

AUTOSAR MCAL R4.0.3

User's Manual

MCU Driver Component Ver.1.0.5
Embedded User's Manual

Target Device:
RH850/P1x

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Abbreviations and Acronyms

Abbreviation / Acronym	Description
ADC	Analog to Digital Converter
ANSI	American National Standards Institute
API	Application Programming Interface
AUTOSAR	AUTomotive Open System ARchitecture
CAN	Controller Area Network
CVM	Core Voltage Monitor
CLMA	Clock Monitor
DEM/Dem	Diagnostic Event Manager
DET/Det	Development Error Tracer
DIO	Digital Input Output
DMA	Direct Memory Access
ECU	Electronic Control Unit
EEPROM	Electrically Erasable Programmable Read-Only Memory
ECM/Ecm	Error Control Module
GNU	GNU's Not Unix
GPT	General Purpose Timer
HW	HardWare
ICU	Input Capture Unit
ID/Id	IDentifier
ISR	Interrupt Service Routine
I/O	Input and Output
KB	Kilo Byte
LIN	Local Interconnect Network
MCAL	Microcontroller Abstraction Layer
MCU/Mcu	MicroController Unit
NA	Not Applicable
NMI	Non Maskable Interrupt
MI	Maskable Interrupt
OS/Os	Operating System
PWM	Pulse Width Modulation
PLL	Phase Locked Loop
RAM/Ram	Random Access Memory
ROM	Read Only Memory
RTE	Run Time Environment
SPI	Serial Peripheral Interface
SW	SoftWare
WDT	WatchDog Timer

Definitions

Term	Represented by
Sl. No.	Serial Number

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Chapter 1 Introduction

The purpose of this document is to describe the information related to MCU Driver Component for Renesas P1x microcontrollers.

This document shall be used as reference by the users of MCU Driver Component. The system overview of complete AUTOSAR architecture is shown in the below Figure:

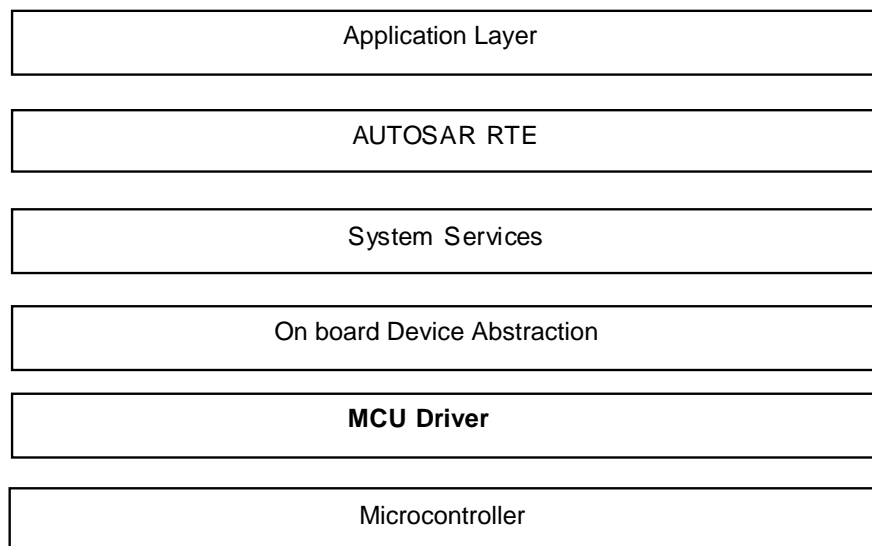


Figure 1-1 System Overview Of AUTOSAR Architecture

The MCU Driver is part of the Microcontroller Abstraction Layer (MCAL), the lowest layer of Basic Software in the AUTOSAR environment.

The Figure in the following page depicts the MCU Driver as part of layered AUTOSAR MCAL Layer:

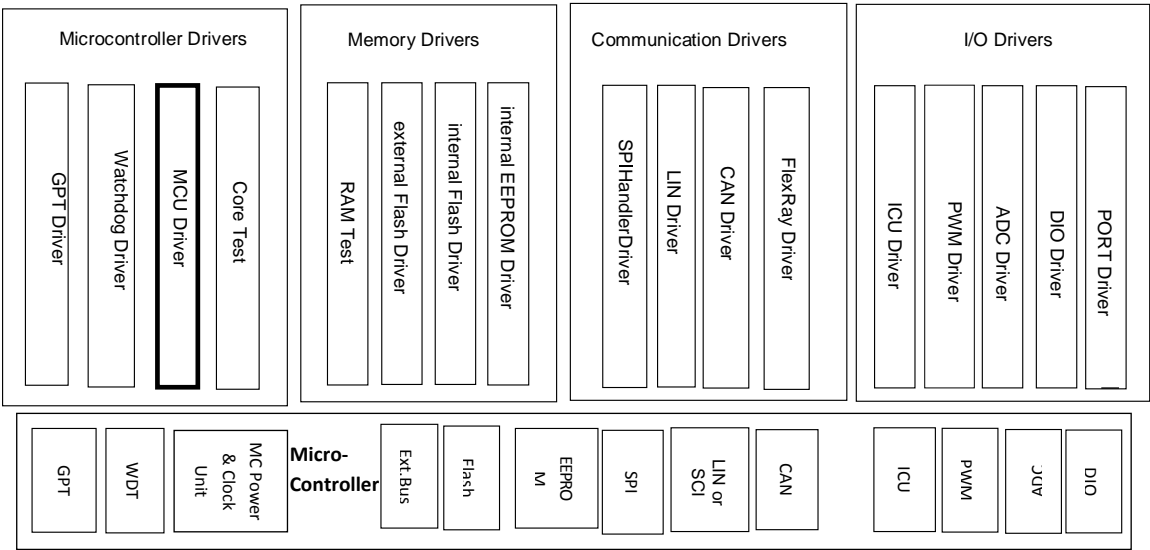


Figure 1-2 System Overview Of The MCU Driver In AUTOSAR MCAL Layer

The RTE provides the encapsulation of Hardware channels and basic services to the Application Software Components. So it is possible to map the Application Software-Components between different ECUs.

The Basic Software Modules are located below the RTE. The Basic Software itself is divided into the subgroups: System Services, Memory, Communication and I/O Hardware-Abstraction. The Complex Drivers are also located below the RTE. Among others, the Operating System (OS), the Watchdog manager and the Diagnostic services are located in the System Services subgroup. The Memory subgroup contains modules to provide access to the non-volatile memories, namely Flash and EEPROM. In the I/O Hardware-Abstraction subgroup the whole MCU Driver Component is provided.

On board Device Abstraction provides an interface to physical values for AUTOSAR software components. It abstracts the physical origin of signals (their paths to the hardware ports) and normalizes the signals with respect to their physical appearance. The Microcontroller driver provides services for basic microcontroller initialization, power down functionality, reset and microcontroller specific functions required from the upper layers.

1.1. Document Overview

The document has been segmented for easy reference. The table below provides user with an overview of the contents of each section:

Section	Contents
Section1 (Introduction)	This section provides an introduction and overview of MCU Driver Component.
Section 2 (Reference Documents)	This section lists the documents referred for developing this document.
Section 3 (Integration And Build Process)	This section explains the folder structure, Makefile structure for MCU Driver Component. This section also explains about the Makefile descriptions, Integration of MCU Driver Component with other components, building the MCU Driver Component along with a sample application.
Section 4 (Forethoughts)	This section provides brief information about the MCU Driver Component, the preconditions that should be known to the user before it is used, data consistency details and deviation list.
Section 5 (Architecture Details)	This section describes the layered architectural details of the MCU Driver Component.
Section 6 (Registers Details)	This section describes the register details of MCU Driver Component.
Section 7 (Interaction between The User And MCU Driver Component)	This section describes interaction of the MCU Driver Component with the upper layers.
Section 8 (MCU Driver Component Header And Source File Description)	This section provides information about the MCU Driver Component source files is mentioned. This section also contains the brief note on the tool generated output file.
Section 9 (Generation Tool Guide)	This section provides information on the MCU Driver Component Code Generation Tool.
Section 10 (Application Programming Interface)	This section explains all the APIs provided by the MCU Driver Component.
Section 11 (Development And Production Errors)	This section lists the DET and DEM errors.
Section 12 (Memory Organization)	This section provides the typical memory organization, which must be met for proper functioning of component.
Section 13 (P1M Specific Information)	This section provides P1M specific information also the information about linker compiler and sample application.
Section 14 (Release Details)	This section provides release details with version name and base version.

Chapter 2 Reference Documents

Sl. No.	Title	Version
1.	AUTOSAR_SWS_MCUDriver.pdf	3.2.0
2.	r01uh0436ej0070_rh850p1x.pdf	0.70
3.	AUTOSAR_SWS_MemoryMapping.pdf	1.4.0
4.	AUTOSAR_SWS_PlatformTypes.pdf	2.5.0
5.	AUTOSAR_BSW_MakefileInterface.pdf	0.3
6.	AUTOSAR_SWS_CompilerAbstraction.pdf	3.2.0
7.	AUTOSAR BUGZILLA (http://www.autosar.org/bugzilla) Note: AUTOSAR BUGZILLA is a database, which contains concerns raised against information present in AUTOSAR Specifications.	-

Chapter 3 Integration and Build Process

In this section the folder structure of the MCU Driver Component is explained. Description of the Make files along with samples is provided in this section.

Remark The details about the C Source and Header files that are generated by the MCU Driver Generation Tool are mentioned in the Generation Tool User's Manual "AUTOSAR_MCU_Tool_UserManual.pdf".

3.1. MCU Driver Component Makefile

The Makefile provided with the MCU Driver Component consists of the GNU Make compatible script to build the MCU Driver Component in case of any change in the configuration. This can be used in the upper level Makefile (of the application) to link and build the final application executable.

3.1.1. Folder Structure

The files are organized in the following folders:

Remark Trailing slash '\' at the end indicates a folder

X1X\P1x\modules\mcu\src

\Mcu.c

\Mcu_Irq.c

\Mcu_Ram.c

\Mcu_Version.c

X1X\P1x\modules\mcu\include

\Mcu.h

\Mcu_Debug.h

\Mcu_Irq.h

\Mcu_PBTypes.h

\Mcu_Ram.h

\Mcu_Types.h

\Mcu_Version.h

X1X\P1x\modules\mcu\sample_application\<SubVariant>\make\<compiler>
\App_MCU_P1M_Sample.mak

X1X\P1x\modules\mcu\sample_application\<SubVariant>\obj\<Compiler>

X1X\P1x\modules\mcu\generator

\Mcu_P1x.exe

\R403_MCU_P1x_BSWMDT.arxml

X1X\P1x\common_family\generator

\Global_Application_P1x.trxml

\Sample_Application_P1x.trxml

\P1x_translation.h

\Test_Application_P1x.trxml
X1X\P1x\modules\mcu\user_manual

(User manuals will be available in this folder)

- Note:
1. <Compiler> can be ghs.
 2. <AUTOSAR_version> should be 4.0.3.
 3. <SubVariant> can be P1M.

Chapter 4 Forethoughts

4.1. General

Following information will aid the user to use the MCU Driver Component software efficiently:

- The MCU Driver does not enable or disable the ECU or Microcontroller power supply. The upper layer should handle this operation.
- The start-up code is ECU and MCU specific. MCU Driver does not implement the start-up code.
- MCU specific initializations such as reset registers, one time writable registers, interrupt stack pointer, user stack pointer and MCU internal watchdog, MCU specific features of internal memory and registers are not implemented by MCU Driver. These initializations should be implemented by the start-up code.
- MCU Driver does not implement any call-back notification functions.
- MCU Driver does not implement scheduled functions.
- The MCU Driver component is implemented as a Post build variant.
- MCU Driver depends on Scheduler and Wake-up source service Modules for disabling all relevant interrupts to protect writing into the protected registers and invoking the ECU state manager functions.
- In P1x PLL clocks are not configurable and it cannot be controlled by software. It works with default values after main oscillator activated. Hence in P1x Mcu driver code `Mcu_DistributePllClock()` and `Mcu_GetPllStatus()` API's none of the action are taken care except DET errors.
- The file `Interrupt_VectorTable.c` provided is just a Demo and not all interrupts will be mapped in this file. So the user has to update the `Interrupt_VectorTable.c` as per his configuration

4.2. Preconditions

Following preconditions have to be adhered by the user, for proper functioning of the MCU Driver Component:

- The `Mcu_Cfg.h`, `Mcu_Cbk.h` and `Mcu_Reg.h` files generated by the MCU Driver component Code Generation Tool must be compiled and linked along with MCU Driver component source files.
- The application has to be rebuilt, if there is any change in the `Mcu_Cfg.h` file generated by the MCU Driver component Generation Tool.
- File `Mcu_PBcfg.c` generated for single configuration set or multiple configuration sets using MCU Driver component Generation Tool can be compiled and linked independently.
- The authorization of the user for calling the software triggering of a hardware reset is not checked in the MCU Driver. This is the responsibility of the upper layer.
- The MCU Driver component needs to be initialized before accepting any request. The API `Mcu_Init` should be called by the ECU State Manager Module to initialize MCU Driver Component.

The user should ensure that MCU Driver component API requests are invoked in the correct and expected sequence and with correct input arguments.

- Input parameters are validated only when the static configuration parameter `MCU_DEV_ERROR_DETECT` is enabled. Application should ensure that the right parameters are passed while invoking the APIs when `MCU_DEV_ERROR_DETECT` is disabled.
- There are different clock settings possible. For more details, please refer the respective device specific component user manual.
- If the handle of clock setting passed to the API `Mcu_InitClock` is not configured to any one of the supported clock settings, then the Development Error Detection function is invoked if the static configuration parameter `MCU_DEV_ERROR_DETECT` is enabled.
- The MCU Driver initializes the clock generator as per the required configuration settings and provides the configured clock sources for the peripherals as applicable. It is the responsibility of the individual drivers to select and initialize the respective driver specific registers as required for their functionality with reference to the clock source provided by the MCU Driver.
- The API `Mcu_InitClock` is implemented considering its invocation at run time. Hence, there is a possibility of change in the baud rate set by the peripheral drivers if the clock setting is different. Hence, the initialization of the respective drivers after the invocation of `Mcu_InitClock`, is the responsibility of the user of MCU Driver services.
- A mismatch in the version numbers of header and the source files results in compilation error. User should ensure that the correct versions of the header and the source files are used.

4.3. Data Consistency

To support the re-entrance and interrupt services, the MCU Driver will ensure the data consistency while accessing its own RAM storage or hardware registers or to prevent any interrupts between the two write instructions of the write protected register and the corresponding write enable register.

The MCU Driver will use `SchM_Enter_Mcu_<Exclusive Area>` and `SchM_Exit_Mcu_<Exclusive Area>` functions.

The `SchM_Enter_Mcu_<Exclusive Area>` function is called before the data needs to be protected and `SchM_Exit_Mcu_<Exclusive Area>` function is called after the data is accessed.

The flowchart will indicate the flow with the precompile option “`McuCriticalSectionProtection`” enabled.

The following exclusive area along with scheduler services is used to provide data integrity for shared resources:

`REG_DATA_PROTECTION`

The functions `SchM_Enter_Mcu_<Exclusive Area>` and `SchM_Exit_Mcu_<Exclusive Area>` can be disabled by disabling the configuration parameter ‘`McuCriticalSectionProtection`’.

4.4. User Mode and Supervisor Mode

The below table specifies the APIs which can run in user mode, supervisor

mode or both modes

Table 4-1 Supervisor mode and User mode details

SI.No.	API Name	User Mode	Supervisor Mode	Known limitation in User mode
1.	Mcu_Init	-	x	1. The enabling of the interrupt will not be possible. 2. Critical section protection cannot be enabled
2.	Mcu_InitRamSection	x	x	Critical section protection cannot be enabled
3.	Mcu_InitClock	x	x	-
4.	Mcu_DistributePllClock	x	x	-
5.	Mcu_GetPllStatus	x	x	-
6.	Mcu_GetResetReason	x	x	-
7.	Mcu_GetResetRawValue	x	x	-
8.	Mcu_PerformReset	x	x	-
9.	Mcu_SetMode	x	x	-
10.	Mcu_GetRamState	x	x	Critical section protection cannot be enabled
11.	Mcu_LockStepSelfDiagnosticTest	x	x	Critical section protection cannot be enabled
12.	Mcu_CvmSelfDiagnosticTest	x	x	-
13.	Mcu_ClmaSelfDiagnosticTest	x	x	-
14.	Mcu_EcmSelfDiagnosticTest	x	x	Critical section protection cannot be enabled
15.	Mcu_SaveResetReason	x	x	Critical section protection cannot be enabled

4.5. Deviation List

Table 4-2 MCU Driver Deviation List

SI. No.	Description	AUTOSAR Bugzilla / Mantis
1.	The parameter McuResetSetting from the sub-container McuModuleConfiguration is not considered.	-
2.	The MCU Driver considers the parameters of RAM section configuration as pre-compile parameters, since the number of RAM settings are not known and hence the generation of handles is not possible at post-build-time.	-

Sl. No.	Description	AUTOSAR Bugzilla / Mantis
3.	The sub-container McuClockReferencePoint in the Clock setting configuration is not used as the reference frequencies specific to various peripheral devices need to be published by MCU Driver component.	-
4.	The parameter McuClockSettingId range in McuClockSettingConfig container is changed from "1 to 255" to "0 to 255" since 0 is valid minimum value for clock setting ID.	54536
5.	If an invalid database is passed as a parameter to API Mcu_Init, DET Error code MCU_E_INVALID_DATABASE is reported to DET.	-
6.	The Mcu_GetVersionInfo API is implemented as macro without DET error MCU_E_PARAM_POINTER.	-

4.6. RAM Initialization

RAM initialization done by an API call to Mcu_InitRamSection must not overwrite other memory sections of static variables. A dedicated memory section shall be defined in linker directive file.

4.7. Callout API

The MCU_RESET_CALLOUT() API is the call out API from the Mcu module which will be called by Mcu_PerformReset() API for the software reset when configuration parameter McuSwResetCall Api is true. This callout API needs to be filled by user to do the software reset. If the configuration parameter McuSwResetCall Api is false, the callout shall not be available and the software reset shall be handled by the MCU itself using HW feature of the SW reset.

Chapter 5 Architecture Details

The MCU Driver architecture is shown in the following figure. The MCU user shall directly use the APIs to configure and execute the MCU conversions:

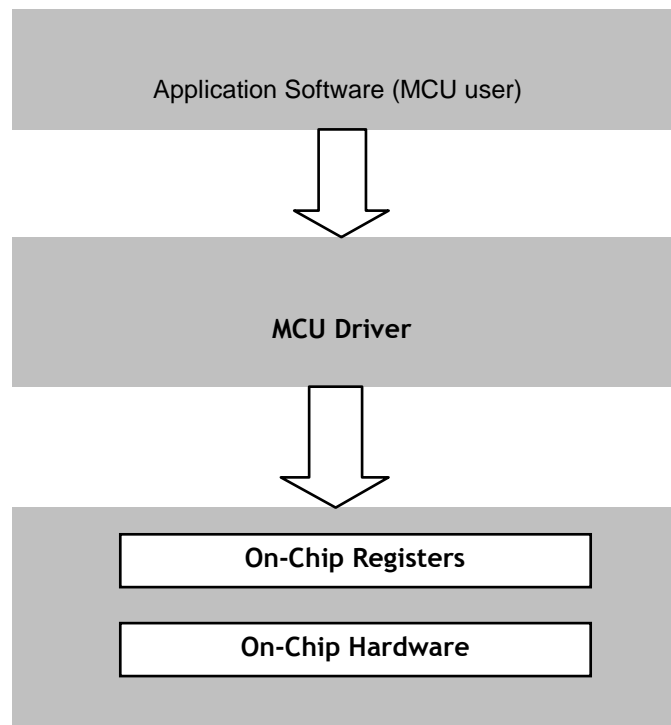


Figure 5-1 MCU Driver Architecture

The MCU driver accesses the microcontroller hardware directly and is located in the MCAL. MCU component provides the functionalities related to PLL Initialization, Clock Initialization and Distribution, RAM sections Initialization, PreScaler Initialization, MCU reduced Power Modes Activation and MCU Reset Activation and Reason.

The component consists of the following sub modules based on the functionality:

- Initialization
- Self-Diagnostic test for ECM, CVM, Clock Monitor and Lock Step.
- Clock Initialization
- RAM sections Initialization and Status Verification
- MCU Reset Activation and Reason
- Version Information

Initialization

This sub module provides the structures and APIs for both global and controller specific initialization. MCU specific initialization is necessary in order to ensure different startup behaviors of the microcontroller. This sub

module also checks if the data base is flashed.

Self-Diagnostic test for ECM, CVM, Clock Monitor and Lock Step

This functionality is provided as part MCU module initialization. Self-diagnostic test for ECM error source is helpful to check the ECM error output signal by creating the real ECM error signal. Self-diagnostic test for CVM and CLMA is possible in real scenario.

Clock Initialization

The clock initialization sub module provides the functionality for generating all the required clock signals for microcontroller operation from any one of the available sources. It enables the provision for individual clock source selection for CPU and groups of peripherals.

This sub module also provides the functionality for obtaining various frequencies required for individual peripheral devices.

For available clock sources, please refer to the respective device specific component user manual.

RAM sections Initialization and Status Verification

This sub module provides the functionality for initializing the RAM with the any given value, at the selected blocks of the RAM and to verify the status of RAM.

MCU Reset Activation and Reason

The microcontroller reset activation will be performed by forcing a software reset. This functionality will be done by using software reset register. ECM error sources can also be configured for internal reset so that if any error occurs device will activate reset.

To provide the reset reason, this sub module captures the information available with RESF – Reset factor register. This register contains information.

Version Information

This module provides APIs for reading Module Id, Vendor Id and vendor specific version numbers.

Chapter 6 Registers Details

This section describes the register details of MCU Driver Component.

Table 6-1 Register Details

API Name	Registers Used	Register Access 8/16/32 bits	Config Parameter	Macro/Variable
Mcu_Init	ECMIRCFG0	32	(LpEcmSetting->ulEcmInternalResetReg0value & (~MCU_RAM_MASK0_VALUE))	MCU_IRCFG0_INIT_VALUE
	LVICNT	32	LulLVICntValue	MCU_LVI_MASK
	PROT1PHCMD	32	-	MCU_WRITE_DATA
	PROT1PS	32	-	-
	ECMMICFG0HH	8	LucDataByte	-
	ECNMICFG0HH	8	LucDataByte	-
	ECMIRCFG0HH	8	LucDataByte	-
	ECMMECLR	8	-	MCU_ONE
	ECMMPCMD0	32	-	MCU_WRITE_DATA
	ECMCECLR	8	-	MCU_ONE
	ECMCPCMD0	32	-	MCU_WRITE_DATA
	ECMESSTC0	32	LulEcmStatusData	-
	CVMDEW	8	LucCVMCntValue	-
	PROTCMDVCM	32	-	MCU_WRITE_DATA
	PROTSCVM	32	-	-
	ECMEPCTL	8	-	MCU_ECM_ERROUT_TIMER
	ECMPCMD1	32	-	MCU_WRITE_DATA
	ECMPS	8	-	-
	EIBD8	32	-	MCU_EIBD08_CPU1_VALUE

API Name	Registers Used	Register Access 8/16/32 bits	Config Parameter	Macro/Variable
	EIC8L	8	-	MCU_ENABLE_TABLE_INTERRUPT
	ECMEMK0	32	-	MCU_ECMEMK0_FULL_MASK
	ECMEMK1	32	-	MCU_ECMEMK1_FULL_MASK
	ECMEPCFG	8	-	MCU_ECM_ERROUT_MODE
	ECMMICFG0	32	((LpEcmSetting->ulEcmMaskInterReg0value & (~MCU_RAM_MASK0_VALUE)) MCU_IRCFG0_INIT_VALUE)	-
	ECMMICFG1	32	(LpEcmSetting->ulEcmMaskInterReg1value & (~MCU_RAM_MASK1_VALUE))	-
	ECNMICFG0	32	(LpEcmSetting->ulEcmNonMaskInterReg0value & (~MCU_RAM_MASK0_VALUE))	-
	ECNMICFG1	32	(LpEcmSetting->ulEcmNonMaskInterReg1value & (~MCU_RAM_MASK1_VALUE))	-
	ECMIRCFG1	32	(LpEcmSetting->ulEcmInternalResetReg1value & (~MCU_RAM_MASK1_VALUE))	-
	ECMDTMCTL	8	-	MCU_ECM_DELY_TIMER_STOP
	ECMDTMCM P	16	-	MCU_ECM_DLYTIMER_VALUE
	ECMDTMCFG0	32	LpEcmSetting->ulEcmDelayTimerReg0 Value, LpEcmSetting->ulEcmDelayTimerReg1 Value, LpEcmSetting->ulEcmDelayTimerReg2 Value, LpEcmSetting->ulEcmDelayTimerReg3 Value	-
Mcu_InitRamSection	ECMMESSTR0	32	-	MCU_RAM_MASK0_VALUE
	ECMESSTC0	32	-	MCU_RAM_MASK0_VALUE

API Name	Registers Used	Register Access 8/16/ 32 bits	Config Parameter	Macro/Variable
	ECMMESSTR1	32	-	MCU_RAM_MASK1_VALUE
	ECMESSTC1	32	-	MCU_RAM_MASK1_VALUE
	ECMPCMD1	32	-	MCU_WRITE_DATA
	ECMPS	8	-	-
	ECMMICFG0	32	LpEcmSetting->ulEcmMaskInterReg0value	-
	ECMMICFG1	32	LpEcmSetting->ulEcmMaskInterReg1value	-
	ECNMICFG0	32	LpEcmSetting->ulEcmNonMaskInterReg0value	-
	ECNMICFG1	32	LpEcmSetting->ulEcmNonMaskInterReg1value	-
	ECMIRCFG0	32	LpEcmSetting->ulEcmInternalResetReg0value	-
	ECMIRCFG1	32	LpEcmSetting->ulEcmInternalResetReg1value	-
	ECMEMK0	32	LpEcmSetting->ulEcmErrorMaskReg0Value	-
	ECMEMK1	32	LpEcmSetting->ulEcmErrorMaskReg1Value	--
Mcu_InitClock	PROT1PHCMD	32	-	MCU_WRITE_DATA
	PROT1PS	32	-	-
	CLMA0CMPH	16	Mcu_GpConfigPtr->usCLMA0CMPH	-
	CLMA0CMPL	16	Mcu_GpConfigPtr->usCLMA0CMPL	-
	CLMA0PCMD	8	-	MCU_WRITE_DATA
	CLMA0PS	8	-	-
	CLMA0CTL0	8	-	MCU_ONE
	CLMA1CMPH	16	Mcu_GpConfigPtr->usCLMA1CMPH	-
	CLMA1CMPL	16	Mcu_GpConfigPtr->usCLMA1CMPL	-

API Name	Registers Used	Register Access 8/16/ 32 bits	Config Parameter	Macro/Variable
	CLMA1PCMD	8	-	MCU_WRITE_DATA
	CLMA1PS	8	-	-
	CLMA1CTL0	8	-	MCU_ONE
	CLMA2CMPH	16	Mcu_GpConfigPtr->usCLMA2CMPH	-
	CLMA2CMPL	16	Mcu_GpConfigPtr->usCLMA2CMPL	-
	CLMA2PCMD	8	-	MCU_WRITE_DATA
	CLMA2PS	8	-	-
	CLMA2CTL0	8	-	MCU_ONE
	CLMA3CMPH	16	Mcu_GpConfigPtr->usCLMA3CMPH	-
	CLMA3CMPL	16	Mcu_GpConfigPtr->usCLMA3CMPL	-
	CLMA3PCMD	8	-	MCU_WRITE_DATA
	CLMA3PS	8	-	-
	CLMA3CTL0	8	-	MCU_ONE
Mcu_DistributePIIClock	-	-	-	-
Mcu_GetPIIStatus	-	-	-	-
Mcu_GetResetReason	-	-	-	-
Mcu_GetResetRawValue	-	-	-	-
Mcu_PerformReset	SWRESA	32	-	MCU_RES_CORRECT_VAL
	PROT1PHCMD	32	-	MCU_WRITE_DATA
	PROT1PS	32	-	-
Mcu_SetMode	-	-	-	-
Mcu_GetRamState	-	-	-	-
Mcu_CvmSelfDiagnosticTest	CVMDIAG	8	-	MCU_TWELVE, MCU_ZERO

API Name	Registers Used	Register Access 8/16/ 32 bits	Config Parameter	Macro/Variable
	CVMFC	8	-	MCU_CVM_FACTOR_CLEAR
	CVMF	8	-	MCU_CVM_FACTOR_CLEAR
	CVMDMASK	8	-	MCU_ONE, MCU_ZERO
	PROTCMDV M	32	-	MCU_WRITE_DATA
	PROTSCVM	32	-	-
Mcu_ClmaSelf DiagnosticTest	CLMATESTS	32	-	-
	CLMATEST	32	LulClimaXTestValue	-
	PROT1PHCM D	32	-	MCU_WRITE_DATA
	PROT1PS	32	-	-
Mcu_EcmSelf DiagnosticTest	ECMEMK0	32	LpEcmSetting->ulEcmErrorMaskReg0V alue	-
	ECMMESSTR 0	32	LulEcmPseudoData	-
	ECMCESSTR 0	32	LulEcmPseudoData	-
	ECMEMK1	32	LpEcmSetting->ulEcmErrorMaskReg1V alue	-
	ECMMESSTR 1	32	LulEcmPseudoData	MCU_ERROROUT_STAT US
	ECMCESSTR 1	32	LulEcmPseudoData	MCU_ERROROUT_STAT US
	ECMESSTC1	32	LulEcmPseudoData	-
	ECMEMK0HH	8	-	MCU_ECM029_MASK_VA LUE
	ECMMICFG0 HH	8	-	(~MCU_ECM029_MASK_ VALUE)
	ECNMICFG0 HH	8	-	(~MCU_ECM029_MASK_ VALUE)
	ECMIRCFG0 HH	8	-	(~MCU_ECM029_MASK_ VALUE)
	ECMMECLR	8	-	MCU_ONE
	ECMMPCMD 0	32	-	MCU_WRITE_DATA

API Name	Registers Used	Register Access 8/16/32 bits	Config Parameter	Macro/Variable
	ECMCECLR	8	-	MCU_ONE
	ECMPCMD0	32	-	MCU_WRITE_DATA
	ECMESSTC0	32	LulEcmPseudoData	(MCU_ECM029_MASK_VALUE << MCU_TWENTYFOUR)
	ECMPCMD1	32	-	MCU_WRITE_DATA
	ECMPE0	32	LulEcmPseudoData	-
	ECMPE1	32	LulEcmPseudoData	-
	ECMPS	8	-	-
Mcu_LockStep SelfDiagnostic Test	TESTCOMPR EG1	32	-	(~MCU_LOCKSTEP_DUMMY_VALUE)
	TESTCOMPR EG0	32	-	MCU_LOCKSTEP_DUMMY_VALUE
	ECMMESSTR 0	32	-	MCU_TWO
	ECMESSTC0	32	-	MCU_TWO
	ECMPCMD1	32	-	MCU_WRITE_DATA
	ECMPS	8	-	-
Mcu_SaveResetReason	POF	32	-	MCU_POF_RST
	POFC	32	-	MCU_POF_CLEAR
	ECMMESSTR 0	32	Mcu_GpEcmSetting->ulEcmInternalResetReg0value	-
	ECMMESSTR 1	32	Mcu_GpEcmSetting->ulEcmInternalResetReg1value	-
	ECMESSTC0	32	LulEcmStatusData0	-
	ECMESSTC1	32	LulEcmStatusData1	-
	ECMPCMD1	32	-	MCU_WRITE_DATA
	ECMPS	8	-	-
	RESF	32	-	MCU_ZERO

API Name	Registers Used	Register Access 8/16/ 32 bits	Config Parameter	Macro/Variable
	RESFC	32	-	MCU_RESF_CLEAR

Chapter 7 Interaction between the User and MCU Driver Component

The details of the services supported by the MCU Driver Component to the upper layers users and the mapping of the channels to the hardware units is provided in the following sections:

7.1. Services Provided By MCU Driver Component To User

The MCU Driver Component provides the following functions to upper layers, if supported by hardware:

- To Perform the Self diagnostic test for the ECM, CVM, Clock Monitor and Lock step.
- To initialize the RAM and to verify the status, section wise.
- To initialize the MCU specific clock options.
- To activate the specific clock to the MCU clock distribution.
- To read the reset type from the hardware.
- To perform the micro controller reset.
- To read the MCU Driver component version information.

Chapter 8 MCU Driver Component Header And Source File Description

This section explains the MCU Driver Component's C Source and C Header files. These files have to be included in the project application while integrating with other modules.

The C header file generated by MCU Driver Generation Tool:

- Mcu_Cfg.h
- Mcu_Reg.h
- Mcu_Cbk.h

The C source file generated by MCU Driver Generation Tool:

- Mcu_PBcfg.c

The MCU Driver Component C header files:

- Mcu.h
- Mcu_Debug.h
- Mcu_Irq
- Mcu_PBTypes.h
- Mcu_Ram.h
- Mcu_Types.h
- Mcu_Version.h

The MCU Driver Component source files:

- Mcu.c
- Mcu_Irq.c
- Mcu_Ram.c
- Mcu_Version.c

The mcu specific C header files:

- Compiler.h
- Compiler_Cfg.h
- MemMap.h
- Platform_Types.h
- rh850_Types.h

The description of the MCU Driver Component files is provided in the table below:

Table 8-1 Description of the MCU Driver Component Files

File	Details
Mcu_Cfg.h	This file is generated by the MCU Driver Module Code Generation Tool for MCU Driver Module pre-compile time parameters. The macros and the parameters generated will vary with respect to the configuration in the input ARXML file.
Mcu_Reg.h	This file contains the definitions for addresses of the hardware registers used in the MCU Driver Module.
Mcu_Cbk.h	This file contains the extern declaration of call back functions used in the MCU Driver Module.

File	Details
Mcu_PBcfg.c	This file contains post-build configuration data. The structures related to MCU Initialization, clock and power mode setting are provided in this file. Data structures will vary with respect to parameters configured.
Mcu.h	This file provides extern declarations for all the MCU Driver Module APIs. This file provides service Ids of APIs, DET Error codes and type definitions for MCU Driver initialization structure. This header file shall be included in other modules to use the features of MCU Driver Module.
Mcu_Irq.h	This file contains the ISR functions prototypes of the MCU Driver Module.
Mcu_Types.h	This file provides data structure and type definitions for initialization of MCU Driver.
Mcu_PBTypes.h	This file contains the macros used for the post build time parameters.
Mcu_Ram.h	This file contains the extern declarations for the global variables that are defined in Mcu_Ram.c file and the version information of the file.
Mcu_Version.h	This file contains the macros of AUTOSAR version numbers of all modules that are interfaced to MCU.
Mcu_Debug.h	This file provides Provision of global variables for debugging purpose.
Mcu.c	This file contains the implementation of all MCU Driver Module APIs.
Mcu_Irq.c	This file contains the ISR functions of the MCU Driver Module.
Mcu_Ram.c	This file contains the global variables used by MCU Driver Module.
Mcu_Version.c	This file contains the code for checking version of all modules that are interfaced to MCU.
Compiler.h	Provides compiler specific (non-ANSI) keywords. All mappings of keywords, which are not standardized, and/or compiler specific are placed and organized in this compiler specific header.
Compiler_Cfg.h	This file contains the memory and pointer classes.
MemMap.h	This file allows mapping of variables, constants and code of modules to individual memory sections. Memory mapping can be modified as per ECU specific needs.
Platform_Types.h	This file provides provision for defining platform and compiler dependent types.
rh850_Types.h	This file provides macros to perform supervisor mode (SV) write enabled Register ICxx and IMR register writing using OR/AND/Direct operation

Chapter 9 Generation Tool Guide

For more information on the MCU Driver Component Generation Tool, please refer “AUTOSAR_MCU_Tool_UserManual.pdf”.

Chapter 10 Application Programming Interface

This section explains the Data types and APIs provided by the MCU Driver Component to the Upper layers.

10.1. Imported Types

This section explains the Data types imported by the MCU Driver Component and lists its dependency on other modules.

10.1.1. Standard Types

In this section all types included from the Std_Types.h are listed:

- Std_ReturnType
- Std_VersionInfoType

10.1.2. Other Module Types

In this chapter all types included from the Dem.h are listed:

- Dem_EventIdType
- Dem_EventStatusType

10.2. Type Definitions

This section explains the type definitions of MCU Driver Component according to AUTOSAR Specification.

For more type definitions refer the SWS of MCU driver as mentioned in chapter 2.

10.2.1 Mcu_ClockType

Name:	Mcu_ClockType
Type:	uint8
Range:	1 to 2
Description:	Type definition for Mcu_ClockType used by the API Mcu_InitClock.

10.2.2 Mcu_RawResetType

Name:	Mcu_RawResetType
Type:	uint32
Range:	0 to 4294967295
Description:	Type definition for Mcu_RawResetType used by the API Mcu_GetResetRawValue.

Note: Mcu_GetResetRawValue API is returning the RESF register status.

10.2.3 Mcu_RamSectionType

Name:	Mcu_RamSectionType
Type:	uint8
Range:	0 to 255
Description:	Type definition for Mcu_RamSectionType used by the API Mcu_InitRamSection.

10.2.4 Mcu_PllStatusTypes

Name:	Mcu_PllStatusType	
Type:	Enumeration	
Range:	MCU_PLL_LOCKED	PLL is locked
	MCU_PLL_UNLOCKED	PLL is unlocked.
	MCU_PLL_STATUS_UNDEFINED	PLL status is unknown
Description:	Status value returned by the API Mcu_GetPllStatus.	

Note: As per CPU manual Mcu_GetPllStatus API is not supporting the PLL clock implementation. Hence Mcu_GetPllStatus is returning always MCU_PLL_LOCKED Status.

10.2.5 Mcu_RamStateType

Following are the type definitions which are specific to R4.0 used by the MCU Driver module:

Name:	Mcu_RamStateType	
Type:	Enumeration	
Range:	MCU_RAMSTATE_INVALID	RAM State is valid.
	MCU_RAMSTATE_VALID	RAM State is invalid.
Description:	Status value returned by the API Mcu_GetRamState	

10.2.6 Mcu_ResetType

Name:	Mcu_ResetType	
Type:	Enumeration	
Range:	MCU_POWER_ON_CLEAR_RST	
	MCU_PIN_RST	
	MCU_SW_RST	
	MCU_WDT_RST	
	MCU_LOCK_STEP_CORE_RST	
	MCU_CLMA0_UPPER_LIMIT_RST	
	MCU_CLMA0_LOWER_LIMIT_RST	
	MCU_CLMA2_UPPER_LIMIT_RST	
	MCU_CLMA2_LOWER_LIMIT_RST	
	MCU_CLMA1_UPPER_LIMIT_RST	
	MCU_CLMA1_LOWER_LIMIT_RST	
	MCU_CLMA3_UPPER_LIMIT_RST	
	MCU_CLMA3_LOWER_LIMIT_RST	
	MCU_LRAM_ECC2_ADDPTY_RST	
	MCU_GRAM_ECC2_ADDPTY_RST	
	MCU_CASHE_RAM_ECC2_RST	
	MCU_CFLH_ECC2_ADDPTY_RST	
	MCU_DATA_FLSH_ECC2_RST	
	MCU_DTS_RAM_ECC2_RST	
	MCU_CSIH_RAM_ECC2_RST	
	MCU_CAN_RAM_ECC2_RST	
	MCU_FLXR_RAM_ECC2_RST	
	MCU_MODE0_RST	

	MCU_MODE1_RST
	MCU_MODE2_RST
	MCU_PEGUARD_RST
	MCU_GRAM_GUARD_RST
	MCU_PBUSGUARD_RST
	MCU_SAR_ADC_PTY_RST
	MCU_DATA_PRTY_RST
	MCU_ECM_COMP_RST
	MCU_LVI_RST
	MCU_TEMP_SENSE_RST
	MCU_DMA_TRANSF_RST
	MCU_DMA_REG_PROTECT_RST
	MCU_LRAM_ECC1_PTY_RST
	MCU_GRAM_ECC1_RST
	MCU_CFLH_ECC1_RST
	MCU_DATA_FLSH_ECC1_RST
	MCU_DTS_RAM_ECC1_RST
	MCU_ALL_PERI_RAM_ECC1_RST
	MCU_BIST_ECC1_RST
	MCU_BIST_ECC2_RST
	MCU_FACI_TRANSF_RST
	MCU_ECM_DELY_OVRFLW_RST
	MCU_RESET_UNDEFINED
	MCU_RESET_UNKNOWN
Description:	Type of reset supported by the hardware

Note:

1. All RAM related ECM error sources are enabled for maskable interrupts only after Ram initialization.
2. User should configure only one ECM event for each ECM error source at a time priority level for the ECM event should be as follow:
 - Internal Reset
 - Maskable Interrupt
 - Non Maskable Interrupt

10.2.7 Mcu_ClmaIndexType

Name:	Mcu_ClmaIndexType	
Type:	Enumeration	
Range:	MCU_CLMA0	CLMA0
	MCU_CLMA1	CLMA1
	MCU_CLMA2	CLMA2
	MCU_CLMA3	CLMA3
Description:	Variable of this type is used to pass in Mcu_ClmaSelfDiagnosticTest API	

10.2.8 Mcu_ModeType

Name:	Mcu_ModeType
Type:	uint8
Range:	0 to 2
Description:	Type definition for Mcu_ModeType used by the API Mcu_SetMode.

Note: As per CPU Manual Mcu_SetMode API is not supporting for any standby mode.
Hence the Mcu_ModeType parameter is unused for P1x MCU module implementation.

10.3. Function Definitions

Table 10-1 API Provided by MCU Driver Component

Sl. No	API's name
1.	Mcu_Init
2.	Mcu_InitRamSection
3.	Mcu_InitClock
4.	Mcu_DistributePllClock
5.	Mcu_GetPllStatus
6.	Mcu_GetResetReason
7.	Mcu_GetResetRawValue
8.	Mcu_PerformReset
9.	Mcu_SetMode
10.	Mcu_GetRamState
11.	Mcu_LockStepSelfDiagnosticTest
12.	Mcu_CvmSelfDiagnosticTest
13.	Mcu_ClmaSelfDiagnosticTest
14.	Mcu_EcmSelfDiagnosticTest
15.	Mcu_SaveResetReason

Chapter 11 Development And Production Errors

In this section the development errors that are reported by the MCU Driver Component are tabulated. The development errors will be reported only when the pre-compiler option `McuDevErrorDetect` is enabled in the configuration. The production code errors are not supported by MCU Driver Component.

11.1. MCU Driver Component Development Errors

The following table contains the DET errors that are reported by MCU Driver Component. These errors are reported to Development Error Tracer Module when the MCU Driver Component APIs are invoked with wrong input parameters or without initialization of the driver.

Table 11-1 DET Errors of MCU Driver Component

Sl. No.	1
Error Code	MCU_E_PARAM_CONFIG
Related API(s)	Mcu_Init
Source of Error	When the API service is called without module initialization.
Sl. No.	2
Error Code	MCU_E_PARAM_CLOCK
Related API(s)	Mcu_InitClock
Source of Error	When Clock Setting is not within the settings defined in the configuration data structure.
Sl. No.	3
Error Code	MCU_E_PARAM_RAMSECTION
Related API(s)	Mcu_InitRamSection
Source of Error	When RamSection is not within the sections defined in the configuration data structure.
Sl. No.	4
Error Code	MCU_E_PLL_NOT_LOCKED
Related API(s)	Mcu_DistributePllClock
Source of Error	When PLL is not locked.
Sl. No.	5
Error Code	MCU_E_UNINIT
Related API(s)	Mcu_InitRamSection, Mcu_InitClock, Mcu_DistributePllClock, Mcu_GetPllStatus, Mcu_GetResetReason, Mcu_GetResetRawValue, Mcu_PerformReset, Mcu_SetMode, Mcu_GetRamState
Source of Error	When the APIs are invoked without the initialization of the MCU Driver Component.
Sl. No.	6
Error Code	MCU_E_INVALID_DATABASE
Related API(s)	Mcu_Init
Source of Error	When the API is invoked with no database.
Sl. No.	7
Error Code	MCU_E_PARAM_MODE
Related API(s)	Mcu_SetMode
Source of Error	When the API is invoked with invalid MCU mode.

11.2. MCU Driver Component Production Errors

In this section the DEM errors identified in the MCU Driver component are listed. MCU Driver component reports these errors to DEM by invoking Dem_ReportErrorStatus API. This API is invoked, when the processing of the given API request fails.

Table 11-2 DEM Errors of MCU Driver Component

Sl. No.	1
Error Code	MCU_E_CLOCK_FAILURE
Related API(s)	Mcu_InitClock
Source of Error	When there is failure of the monitored clock frequency.
Sl. No.	2
Error Code	MCU_E_WRITE_TIMEOUT_FAILURE
Related API(s)	Mcu_PerformReset, Mcu_ProtectedWrite
Source of Error	When writing to a write-protected register fails
Sl. No.	3
Error Code	MCU_E_CVM_SELFDIAG_FAILURE
Related API(s)	Mcu_CvmSelfDiagnosticTest
Source of Error	When there is failure CVM self-diagnostic test.
Sl. No.	4
Error Code	MCU_E_CLM_SELFDIAG_FAILURE
Related API(s)	Mcu_ClmaSelfDiagnosticTest
Source of Error	When there is failure CLMA self-diagnostic test.
Sl. No.	5
Error Code	MCU_E_ECM_SELFDIAG_FAILURE
Related API(s)	Mcu_EcmSelfDiagnosticTest
Source of Error	When there is failure ECM self-diagnostic test.

Chapter 12 Memory Organization

Following picture depicts a typical memory organization, which must be met for proper functioning of MCU Driver Component software.

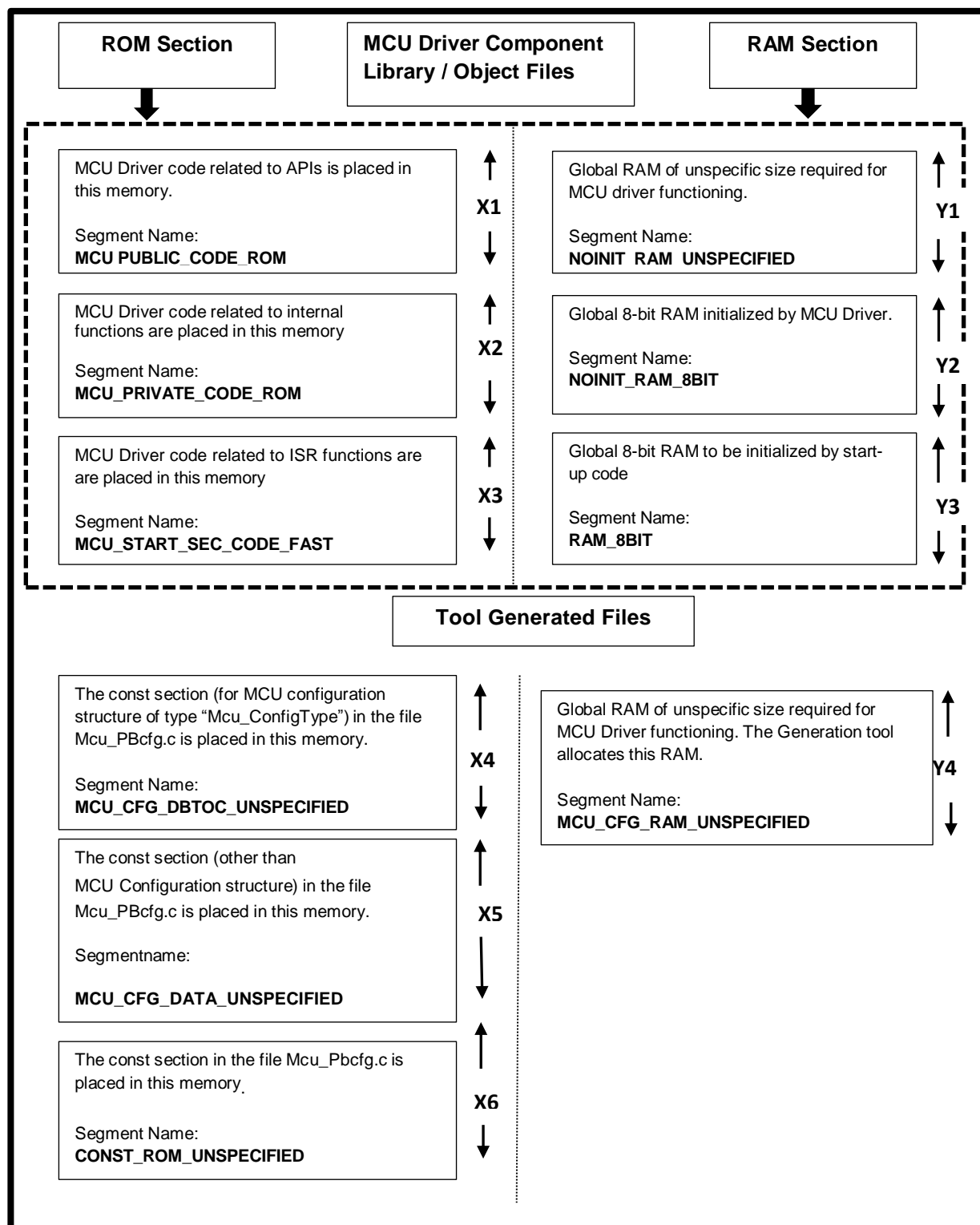


Figure 12-1 MCU Driver Component Memory Organization

ROM Section (X1, X2, X3, X4, X5 and X6):

MCU_PUBLIC_CODE_ROM (X1): API(s) of MCU Driver Component, which can be located in code memory.

MCU_PRIVATE_CODE_ROM (X2): Internal functions of MCU Driver Component code that can be located in code memory.

MCU_START_SEC_CODE_FAST (X3): Interrupt functions of MCU Driver Component code that can be located in code memory.

MCU_CFG_DBTOC_UNSPECIFIED (X4): This section consists of MCU Driver Component database table of contents generated by the MCU Driver Component Generation Tool. This can be located in code memory.

MCU_CFG_DATA_UNSPECIFIED (X5): This section consists of MCU Driver Component constant configuration structures. This can be located in code memory.

CONST_ROM_UNSPECIFIED (X6): This section consists of MCU Driver Component constant structures used for function pointers in MCU Driver Component. This can be located in code memory.

RAM Section (Y1, Y2, Y3 and Y4):

NOINIT_RAM_UNSPECIFIED (Y1): This section consists of the global RAM variables that are used internally by MCU Driver Component. This can be located in data memory.

NOINIT_RAM_8BIT (Y2): This section consists of the global RAM variables of 8-bit size that are used internally by MCU Driver Component. This can be located in data memory.

RAM_1BIT (Y3): This section consists of the global RAM variables of 1-bit size that are initialized by start-up code and used internally by MCU Driver Component. This can be located in data memory.

MCU_CFG_RAM_UNSPECIFIED (Y4): This section consists of the global RAM variables that are generated by MCU Driver Component Generation Tool. This can be located in data memory.

Remark

- X1, X2, Y1, Y2 and Y3 pertain to only MCU Driver Component and do not include memory occupied by Mcu_PBCfg.c file generated by MCU Driver Component Generation Tool.

User must ensure that none of the memory areas overlap with each other. Even 'debug' information should not overlap.

Chapter 13 P1M Specific Information

P1M supports following devices:

- R7F701304
- R7F701305
- R7F701310
- R7F701311
- R7F701312
- R7F701313
- R7F701314
- R7F701315
- R7F701318
- R7F701319
- R7F701320
- R7F701321
- R7F701322
- R7F701323

13.1. Interaction between the User and MCU Driver Component

The details of the services supported by the MCU Driver Component to the upper layers users and the mapping of the channels to the hardware units is provided in the following sections:

13.1.1. Translation Header File

The P1x_translation.h translation header file supports following devices:

- R7F701304
- R7F701305
- R7F701310
- R7F701311
- R7F701312
- R7F701313
- R7F701314
- R7F701315
- R7F701318
- R7F701319
- R7F701320
- R7F701321
- R7F701322
- R7F701323

13.1.2. ISR Function

The table below provides the list of handler addresses corresponding to the hardware unit ISR(s) in MCU Driver Component. The user should configure the ISR functions mentioned below:

Table 13-1 ISR For MCU

Interrupt Source	Name of the ISR Function
INTECM	MCU_FEINT_ISR
	MCU_ECM_EIC_ISR

13.1.3. Parameter Definition File

Parameter definition files support information for P1M

Table 13-2 PDF information for P1M

PDF Files	Devices supported
R403_MCU_P1M_04_05.arxml	701304, 701305
R403_MCU_P1M_10_to_15_18_to_23.arxml	701310, 701311, 701312, 701313, 701314, 701315, 7013018, 701319, 701320, 701321, 701322, 7013023

13.2. Sample Application

13.2.1 Sample Application Structure

The Sample Application is provided as reference to the user to understand the method in which the MCU APIs can be invoked from the application.

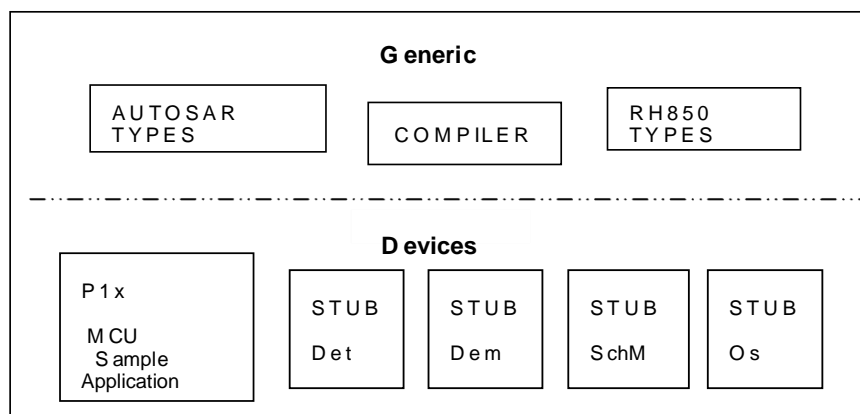


Figure 13-1 Overview of MCU Driver Sample Application

The Sample Application of the P1M is available in the path:

X1X\P1x\modules\mcu\sample_application

The Sample Application consists of the following folder structure:

```

X1X\P1x\modules\mcu\definition\<AUTOSAR_version>\<SubVariant>
\R403_MCU_P1M_04_05.arxml
\R403_MCU_P1M_10_to_15_18_to_23.arxml
X1X\P1x\modules\mcu\sample_application
    \<SubVariant>\<AUTOSAR_version>
        \src\Mcu_PBcfg.c
        \include\Mcu_Cfg.h
        \include\Mcu_Cbk.h
        \include\Mcu_Reg.h

    \config\App_MCU_P1M_701304_Sample.arxml
    \config\App_MCU_P1M_701304_Sample.html
    \config\App_MCU_P1M_701304_Sample.one

    \config\App_MCU_P1M_701305_Sample.arxml
    \config\App_MCU_P1M_701305_Sample.html
    \config\App_MCU_P1M_701305_Sample.one

    \config\App_MCU_P1M_701310_Sample.arxml
    \config\App_MCU_P1M_701310_Sample.html
    \config\App_MCU_P1M_701310_Sample.one

    \config\App_MCU_P1M_701311_Sample.arxml
    \config\App_MCU_P1M_701311_Sample.html
    \config\App_MCU_P1M_701311_Sample.one

    \config\App_MCU_P1M_701312_Sample.arxml
    \config\App_MCU_P1M_701312_Sample.html
    \config\App_MCU_P1M_701312_Sample.one

    \config\App_MCU_P1M_701313_Sample.arxml
    \config\App_MCU_P1M_701313_Sample.html
    \config\App_MCU_P1M_701313_Sample.one

    \config\App_MCU_P1M_701314_Sample.arxml
    \config\App_MCU_P1M_701314_Sample.html
    \config\App_MCU_P1M_701314_Sample.one

    \config\App_MCU_P1M_701315_Sample.arxml
    \config\App_MCU_P1M_701315_Sample.html
    \config\App_MCU_P1M_701315_Sample.one

    \config\App_MCU_P1M_701318_Sample.arxml
    \config\App_MCU_P1M_701318_Sample.html
    \config\App_MCU_P1M_701318_Sample.one

    \config\App_MCU_P1M_701319_Sample.arxml
    \config\App_MCU_P1M_701319_Sample.html
    \config\App_MCU_P1M_701319_Sample.one

    \config\App_MCU_P1M_701320_Sample.arxml
    \config\App_MCU_P1M_701320_Sample.html
    \config\App_MCU_P1M_701320_Sample.one

```

```
\config\App_MCU_P1M_701321_Sample.arxml  
\config\App_MCU_P1M_701321_Sample.html  
\config\App_MCU_P1M_701321_Sample.one
```

```
\config\App_MCU_P1M_701322_Sample.arxml  
\config\App_MCU_P1M_701322_Sample.html  
\config\App_MCU_P1M_701322_Sample.one
```

```
\config\App_MCU_P1M_701323_Sample.arxml  
\config\App_MCU_P1M_701323_Sample.html  
\config\App_MCU_P1M_701323_Sample.one
```

In the Sample Application all the MCU APIs are invoked in the following sequence:

- The API Mcu_Init is invoked with a valid database address for the proper initialization of the MCU Driver, all the MCU Driver control registers and RAM variables will get initialized after this API is called.
- The API Mcu_InitRamSection is invoked to initialize the RAM section wise as provided from the configuration structure.
- The API Mcu_InitClock is invoked to initialize the clock sources Main Osc, High Speed Internal ring Oscillator.
- The API Mcu_GetPllStatus is invoked to provide the lock status of the PLL. This API will return the PLLstatus as MCU_PLL_LOCKED or MCU_PLL_UNLOCKED.
- The API Mcu_GetResetReason is invoked to read the reset type from the hardware by checking the RESF register and if not supported, returns MCU_POWER_ON_RESET. This API shall clear the reset factor register.
- The API Mcu_GetResetRawValue is invoked to return reset type value from the hardware register RESF
- The API Mcu_GetVersionInfo is invoked to get the version of the MCU Driver module with a variable of Std_VersionInfoType, after the call of this API the passed parameter will get updated with the MCU Driver version details.
- The API Mcu_PerformReset invoked to microcontroller reset is performed by accessing the software reset register.
- The API Mcu_SetMode is invoked to activate the MCU power modes.

Remark To unmask all resets 'target pinmask k' command is used.

13.2.2 Building Sample Application

13.2.2.1. Configuration Example

This section contains the typical configuration which is used for measuring RAM/ROM consumption, stack depth and throughput details.

Configuration Details: App_MCU_P1M_701312_Sample.html

13.2.2.2. Debugging the Sample Application

Remark GNU Make utility version 3.81 or above must be installed and available in the path as defined by the environment user variable “GNUMAKE” to complete the build process using the delivered sample files.

Open a Command window and change the current working directory to “make” directory present as mentioned in below path:

“X1X\P1x\common_family\make\<compiler>”

Now execute the batch file SampleApp.bat with following parameters:

SampleApp.bat mcu <AUTOSAR_version> <Device_name>

- After this, the tool output files will be generated with the configuration as mentioned in App_MCU_P1M_701312_Sample.html file available in the path:

“X1X\P1x\modules\mcu\sample_application\<SubVariant>\<AUTOSAR_version>\config\App_MCU_P1M_701312_Sample.html”

- After this, all the object files, map file and the executable file App_MCU_P1M_Sample.out will be available in the output folder: (“X1X\P1x\modules\mcu\sample_application\<SubVariant>\obj\<compiler>”)
- The executable can be loaded into the debugger and the sample application can be executed

Remark Executable files with “*.out” extension can be downloaded into the target hardware with the help of Green Hills debugger.

- If any configuration changes (only post-build) are made to the ECU Configuration Description files
“X1X\P1x\modules\mcu\sample_application\<SubVariant>\<AUTOSAR_version>\config\App_MCU_P1M_701312_Sample.arxml”
- The database alone can be generated by using the following commands.
make -f App_MCU_P1M_Sample.mak generate_mcu_config
make -f App_MCU_P1M_Sample.mak App_MCU_P1M_Sample.s37
- After this, a flash able Motorola S-Record file App_MCU_P1M_Sample.s37 is available in the output folder.

Note: The <Device_name> indicates the device to be compiled, which can be 701304, 701305, 701310, 701311, 701312, 701313, 701314, 701315, 701318, 701319, 701320, 701321, 701322, 701323.

13.3. Memory and Throughput

13.3.1. ROM/RAM Usage

The details of memory usage for the typical configuration, with DET disabled as provided in Section 13.3.2.1 *Configuration Example* are provided in this section.

Table 13-3 ROM/RAM Details without DET

Sl. No.	ROM/RAM	Segment Name	Size in bytes in GHS
1.	ROM	MCU_PUBLIC_CODE_ROM	3578
		MCU_PRIVATE_CODE_ROM	2788
		MCU_FAST_CODE_ROM	1276
		MCU_CFG_DBTOC_UNSPECIFIED	52
		MCU_CFG_DATA_UNSPECIFIED	760
		ROM.RAM_1BIT	3
		ROM.RAM_32BIT	8
2.	RAM	RAM_UNSPECIFIED	16
		RAM_1BIT	3
		NOINIT_RAM_8BIT	0
		RAM_32BIT	8
		NOINIT_RAM_UNSPECIFIED	16
		MCU_CFG_RAM_UNSPECIFIED	0

The details of memory usage for the typical configuration, with DET enabled and all other configurations as provided in 13.3.2.1 *Configuration Example* are provided in this section.

Table 13-4 ROM/RAM Details with DET

Sl. No.	ROM/RAM	Segment Name	Size in bytes in GHS
1.	ROM	MCU_PUBLIC_CODE_ROM	3566
		MCU_PRIVATE_CODE_ROM	2788
		MCU_FAST_CODE_ROM	1276
		MCU_CFG_DBTOC_UNSPECIFIED	52
		MCU_CFG_DATA_UNSPECIFIED	760
		ROM.RAM_1BIT	3
		ROM.RAM_32BIT	8

Sl. No.	ROM/RAM	Segment Name	Size in bytes in GHS
2.	RAM	RAM_UNSPECIFIED	16
		RAM_1BIT	3
		NOINIT_RAM_8BIT	0
		RAM_32BIT	8
		NOINIT_RAM_UNSPECIFIED	16
		MCU_CFG_RAM_UNSPECIFIED	0

13.3.2. Stack Depth

The worst-case stack depth for MCU Driver Component for the typical configuration provided in Section 13.3.2.1 Configuration Example is approximately 64 bytes.

13.3.3. Throughput Details

The throughput details of the APIs for the configuration mentioned in the Section 13.3.2.1 Configuration Example is as given below.

Table 13-5 Throughput Details of the APIs

Sl. No.	API Name	Throughput in microseconds in GHS	Remarks
1.	Mcu_Init	45.5391	-
2.	Mcu_InitClock	154.55	-
3.	Mcu_GetPIIStatus	0.25	-
4.	Mcu_InitRamSection	9.137	-
5.	Mcu_GetResetReason	0.25	-
6.	Mcu_GetResetRawValue	0.25	-
7.	Mcu_GetVersionInfo	0.12	-
8.	Mcu_GetRamState	0.562	-
9.	Mcu_DistributePIIClock	0.12	-
10.	Mcu_SetMode	0.12	-
11.	Mcu_PerformReset	0.12	-
12.	Mcu_FEINT_ISR	0.437	-

Chapter 14 Release Details

MCU Driver Software

Version: 1.0.3

Revision History

Sl. No.	Description	Version	Date
1.	Initial Version	1.0.0	18-Oct-2013
2.	<p>Following changes are made:</p> <ol style="list-style-type: none"> Chapter 2 is updated for reference documents. Section 4.3 is updated for Exclusive Area name change. Section 4.4 is updated for adding user and supervisor mode details for new APIs. Chapter 6 is updated for Register details used in APIs. Chapter 8 is updated for adding file description for tool generated file 'Mcu_Cbk.h'. Section 10.3 is updated for adding new APIs in function definition. Section 11.1 is updated for adding DET error. Chapter 13 and section 13.1.1 is updated for adding new supported devices. Section 13.2 is updated for change in compiler and linker version details. Section 13.3 is updated for adding latest configuration details for supported devices. Section 13.3.2 is updated for change in configuration example for sample application testing. Section 13.4 is updated for updating ROM/RAM, Stack and Throughput details. Chapter 14 is updated for increment in MCU Driver software version. 	1.0.1	30-Apr-2014
3.	<p>Following changes are made:</p> <ol style="list-style-type: none"> Chapter 4 is updated for adding a new section regarding RAM Initialization. Chapter 13 and section 13.3.1 is updated for removal of unsupported devices. 	1.0.2	09-May-2014
4.	<p>Following changes are made:</p> <ol style="list-style-type: none"> Chapter 2 is updated for referenced documents version. Section 13.1.1 is updated for adding the device names. Section 13.2 is updated for compiler, assembler and linker details. Section 13.3 is updated to add parameter definition file and sample application configuration files for all P1M devices. Chapter 14 is updated for MCU driver component version information. Deviation list is updated to add MCU_E_PARAM_POINTER error for Mcu_GetVersiInfo API and AUTOSAR requirement. 	1.0.3	20-Oct-2014
5	<p>Following changes are made:</p> <ol style="list-style-type: none"> Chapters 7 to 11 updated to start at odd page. Date in Revision History updated. Document page numbers are corrected. Chapter 11 updated to add MCU_E_PARAM_MODE DET. Page number is removed from publication info page. Section 13.2 is updated for compiler, assembler and linker details. Chapter 8 is update to include rh850_types.h file. Section 13.4 is updated for Memory and throughput details. 	1.0.4	12-Dec-2014

6	<p>Following changes are made:</p> <ol style="list-style-type: none"> 1. New section, "4.7 Callout API" added to chapter 4. 2. Information regarding Interrupt vector table is added to "Section 4.1 General". 3. As part of device support activity for R7F701304, R7F701305, R7F701313, R7F701315, R7F701318 to R7F701323 updated sections 3.1.1, 13.1, 13.2. 4. Removed section Compiler, Linker and Assembler in Chapter 13. 5. Updated section 13.3 for memory and throughput 6. Copyright information has been changed to 2015 	1.0.5	30-Apr-2015
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