication according to UDP - ISO14229 - functional interface for diagnostic services - handling of specific diagnostic requests (enable/disable normal message transmission, tester present)	3.0	Many ISO14229 services have to be handled by AUTOSAR software components.	Communication Services	1
Diagnostic Event Manager	Dem	54	Management of error data - Structuring of error data which shall be saved to the NVRAM - Non volatile setting, counting, resetting and reading of	3.0	Nearly every AUTOSAR software component needs the possibility to report errors to be written to the error memory.	Communication Services	1
Flash EEPROM Emulation	Fee	21	Emulates EEPROM functionality using the flash memory	3.0		Memory Services	1
NVRAM Manager	NvM	20	Management of non volatile data - immediate/queued/delayed writing - data shadowing in RAM - data encryption in NVRAM	3.0	Nearly every AUTOSAR software component needs non volatile data to be managed. For relocatability a	Memory Services	1
BSW Scheduler Module	SchM	130	Provide scheduling of all BSW modules, e.g. assigns priority and memory protection to each BSW module used in an ECU.	3.0		System Services	1
Memory Abstraction Interface	MemIf	22	Abstracts the memory interface for different memory devices.	3.0		Memory Services	1
Watchdog Manager	WdgM	13	Supervision of application functions - checking aliveness of applications (e.g. collecting flags,	3.0		System Services	1
IPDU Multiplexer	IpduM	52	Handles multiplexing of PDU's	3.0			1

4 Module Overview

AUTOSAR name of function / module	Module short name (API service prefix)	Module ID (uint8)	Functional description	Current Autosar Release	Rationale	AUTOSAR SW Layer	Number of instances
CAN State Manager	CanSM	140	Mastering states for the CAN bus	3.0			1..*
LIN State Manager	LinSM	141	Mastering states for the LIN bus	3.0			1..*
FlexRay State Manager	FrSM	142	Mastering states for the FlexRay bus	3.0			1..*
Complex Drivers	no prefix (AUTOSAR interface)	255	A high number of different drivers for complex sensor evaluation and actuator control with direct access to the µC using specific interrupts and/or complex µC peripherals (like PCP, TPU), e.g.	3.0			1..*
Generic NM Inter	Nm	29	Network management - provides common, network independent API - synchronisation of network, cluster wide, shut down of communication system.	3.0			1