

# Integration Manual

for S32 PLATFORM Driver

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## Chapter 1

### Revision History

Revision	Date	Author	Description
1.0	21.12.2021	NXP RTD Team	Prepared for release S32 RTD AUTOSAR 4.4 Version 3.0.0 Release

## Chapter 2

### Introduction

- [Supported Derivatives](#)
- [Overview](#)
- [About This Manual](#)
- [Acronyms and Definitions](#)
- [Reference List](#)

This integration manual describes the integration requirements for PLATFORM Driver for S32XX microcontrollers.

### 2.1 Supported Derivatives

The software described in this document is intended to be used with the following microcontroller devices of NXP Semiconductors:

- s32g274a\_bga525
- s32g254a\_bga525
- s32g233a\_bga525
- s32g234m\_bga525
- s32g378a\_bga525
- s32g379a\_bga525
- s32g398a\_bga525
- s32g399a\_bga525
- s32g338m\_bga525
- s32g339m\_bga525
- s32g358a\_bga525
- s32g359a\_bga525
- s32r45\_bga780

All of the above microcontroller devices are collectively named as S32.

## 2.2 Overview

**AUTOSAR (AUTomotive Open System ARchitecture)** is an industry partnership working to establish standards for software interfaces and software modules for automobile electronic control systems.

AUTOSAR:

- paves the way for innovative electronic systems that further improve performance, safety and environmental friendliness.
- is a strong global partnership that creates one common standard: "Cooperate on standards, compete on implementation".
- is a key enabling technology to manage the growing electrics/electronics complexity. It aims to be prepared for the upcoming technologies and to improve cost-efficiency without making any compromise with respect to quality.
- facilitates the exchange and update of software and hardware over the service life of the vehicle.

## 2.3 About This Manual

This Technical Reference employs the following typographical conventions:

- **Boldface** style: Used for important terms, notes and warnings.
- *Italic* style: Used for code snippets in the text. Note that C language modifiers such "const" or "volatile" are sometimes omitted to improve readability of the presented code.

Notes and warnings are shown as below:

Note

This is a note.

Warning

This is a warning

## 2.4 Acronyms and Definitions

Term	Definition
API	Application Programming Interface
ASM	Assembler
BSMI	Basic Software Make file Interface
CAN	Controller Area Network
C/CPP	C and C++ Source Code
CS	Chip Select
CTU	Cross Trigger Unit
DEM	Diagnostic Event Manager
DET	Development Error Tracer
DMA	Direct Memory Access
ECU	Electronic Control Unit
FIFO	First In First Out
LSB	Least Significant Bit
MCU	Micro Controller Unit
MIDE	Multi Integrated Development Environment
MSB	Most Significant Bit
N/A	Not Applicable
RAM	Random Access Memory
SIU	Systems Integration Unit
SWS	Software Specification
VLE	Variable Length Encoding
XML	Extensible Markup Language

## 2.5 Reference List

#	Title	Version
1	S32G2 Reference Manual	Rev. 4, October, 2021
2	S32G3 Reference Manual	Rev. 1, 11/2021
3	S32R45 Reference Manual	Rev. 3 Draft D, 07/2021
4	S32G2: Mask Set Errata for Mask 0P77B	Rev. 2.0
5	S32G3: Mask Set Errata for Mask 0P23E	Rev. 0
6	S32R45: Mask Set Errata for Mask P57D	Rev. 1.1
7	S32G2 Data Sheet	Rev. 4 — 11/2021
8	S32G3 Data Sheet	Rev. 1 — 11/2021
9	VR5510 Data Sheet	Rev. 4 — 6 October 2021
10	S32R45 Data Sheet	Rev. 2 DraftC — 10/2021

## Chapter 3

### Building the driver

- [Build Options](#)
- [Files required for compilation](#)
- [Setting up the plugins](#)

This section describes the source files and various compilers, linker options used for building the driver. It also explains the EB Tresos Studio plugin setup procedure.

#### 3.1 Build Options

- [GCC Compiler/Assembler/Linker Options](#)
- [GHS Compiler/Assembler/Linker Options](#)
- [DIAB Compiler/Assembler/Linker Options](#)

The RTD driver files are compiled using:

- NXP GCC 9.2.0 20190812 (Build 1649 Revision gaf57174)
- Green Hills Multi 7.1.6d / Compiler 2020.1.4
- Wind River Diab Compiler 7.0.3

The compiler, assembler, and linker flags used for building the driver are explained below.

The TS\_T40D11M30I0R0 part of the plugin name is composed as follows:

- T = Target\_Id (e.g. T40 identifies Cortex-M architecture)
- D = Derivative\_Id (e.g. D11 identifies S32 platform)
- M = SW\_Version\_Major and SW\_Version\_Minor
- I = SW\_Version\_Patch
- R = Reserved

##### 3.1.1 GCC Compiler/Assembler/Linker Options

###### 3.1.1.1 GCC Compiler Options



Compiler Option	Description
-mcpu=cortex-m7	Targeted ARM processor for which GCC should tune the performance of the code
-mthumb	Generates code that executes in Thumb state
-mlittle-endian	Generate code for a processor running in little-endian mode
-mfpv=fpv5-sp-d16	Specifies the floating-point hardware available on the target
-mfloat-abi=hard	Specifies the floating-point ABI to use. "hard" allows generation of floating-point instructions and uses FPU-specific calling conventions
-std=c99	Specifies the ISO C99 base standard
-Os	Optimize for size. Enables all -O2 optimizations except those that often increase code size
-ggdb3	Produce debugging information for use by GDB using the most expressive format available, including GDB extensions if at all possible. Level 3 includes extra information, such as all the macro definitions present in the program
-Wall	Enables all the warnings about constructions that some users consider questionable, and that are easy to avoid (or modify to prevent the warning), even in conjunction with macros
-Wextra	This enables some extra warning flags that are not enabled by -Wall
-pedantic	Issue all the warnings demanded by strict ISO C. Reject all programs that use forbidden extensions. Follows the version of the ISO C standard specified by the aforementioned -std option
-Wstrict-prototypes	Warn if a function is declared or defined without specifying the argument types
-Wundef	Warn if an undefined identifier is evaluated in an #if directive. Such identifiers are replaced with zero
-Wunused	Warn whenever a function, variable, label, value, macro is unused
-Werror=implicit-function-declaration	Make the specified warning into an error. This option throws an error when a function is used before being declared
-Wsign-compare	Warn when a comparison between signed and unsigned values could produce an incorrect result when the signed value is converted to unsigned.
-Wdouble-promotion	Give a warning when a value of type float is implicitly promoted to double
-fno-short-enums	Specifies that the size of an enumeration type is at least 32 bits regardless of the size of the enumerator values.
-funsigned-char	Let the type char be unsigned by default, when the declaration does not use either signed or unsigned
-funsigned-bitfields	Let a bit-field be unsigned by default, when the declaration does not use either signed or unsigned
-fomit-frame-pointer	Omit the frame pointer in functions that don't need one. This avoids the instructions to save, set up and restore the frame pointer; on many targets it also makes an extra register available.

Compiler Option	Description
-fno-common	Makes the compiler place uninitialized global variables in the BSS section of the object file. This inhibits the merging of tentative definitions by the linker so you get a multiple-definition error if the same variable is accidentally defined in more than one compilation unit
-fstack-usage	Makes the compiler output stack usage information for the program, on a per-function basis
-fdump-ipa-all	Enables all inter-procedural analysis dumps
-c	Stop after assembly and produce an object file for each source file
-DS32XX	Predefine S32XX as a macro, with definition 1
-DS32G2XX	Predefine S32G2XX as a macro, with definition 1
-DGCC	Predefine GCC as a macro, with definition 1
-DUSE_SW_VECTOR_MODE	Predefine USE_SW_VECTOR_MODE as a macro, with definition 1. By default, the drivers are compiled to handle interrupts in Software Vector Mode
-DD_CACHE_ENABLE	Predefine D_CACHE_ENABLE as a macro, with definition 1. Enables data cache initialization in source file system.c under the Platform driver
-DI_CACHE_ENABLE	Predefine I_CACHE_ENABLE as a macro, with definition 1. Enables instruction cache initialization in source file system.c under the Platform driver
-DENABLE_FPU	Predefine ENABLE_FPU as a macro, with definition 1. Enables FPU initialization in source file system.c under the Platform driver
-DMCAL_ENABLE_USER_MODE_SUPPORT	Predefine MCAL_ENABLE_USER_MODE_SUPPORT as a macro, with definition 1. Allows drivers to be configured in user mode.

### 3.1.1.2 GCC Assembler Options

Assembler Option	Description
-X assembler-with-cpp	Specifies the language for the following input files (rather than letting the compiler choose a default based on the file name suffix)
-mcpu=cortexm7	Targeted ARM processor for which GCC should tune the performance of the code
-mthumb	Generates code that executes in Thumb state
-c	Stop after assembly and produce an object file for each source file

### 3.1.1.3 GCC Linker Options

Linker Option	Description
-Wl,-Map,filename	Produces a map file
-T linkerfile	Use linkerfile as the linker script. This script replaces the default linker script (rather than adding to it)
-entry=Reset_Handler	Specifies that the program entry point is Reset_Handler

Linker Option	Description
-nostartfiles	Do not use the standard system startup files when linking
-mcpu=cortexm7	Targeted ARM processor for which GCC should tune the performance of the code
-mthumb	Generates code that executes in Thumb state
-mfpv=fpv5-sp-d16	Specifies the floating-point hardware available on the target
-mfloat-abi=hard	Specifies the floating-point ABI to use. "hard" allows generation of floating-point instructions and uses FPU-specific calling conventions
-mlittle-endian	Generate code for a processor running in little-endian mode
-ggdb3	Produce debugging information for use by GDB using the most expressive format available, including GDB extensions if at all possible. Level 3 includes extra information, such as all the macro definitions present in the program
-lc	Link with the C library
-lm	Link with the Math library
-lgcc	Link with the GCC library

### 3.1.2 GHS Compiler/Assembler/Linker Options

#### 3.1.2.1 GHS Compiler Options

Compiler Option	Description
-cpu=cortexm7	Selects target processor: Arm Cortex M7
-thumb	Selects generating code that executes in Thumb state
-fpu=vfpv5_d16	Specifies hardware floating-point using the v5 version of the VFP instruction set, with 16 double-precision floating-point registers
-fsingle	Use hardware single-precision, software double-precision FP instructions
-C99	Use (strict ISO) C99 standard (without extensions)
-ghstd=last	Use the most recent version of Green Hills Standard mode (which enables warnings and errors that enforce a stricter coding standard than regular C and C++)
-Osize	Optimize for size
-gnu_asm	Enables GNU extended asm syntax support
-dual_debug	Generate DWARF 2.0 debug information
-G	Generate debug information
-keeptempfiles	Prevents the deletion of temporary files after they are used. If an assembly language file is created by the compiler, this option will place it in the current directory instead of the temporary directory
-Wimplicit-int	Produce warnings if functions are assumed to return int
-Wshadow	Produce warnings if variables are shadowed
-Wtrigraphs	Produce warnings if trigraphs are detected
-Wundef	Produce a warning if undefined identifiers are used in #if preprocessor statements
-unsigned_chars	Let the type char be unsigned, like unsigned char

Compiler Option	Description
-unsigned_fields	Bitfields declared with an integer type are unsigned
-no_commons	Allocates uninitialized global variables to a section and initializes them to zero at program startup
-no_exceptions	Disables C++ support for exception handling
-no_slash_comment	C++ style // comments are not accepted and generate errors
-prototype_errors	Controls the treatment of functions referenced or called when no prototype has been provided
-incorrect_pragma_warnings	Controls the treatment of valid #pragma directives that use the wrong syntax
-c	Stop after assembly and produce an object file for each source file
-DS32XX	Predefine S32XX as a macro, with definition 1
-DS32G2XX	Predefine S32G2XX as a macro, with definition 1
-DGHS	Predefine GHS as a macro, with definition 1
-DUSE_SW_VECTOR_MODE	Predefine USE_SW_VECTOR_MODE as a macro, with definition 1. By default, the drivers are compiled to handle interrupts in Software Vector Mode
-DD_CACHE_ENABLE	Predefine D_CACHE_ENABLE as a macro, with definition 1. Enables data cache initialization in source file system.c under the Platform driver
-DI_CACHE_ENABLE	Predefine I_CACHE_ENABLE as a macro, with definition 1. Enables instruction cache initialization in source file system.c under the Platform driver
-DENABLE_FPU	Predefine ENABLE_FPU as a macro, with definition 1. Enables FPU initialization in source file system.c under the Platform driver
-DMCAL_ENABLE_USER_MODE_SUPPORT	Predefine MCAL_ENABLE_USER_MODE_SUPPORT as a macro, with definition 1. Allows drivers to be configured in user mode

### 3.1.2.2 GHS Assembler Options

Assembler Option	Description
-cpu=cortexm7	Selects target processor: Arm Cortex M7
-preprocess_assembly_files	Controls whether assembly files with standard extensions such as .s and .asm are preprocessed
-list	Creates a listing by using the name and directory of the object file with the .lst extension
-c	Stop after assembly and produce an object file for each source file

### 3.1.2.3 GHS Linker Options

Linker Option	Description
-e Reset_Handler	Make the symbol Reset_Handler be treated as a root symbol and the start label of the application

Linker Option	Description
-T linker_script_file.ld	Use linker_script_file.ld as the linker script. This script replaces the default linker script (rather than adding to it)
-map	Produce a map file
-keepmap	Controls the retention of the map file in the event of a link error
-Mn	Generates a listing of symbols sorted alphabetically/numerically by address
-delete	Instructs the linker to remove functions that are not referenced in the final executable. The linker iterates to find functions that do not have relocations pointing to them and eliminates them
-ignore_debug_references	Ignores relocations from DWARF debug sections when using -delete. DWARF debug information will contain references to deleted functions that may break some third-party debuggers
-Llibrary_path	Points to library_path (the libraries location) for thumb2 to be used for linking
-larch	Link architecture specific library
-lstartup	Link run-time environment startup routines. The source code for the modules in this library is provided in the src/libstartup directory
-lind_sd	Link language-independent library, containing support routines for features such as software floating point, run-time error checking, C99 complex numbers, and some general purpose routines of the ANSI C library
-v	Prints verbose information about the activities of the linker, including the libraries it searches to resolve undefined symbols
-nostartfiles	Controls the start files to be linked into the executable

### 3.1.3 DIAB Compiler/Assembler/Linker Options

#### 3.1.3.1 DIAB Compiler Options

Compiler Option	Description
-tARMCORTEXM7MG:simple	Selects target processor (hardware single-precision, software double-precision floating-point)
-mthumb	Selects generating code that executes in Thumb state
-std=c99	Follows the C99 standard for C
-Oz	Like -O2 with further optimizations to reduce code size
-g	Generates DWARF 4.0 debug information
-fstandalone-debug	Emits full debug info for all types used by the program
-Wstrict-prototypes	Warn if a function is declared or defined without specifying the argument types
-Wsign-compare	Produce warnings when comparing signed type with unsigned type
-Wdouble-promotion	Give a warning when a value of type float is implicitly promoted to double
-Wunknown-pragmas	Issues a warning for unknown pragmas
-Wundef	Warns if an undefined identifier is evaluated in an #if directive. Such identifiers are replaced with zero
-Wextra	Enables some extra warning flags that are not enabled by '-Wall'

Compiler Option	Description
-Wall	Enables all of the most useful warnings (for historical reasons this option does not literally enable all warnings)
-pedantic	Emits a warning whenever the standard specified by the -std option requires a diagnostic
-Werror=implicit-function-declaration	Generates an error whenever a function is used before being declared
-fno-common	Compile common globals like normal definitions
-fno-signed-char	Char is unsigned
-fno-trigraphs	Do not process trigraph sequences
-V	Displays the current version number of the tool suite
-c	Stop after assembly and produce an object file for each source file
-DS32XX	Predefine S32XX as a macro, with definition 1
-DS32G2XX	Predefine S32G2XX as a macro, with definition 1
-DDIAB	Predefine DIAB as a macro, with definition 1
-DUSE_SW_VECTOR_MODE	Predefine USE_SW_VECTOR_MODE as a macro, with definition 1. By default, the drivers are compiled to handle interrupts in Software Vector Mode
-DD_CACHE_ENABLE	Predefine D_CACHE_ENABLE as a macro, with definition 1. Enables data cache initialization in source file system.c under the Platform driver
-DI_CACHE_ENABLE	Predefine I_CACHE_ENABLE as a macro, with definition 1. Enables instruction cache initialization in source file system.c under the Platform driver
-DENABLE_FPU	Predefine ENABLE_FPU as a macro, with definition 1. Enables FPU initialization in source file system.c under the Platform driver
-DMCAL_ENABLE_USER_MODE_SUPPORT	Predefine MCAL_ENABLE_USER_MODE_SUPPORT as a macro, with definition 1. Allows drivers to be configured in user mode

### 3.1.3.2 DIAB Assembler Options

Assembler Option	Description
-mthumb	Selects generating code that executes in Thumb state
-Xpreprocess-assembly	Invokes C preprocessor on assembly files before running the assembler
-Xassembly-listing	Produces an .lst assembly listing file
-c	Stop after assembly and produce an object file for each source file

### 3.1.3.3 DIAB Linker Options

Linker Option	Description
-e Reset_Handler	Make the symbol Reset_Handler be treated as a root symbol and the start label of the application

Linker Option	Description
linker_script_file.dld	Use linker_script_file.dld as the linker script. This script replaces the default linker script (rather than adding to it)
-m30	m2 + m4 + m8 + m16
-Xstack-usage	Gathers and display stack usage at link time
-Xpreprocess-lecl	Perform pre-processing on linker scripts
-Llibrary_path	Points to the libraries location for ARMV7EMMG to be used for linking
-lc	Links with the standard C library
-lm	Links with the math library

## 3.2 Files required for compilation

This section describes the include files required to compile, assemble (if assembler code) and link the PLATFORM driver for NXP S32G274 microcontrollers. To avoid integration of incompatible files, all the include files from other modules shall have the same AR\_MAJOR\_VERSION and AR\_MINOR\_VERSION, i.e. only files with the same AUTOSAR major and minor versions can be compiled.

### PLATFORM files

- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0\src\IntCtrl\_Ip.c
- ..\Platform\_TS\_T40D11M30I0R0\src\Platform.c
- ..\Platform\_TS\_T40D11M30I0R0\src\Platform\_Ipw.c

**PLATFORM** generated files (these files should be generated by the user using a configuration tool):

- IntCtrl\_Ip\_Cfg.h
- IntCtrl\_Ip\_CfgDefines.h
- Platform\_Cfg.h
- Platform\_CfgDefines.h
- Platform\_Ipw\_Cfg.h
- System\_Ip\_Cfg.h

## Building the driver

- System\_Ip\_CfgDefines.h
- IntCtrl\_Ip\_Cfg.c
- Platform\_Cfg.c
- Platform\_Ipw\_Cfg.c

**Files** from Base common folder:

- Base\_TS\_T40D11M30I0R0\include\BasicTypes.h
  - Base\_TS\_T40D11M30I0R0\include\Compiler.h
  - Base\_TS\_T40D11M30I0R0\include\CompilerDefinition.h
  - Base\_TS\_T40D11M30I0R0\include\Compiler\_Cfg.h
  - Base\_TS\_T40D11M30I0R0\include\Devassert.h
  - Base\_TS\_T40D11M30I0R0\include\PlatformTypes.h
  - Base\_TS\_T40D11M30I0R0\include\Platform\_MemMap.h
  - Base\_TS\_T40D11M30I0R0\include\StandardTypes.h
  - Base\_TS\_T40D11M30I0R0\generate\_PC\include\Mcal.h
  - Base\_TS\_T40D11M30I0R0\header\S32G274A\_MSCM.h
  - Base\_TS\_T40D11M30I0R0\header\S32G274A\_NVIC.h
  - Base\_TS\_T40D11M30I0R0\header\S32G274A\_MCM.h
  - Base\_TS\_T40D11M30I0R0\header\S32G399A\_MSCM.h
  - Base\_TS\_T40D11M30I0R0\header\S32G399A\_NVIC.h
  - Base\_TS\_T40D11M30I0R0\header\S32G399A\_MCM.h
  - ..\DetTS\_T40D11M30I0R0.h
- Files** from Det folder:

## 3.3 Setting up the plugins

The PLATFORM driver was designed to be configured by using the EB Tresos Studio (version EB tresos Studio 27.1.0 or later).



### 3.3.1 Location of various files inside the PLATFORM module folder VSMD (Vendor Specific Module Definition) file in EB tresos Studio XDM format:

- ..\Platform\_TS\_T40D11M30I0R0\config\Platform.xdm
- ..\Base\_TS\_T40D11M30I0R0\config\Base.xdm
- ..\ResourceTS\_T40D11M30I0R0\config\Resource.xdm VSMD (Vendor Specific Module Definition) file(s) in AUTOSAR compliant EPD format:
- ..\Platform\_TS\_T40D11M30I0R0\autosar\Platform.epd
- ..\Base\_TS\_T40D11M30I0R0\autosar\Base.epd
- ..\ResourceTS\_T40D11M30I0R0\autosar\Resource.epd Code Generation Templates for Pre-Compile time configuration parameters:
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0.h
- ..\Platform\_TS\_T40D11M30I0R0\src\IntCtrl\_Ip\_Cfg.c
- ..\Platform\_TS\_T40D11M30I0R0\src\Platform\_Cfg.c
- ..\Platform\_TS\_T40D11M30I0R0\src\Platform\_Ipw\_Cfg.c

### 3.3.2 Dependencies

- RESOURCE is required to select processor derivative. Current PLATFORM driver has support for the following derivatives, each one having attached a Resource file: s32g274a\_bga525, s32g254a\_bga525, s32g233a\_bga525, s32g234m\_bga525, s32r45\_bga780, s32g399a\_bga525, s32g378a\_bga525, s32g379a\_bga525, s32g398a\_bga525, s32g338m\_bga525, s32g339m\_bga525, s32g358a\_bga525, s32g359a\_bga525.
- DET is required for signaling the development error detection (parameters out of range, null pointers, etc).
- BASE is required for platform specific header files and other header definitions.

## Chapter 4

### Function calls to module

- [Function Calls during Start-up](#)
- [Function Calls during Shutdown](#)
- [Function Calls during Wake-up](#)

#### 4.1 Function Calls during Start-up

The API to be called for this is *Platform\_Init()*. The MCU module should be initialized before Platform, enabling clock gates for all the IPs accessed by Platform CDD. All modules which require settings configured by Platform (e.g. interrupts) should be initialized after MCL. The Platform CDD can be re-initialized without any specific sequence (no deinit function).

#### 4.2 Function Calls during Shutdown

None.

#### 4.3 Function Calls during Wake-up

None.

## Chapter 5

### Module requirements

- Exclusive areas to be defined in BSW scheduler
- Peripheral Hardware Requirements
- ISR to configure within AutosarOS - dependencies
- ISR Macro
- Other AUTOSAR modules - dependencies
- Data Cache Restrictions
- User Mode support
- Multicore support

#### 5.1 Exclusive areas to be defined in BSW scheduler

Platform driver does not contain any exclusive areas.

#### 5.2 Peripheral Hardware Requirements

None.

#### 5.3 ISR to configure within AutosarOS - dependencies

N/A.

#### 5.4 ISR Macro

RTD drivers use the ISR macro to define the functions that will process hardware interrupts. Depending on whether the OS is used or not, this macro can have different definitions.

**5.4.1 Without an Operating System** The macro `USING_OS_AUTOSAROS` must not be defined.

### 5.4.1.1 Using Software Vector Mode

The macro `USE_SW_VECTOR_MODE` must be defined and the ISR macro is defined as:

```
#define ISR(IsrName) void IsrName(void)
```

In this case, the drivers' interrupt handlers are normal C functions and their prologue/epilogue will handle the context save and restore.

### 5.4.1.2 Using Hardware Vector Mode

The macro `USE_SW_VECTOR_MODE` must not be defined and the ISR macro is defined as:

```
#define ISR(IsrName) INTERRUPT_FUNC void IsrName(void)
```

In this case, the drivers' interrupt handlers must also handle the context save and restore.

**5.4.2 With an Operating System** Please refer to your OS documentation for description of the ISR macro.

## 5.5 Other AUTOSAR modules - dependencies

- **BASE:** The BASE module contains the common files/definitions needed by all RTD modules.
- **DET:** This module is necessary for enabling Development error detection. The API function used is `Det_ReportError()`. The activation/deactivation of Development error detection is configurable using 'PlatformDevErrorDetect' configuration parameter.
- **RESOURCE:** Sub-Derivative model is selected from Resource configuration.

## 5.6 Data Cache Restrictions

None.

## 5.7 User Mode support

- [User Mode configuration in the module](#)
- [User Mode configuration in AutosarOS](#)

### 5.7.1 User Mode configuration in the module

The Platform can be run in user mode if the following steps are performed:

- Enable **PlatformEnableUserModeSupport** from the configuration
- Call the following functions as trusted functions:

Function syntax	Description	Available via
void IntCtrl_Ip_InstallHandler← Privileged(IRQn_Type eIrq← Number, const IntCtrl_Ip_← IrqHandlerType pfNewHandler, IntCtrl_Ip_IrqHandlerType* const pfOldHandler);	Installs a handler for an IRQ	
void IntCtrl_Ip_EnableIrq← Privileged(IRQn_Type eIrq← Number)	Enables an interrupt request	
void IntCtrl_Ip_DisableIrq← Privileged(IRQn_Type eIrq← Number)	Disables an interrupt request	
void IntCtrl_Ip_SetPriority← Privileged(IRQn_Type eIrq← Number, uint8 u8Priority)	Sets the priority for an interrupt request	
uint8 IntCtrl_Ip_GetPriority← Privileged(IRQn_Type eIrq← Number)	Gets the priority for an interrupt request	
void IntCtrl_Ip_ClearPending← Privileged(IRQn_Type eIrq← Number)	Clears the pending flag for an interrupt request	
void IntCtrl_Ip_Group1← Privileged(IRQn_Type eIrq← Number)	Set group1 for an interrupt request	
void IntCtrl_Ip_Configure← SpiPrivileged(IRQn_Type eIrqNumber, IntCtrl_Ip_← TriggerType conf)	Set Configure Spi for an interrupt request	
void IntCtrl_Ip_SetIntTarget← Privileged(IRQn_Type eIrq← Number, IntCtrl_Ip_Routing_← ModeType target)	Set interrupt target request	
void IntCtrl_Ip_SetPending← Privileged(IRQn_Type eIrq← Number)	Sets the pending flag for an interrupt request	
boolean IntCtrl_Ip_Get← PendingPrivileged(IRQn_Type eIrqNumber)	Gets the pending flag for an interrupt request	
boolean IntCtrl_Ip_Get← ActivePrivileged(IRQn_Type eIrqNumber)	Gets the active flag for an interrupt request	
void IntCtrl_Ip_SetTarget← CoresPrivileged(IRQn_Type eIrqNumber, uint8 u8Target← Cores)	Sets the target cores for an interrupt request	

IntCtrl\_Ip\_TrustedFunctions.h

## Module requirements

Function syntax	Description	Available via
void IntCtrl_Ip_Generate↵ DirectedCpuInterrupt↵ Privileged(IRQn_Type eIrq↵ Number, IntCtrl_Ip_IrqTarget↵ Type eCpuTarget)	Generate directed cpu Interrupt interrupt flag	
void IntCtrl_Ip_ClearDirected↵ CpuInterruptPrivileged(IRQn_↵ Type eIrqNumber)	Clear directed cpu Interrupt interrupt flag	
boolean IntCtrl_Ip_Get↵ DirectedCpuInterrupt↵ Privileged(IRQn_Type eIrq↵ Number)	Get directed cpu Interrupt interrupt flag	

### 5.7.2 User Mode configuration in AutosarOS

When User mode is enabled, the driver may has the functions that need to be called as trusted functions in AutosarOS context. Those functions are already defined in driver and declared in the header `<IpName>_Ip↵_TrustedFunctions.h`. This header also included all headers files that contains all types definition used by parameters or return types of those functions. Refer the chapter [User Mode configuration in the module](#) for more detail about those functions and the name of header files they are declared inside. Those functions will be called indirectly with the naming convention below in order to AutosarOS can call them as trusted functions.

```
Call_<Function_Name>_TRUSTED(parameter1,parameter2,...)
```

That is the result of macro expansion `OsIf_Trusted_Call` in driver code:

```
#define OsIf_Trusted_Call[1-6params](name,param1,...,param6) Call_##name##_TRUSTED(param1,...,param6)
```

So, the following steps need to be done in AutosarOS:

- Ensure `MCAL_ENABLE_USER_MODE_SUPPORT` macro is defined in the build system or somewhere global.
- Define and declare all functions that need to call as trusted functions follow the naming convention above in Integration/User code. They need to visible in `Os.h` for the driver to call them. They will do the marshallng of the parameters and call `CallTrustedFunction()` in OS specific manner.
- `CallTrustedFunction()` will switch to privileged mode and call `TRUSTED_<Function_Name>()`.
- `TRUSTED_<Function_Name>()` function is also defined and declared in Integration/User code. It will un-marshallng of the parameters to call `<Function_Name>()` of driver. The `<Function_Name>()` functions are already defined in driver and declared in `<IpName>_Ip_TrustedFunctions.h`. This header should be included in OS for OS call and indexing these functions.

See the sequence chart below for an example calling `Linflexd_Uart_Ip_Init_Privileged()` as a trusted function.

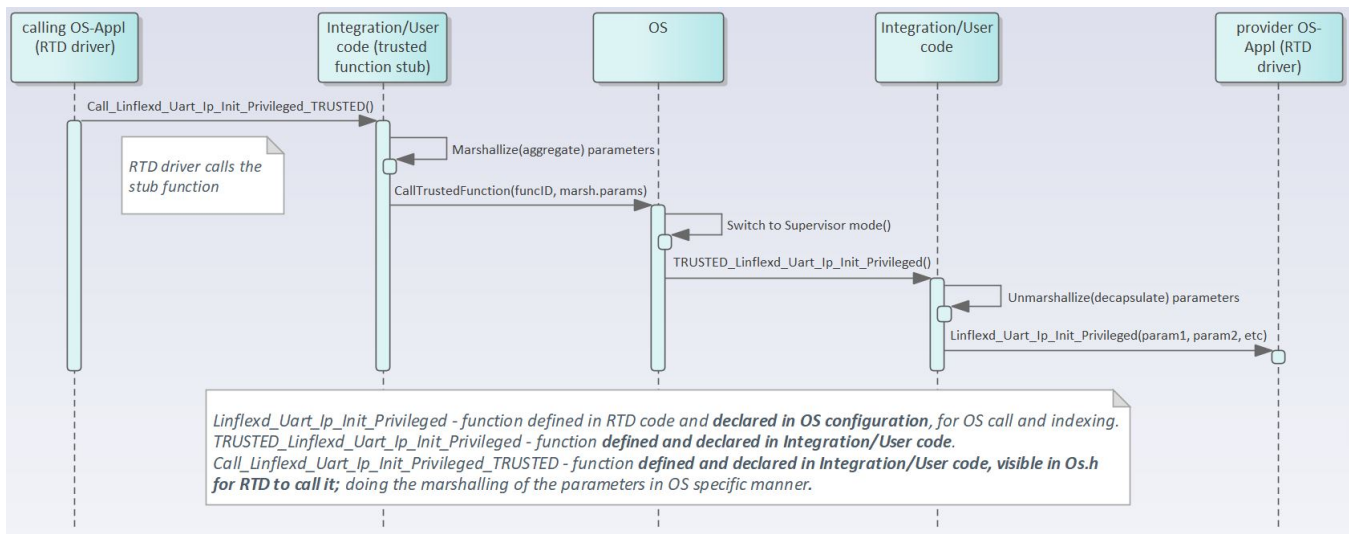


Figure 5.1 Example sequence chart for calling **Linflexd\_Uart\_Ip\_Init\_Privileged** as trusted function

## 5.8 Multicore support

1. The Platform implements the "Autosar 4.4 MCAL Multicore Distribution" according to type II, in which the mappable element is set to whole Hw\_Unit for NVIC, MSCM and MCM Ips. For additional details, please refer to AUTOSAR\_EXP\_BSWDistributionGuide.
2. The Platform can be allocated to zero, one or several ECUC partitions, by means of "PlatformEcucPartition←Ref". If the Platform is mapped to zero ECUC partitions, the Platform behavior reverts to single-core implementation, similar to previous Autosar versions. If the Platform is mapped to one or more ECUC partitions, the Platform enforces the following multi-core assumptions:
  - The Platform assumes there is a single EcucPartition allocated per core. Internally, the module will use the Core ID returned by GetCoreID API to reference the appropriate global data and configuration elements.
  - The Platform assumes the EcucCoreIDs are defined in a compact/consecutive order, starting from zero. The rationale is that the number of EcucPartitions is used for dimensioning the Platform internal variables and the EcucCoreIDs are used for indexing those variables (AR-86601 Zero based and dense IDs for OS-Cores and OSApplications)
  - The Platform assumes that initialization is performed on each core, Platform\_Init() is called separately for each core, using a different configuration structure. (Type II)
  - The Platform initialization expects the upper layer will pass the correct initialization pointer, specific to the partition in which the driver is to be used. For example: EcucPartition\_1 is assigned to CoreID 1; Platform\_Init function will be called with Platform\_Config\_EcucPartition\_1 configuration structure, on Core 1.
  - The configuration structure name shall be available in the caller scope of Platform\_Init() function by being declared with EXTERN, according to its generated name.

### Module specific limitation:

## Module requirements

- For current implementation, Platform driver does not support Hw\_Unit instance mapping with zero ECUC partition in configuration. Therefore the driver will force user to map each Hw\_Unit instance with one partition only
- There are only one instance of MSCM Hw\_Unit (Generic Interrupt Settings) available but affects to all other partitions. Therefore partition mapped to MSCM Hw\_Unit should call Platform\_Init before before calling Platform\_Init from other partitions.





## Chapter 6

### Main API Requirements

- [Main function calls within BSW scheduler](#)
- [API Requirements](#)
- [Calls to Notification Functions, Callbacks, Callouts](#)

#### 6.1 Main function calls within BSW scheduler

None.

#### 6.2 API Requirements

N/A.

#### 6.3 Calls to Notification Functions, Callbacks, Callouts

N/A.

## Chapter 7

### Memory allocation

- Sections to be defined in `__driver__MemMap.h`
- Linker command file

#### 7.1 Sections to be defined in `__driver__MemMap.h`

Section name	Type of section	Description
PLATFORM_START_SEC_CONFIG↔ _DATA_UNSPECIFIED	Configuration Data	Start of Memory Section for Config Data
PLATFORM_STOP_SEC_CONFIG↔ _DATA_UNSPECIFIED	Configuration Data	End of Memory Section for Config Data
PLATFORM_START_SEC_CODE	Code	Start of memory Section for Code
PLATFORM_STOP_SEC_CODE	Code	End of memory Section for Code

#### 7.2 Linker command file

Memory shall be allocated for every section defined in the driver's "<Module>"\_MemMap.h.



## Chapter 8

### Integration Steps

This section gives a brief overview of the steps needed for integrating this module:

1. Generate the required module configuration(s). For more details refer to section [Files Required for Compilation](#)
2. Allocate the proper memory sections in the driver's memory map header file ("`<Module>_MemMap.h`") and linker command file. For more details refer to section [Sections to be defined in `<Module>\_MemMap.h`](#)
3. Compile & build the module with all the dependent modules. For more details refer to section [Building the Driver](#)

## Chapter 9

### External assumptions for driver

The section presents requirements that must be complied with when integrating the PLATFORM driver into the application.

External Assumption Req ID	External Assumption Text
EA_RTD_00071	If interrupts are locked, a centralized function pair to lock and unlock interrupts shall be used.
EA_RTD_00082	When caches are enabled and data buffers are allocated in cacheable memory regions the buffers involved in DMA transfer shall be aligned with both start and end to cache line size. Note: <b>Rationale:</b> This ensures that no other buffers/variables compete for the same cache lines.
EA_RTD_00106	Standalone IP configuration and HL configuration of the same driver shall be done in the same project
EA_RTD_00107	The integrator shall use the IP interface only for hardware resources that were configured for standalone IP usage. Note: The integrator shall not directly use the IP interface for hardware resources that were allocated to be used in HL context.
EA_RTD_00108	The integrator shall use the IP interface to build a CDD, therefore the BSWMD will not contain reference to the IP interface

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