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Initial Program Loader for CR7

Release Note: Software

R-Car H3/M3/M3N/E3 Series

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How to Use This Manual

- **[Readers]**

This manual is intended for engineers who develop products which use the R-Car H3/M3/M3N/E3 processor.

- **[Purpose]**

This manual is intended to give users an understanding of the functions of the R-Car H3/M3/M3N/E3 processor device driver and to serve as a reference for developing hardware and software for systems that use this driver.

- **[How to Read This Manual]**

It is assumed that the readers of this manual have general knowledge in the fields of electrical

— Engineering, logic circuits, microcontrollers, and Linux.

→ Read this manual in the order of the CONTENTS.

— To understand the functions of a multimedia processor for R-Car H3/M3/M3N/E3

→ See the R-Car H3/M3/M3N/E3 User's Manual.

— To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N/E3

→ See the R-Car H3/M3/M3N/E3 Data Sheet.

- **[Conventions]**

The following symbols are used in this manual.

Data significance: Higher digits on the left and lower digits on the right

Note: Footnote for item marked with Note in the text

Caution: Information requiring particular attention

Remark: Supplementary information

Numeric representation: Binary ... xxxx, 0bxxxx, or xxxxB

Decimal ... xxxx

Hexadecimal ... 0xxxx or xxxxH

Data type: Double word ... 64 bits

Word ... 32 bits

Half word ... 16 bits

Byte ... 8 bits

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1. Introduction

1.1 Objectives

This manual explains the package construction of R-Car H3/M3/M3N/E3 Initial Program Loader for CR7 (hereinafter called "Loader").

1.2 References

[1] Renesas Electronics Corp., *Linux Interface Specification Yocto recipe Start-Up Guide*.

[2] Renesas Electronics Corp., *Initial Program Loader for CR7 User's Manual*.

2. Component

The following is included in this product.

2.1 Software components

The following shows Loader and related programs.

RTOS is the Real Time OS that runs on the Cortex-R7.

CA57/53 Loader (hereinafter called "CA5x Loader") is the boot program of the Main CPU(work on the Cortex-A57/53).

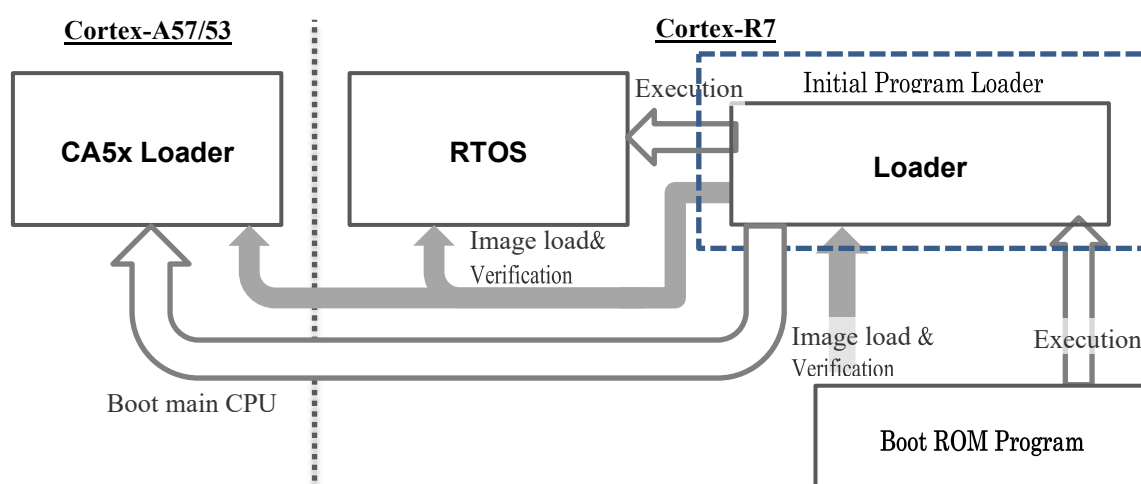


Figure 1 Software components

2.2 Software

Loader loads images and certificates of RTOS, CA5x Loader, and verifies the images and certificates, and executes RTOS, and boot the Main CPU(Cortex-A57/53).

2.3 Initial Clock setting

Initial clock setting of each module at that time of exit for the Initial Program Loader is below.

2.3.1 R-Car H3 Ver.2.0 / Ver.3.0

Module	Initial clock setting
Cortex-R7	800 MHz
Cortex-A57	1500 MHz
Cortex-A53	1200 MHz
3DGE	600 MHz
System (AXI-bus)	400 MHz
LPDDR4-SDRAM	DDR3200 (MD19=ON/MD17=ON)

2.3.2 R-Car M3 Ver.1.1 / Ver.1.2 / Ver.1.3 / Ver.3.0

Module	Initial clock setting
Cortex-R7	800 MHz
Cortex-A57	1500 MHz
Cortex-A53	1200 MHz
3DGE	600 MHz
System (AXI-bus)	400 MHz
LPDDR4-SDRAM	DDR3200 (MD19=ON/MD17=ON)

2.3.3 R-Car M3N Ver.1.1

Module	Initial clock setting
Cortex-R7	800 MHz
Cortex-A57	1500 MHz
3DGE	600 MHz
System (AXI-bus)	400 MHz
LPDDR4-SDRAM	DDR3200 (MD19=ON/MD17=ON)

2.3.4 R-Car E3 Ver.1.0 / Ver.1.1

Module	Initial clock setting
Cortex-R7	800 MHz
Cortex-A53	1200 MHz
3DGE	600 MHz
System (AXI-bus)	266 MHz
DDR3L-SDRAM	DDR1856 (MD19=OFF)

3. Change History

Following change histories are representative lists.

3.1 IPL Version.1.0.7

First release version.

3.2 IPL Version.1.0.8

Fix and add about following restrictions and functions.

No.	Description
#128714	Fix M3 ECC enable area set to Linear split.

3.3 IPL Version.1.0.9

Fix and add about following restrictions and functions.

No.	Description
#125204	Add DRAM split 2ch for H3.
#127024	Update of CPG setting code for each LSI.
#127444	Fix load area check judge.
#129889	Fix report_exception code. Remove tcm_loader code. Move prr register define to common header file. Remove some unnecessary processing. Fix some comments.
#134489	Update QoS/DDR code. QoS H3Ver1.0:rev.0.36 H3Ver1.1:rev.0.37 H3Ver2.0:rev.0.18 M3Ver1.0:rev.0.19 M3Ver1.1:rev.0.16 DDR:Rev0.27
#135444	Fix unused register setting.
#139645	Remove fault status and fault address register clear code.
#141490	Update CPG setting code.
#141517	Fix Power-Up/Down Mechanism code. Remove 10us wait for DRAM/SRAM protection. Remove IPMMU/SystemRAM ECC section. Remove PFC setting from SCIF setting.
#143525	Fix loader_main code.

3.4 IPL Version.1.0.10

Fix and add about following restrictions and functions.

No.	Description
#141249	Fix disappearance of first transaction.
#147141	Fix panic if DRAM ECC area and extra area set same area.
#147161	Fix LifeC dummy read after access protection setting.
#150908	Update IPL version.
#150922	Change comment from "WS" to "Ver".
#150938	Fix micro_wait correction.
#153857	Add CPG setting code for M3N.
#153858	Add PFC setting code for M3N.
#153859	Update DDR setting code. DDR:rev.0.29
#153860	Update QoS setting code. H3 Ver.1.0:rev.0.36 H3 Ver.1.1:rev.0.37 H3 Ver.2.0:rev.0.19 M3 Ver.1.0:rev.0.19 M3 Ver.1.1:rev.0.17 M3N Ver.1.0:rev.0.05 M3N Ver.1.1:rev.0.05
#153861	Add version determination for M3N.
#153862	Add compile options for M3N.
#154314	Add D-Cache invalidate in entry point.
#156536	Change eMMC driving abilities.
#156773	Remove unnecessary code in PFC setting code.
#157613	Update PFC setting code.
#157731	Update LifeC setting code.
#158190	Remove private register code in rom_api.c.
#158272	Update LSI_CUT option code.

3.5 IPL Version.1.0.11

Fix and add about following restrictions and functions.

No.	Description
#158445	Modify array size of IPL version.
#159115	Modify bit 29/28 of RMSTPCR2/SMSTPCR2 in H3/M3/M3N.
#162330	Optimize the micro_wait function.
#172247	Add build option for E3 Ver.1.0.
#172252	Modify size of the SystemRAM for E3 from 384KB to 128KB.
#172254	Add E3 to the LSI display.
#172258	Modify magic number to macro definition.
#172261	Modify the clock setting of SCIF2 according to the setting of MD12.
#172264	Add CPG setting for E3.

#172268	Add PFC/GPIO setting for E3.
#172270	Add LifeC setting for E3.
#172273	Add support the dummy certificate of IPL for E3.
#172278	Add display of boot device and Hyper Flash Clock for E3.
#172282	Add display whether RCAR_KICK_MAIN_CPU is set.
#172284	Fix checking loadable area in Flash.
#172285	Fix checking loadable area in RAM.
#172305	Modify round up to the 256 bytes boundaries for DMA transfer from RPC.
#172313	Add read the status after writing MSTP register
#172329	Add DDR Memory Config log output.
#172340	Fix the SWTCNT setting of E3.
#172345	Modify the Define name containing the character of ES.
#172349	Update DDR setting for H3/M3/M3N. DDR : rev.0.33
#172354	Add QoS setting for E3 and Update QoS setting for M3N. E3 Ver.1.0 : rev.0.02 M3N Ver.1.0 : rev.0.06 M3N Ver.1.1 : rev.0.06
#172360	Add Ver.1.2 to version display of M3 Ver.1.1.
#172362	Add comment to GIC setting code on CR7.
#172365	Remove unnecessary code.
#172368	Modify alignment of loader_ro section and data section.
#172378	Fix to add dummy read in the last of LifeC setting code.
#173658	Modify to access ITCM after enabling ITCM
#179410	Add judgement of whether the SWDT_COUNT_SEC is in valid range.
#181686	Move a part of processing in tcm_loader to tcm_loader_main.
#183705	Modify bit 21 of the RMSTPCR0 in H3/M3/M3N.
#184186	Fix PFC/GPIO setting for H3.
#184598	Add DDR setting for E3. DDR : rev.0.06
#184630	Add QoS setting for H3 Ver.3.0. H3 Ver.3.0 : rev.0.07
#185671	Fix there is no alignment in bss section.
#186375	Fix value of the WDCNT for H3 Ver.1.0.
#187075	Modify the wording "R-Car Gen3" to "R-Car Series, 3rd Generation"
#187076	Remove log output of "R-Car Gen3 tcm loader(CR7)".
#188832	Modify address of content certificate for the CA5x Loader to 0xE6302000.

3.6 IPL Version.1.0.12

Fix and add about following restrictions and functions.

No.	Description
#198658	Update DDR setting code. H3/M3/M3N : rev.0.34 E3 : rev.0.11
#198663	Update QoS setting code. H3 Ver.2.0 : rev.0.20 H3 Ver.3.0 : rev.0.10 M3 Ver.1.1 : rev.0.18 M3N Ver.1.1 : rev.0.08 E3 Ver.1.0 : rev.0.05

3.7 IPL Version.2.0.0

Fix and add about following restrictions and functions.

No.	Description
#179940	Fix no build error when specified build option DEBUG=1.
#181692	Optimize processing of loading certificate and enabling exception.
#182465	Unify license comment.
#182606	Modify the part exceeding 80 columns in source code.
#182712	Modify micro_wait function by using Global Timer.
#185882	Add error log output judgment when CA5x CPU is kicked.
#186363	Add build option for H3N.
#187071	Modify Dual Channel ECC function for H3 Ver.3.0(SDRAM 8GB).
#193787	Add DDR Memory Config log output for E3.
#193892	Add Single Channel ECC function and modify Dual Channel ECC function.
#193904	Modify CPG setting in RMSTPCR4, RMSTPCR8 and RMSTPCR9.
#193918	Fix to conform to QAC.
#193919	Modify the condition of data transmission end of SCIF transmission.
#193920	Modify address area in the DDR memory config log output for H3 Ver.3.0.
#194899	Remove unused macros of CPG registers.
#196363	Unify the notation method of include files.
#201060	Modify Dual Channel ECC function so that support for specifying build option RCAR_DRAM_SPLIT=AUTO.
#201529	Remove unnecessary processing in Dual Channel ECC function.
#207843	Fix processing of filling System RAM with 0.
#208229	Fix tcm_loader_main function and processing of loading certificate.
#208857	Update DDR setting code. H3/M3/M3N : rev.0.34patch1

#209097	Update QoS setting code. H3 Ver.2.0 : rev.0.21 H3 Ver.3.0 : rev.0.11 M3 Ver.1.1 : rev.0.19 M3N Ver.1.1 : rev.0.09
#209341	Modify enabling the build option of periodic write DQ training.

3.8 IPL Version.2.0.1

Fix and add about following restrictions and functions.

No.	Description
#202594	Clean up source code by applying checkpatch.pl.
#210680	Modify suffix of address definition for single channel ECC.
#216183	Add PHY calibration setting when initialize RPC driver.
#216964	Modify according to Errata of Hardware User's Manual. - Modify PFC setting code. - Rename macro of MFIS register.
#217790	Update DDR setting for H3/M3/M3N to rev.0.36.
#217793	Add QoS setting for M3 Ver.3.0. - M3 Ver.3.0 QoS setting rev.0.03. - Add copyright and license headers. - Clean up QoS setting code.
#217809	Add support for M3 Ver.1.3/Ver.3.0.
#217811	Add support for E3 Ver.1.1.
#217816	Modify Dual Channel ECC setting code for M3 Ver.3.0.
#217817	Modify Single Channel ECC setting code for M3 Ver.3.0.
#217820	Remove unnecessary object in linker script.
#218796	Update DDR setting for E3 to rev.0.12.
#221056	Add internal bus interface check of DDR-PHY register for M3N.

3.9 IPL Version.2.0.2

Fix and add about following restrictions and functions.

No.	Description
#221806	Add build option for internal bus interface check of DDR-PHY register.
#221828	Add internal bus interface check of DDR-PHY register for H3.
#223012	Add comment to some switch statement.

3.10 IPL Version.2.0.3

Fix and add about following restrictions and functions.

No.	Description
#225618	Update DDR setting for H3/M3/M3N to rev.0.38.
#225620	Update QoS setting for M3 Ver.3.0 to rev.0.04.
#225621	Update internal bus interface check of DDR-PHY register to rev.0.07.
#227334	Change the license from BSD-3-clause to proprietary.
#228609	Add internal bus interface check of DDR-PHY register for M3.

3.11 IPL Version.2.0.4

Fix and add about following restrictions and functions.

No.	Description
#243487	Update DDR setting for H3/M3/M3N to rev.0.39.

3.12 IPL Version.2.0.5

Fix and add about following restrictions and functions.

No.	Description
#249210	Update DDR setting for H3/M3/M3N to rev.0.40.

3.13 IPL Version.2.0.6

Fix and add about following restrictions and functions.

No.	Description
#251176	Modify the license and the copyright (change only comments). <ul style="list-style-type: none"> - Change the license from BSD-3-clause to proprietary and remove the copyright of ARM Limited and Contributors (rcar_pwrc.c, rcar_pwrc.h, rcar_version.c). - Change the license from proprietary to BSD-3-clause and add the copyright of ARM Limited and Contributors (mmio.h). - Remove the copyright of Renesas Electronics Corporation (debug.h).

3.14 IPL Version.2.0.7

Fix and add about following restrictions and functions.

No.	Description
#303494	Update DDR setting for H3/M3/M3N to rev.0.41.

3.15 IPL Version.2.0.8

Fix and add about following restrictions and functions.

No.	Description
#329024	Changed the size of RTOS to 24MiB
#338600	LifeC settings have been disabled by default.

3.16 IPL Version.2.0.9

Fix about following restrictions and functions.

No.	Description
#122321	Removed hardware restrictions from the user's manual

4. Confirming the execution software components

When you confirm executing Initial Program Loader, please follow the documents [1].
The hardware environment is below.

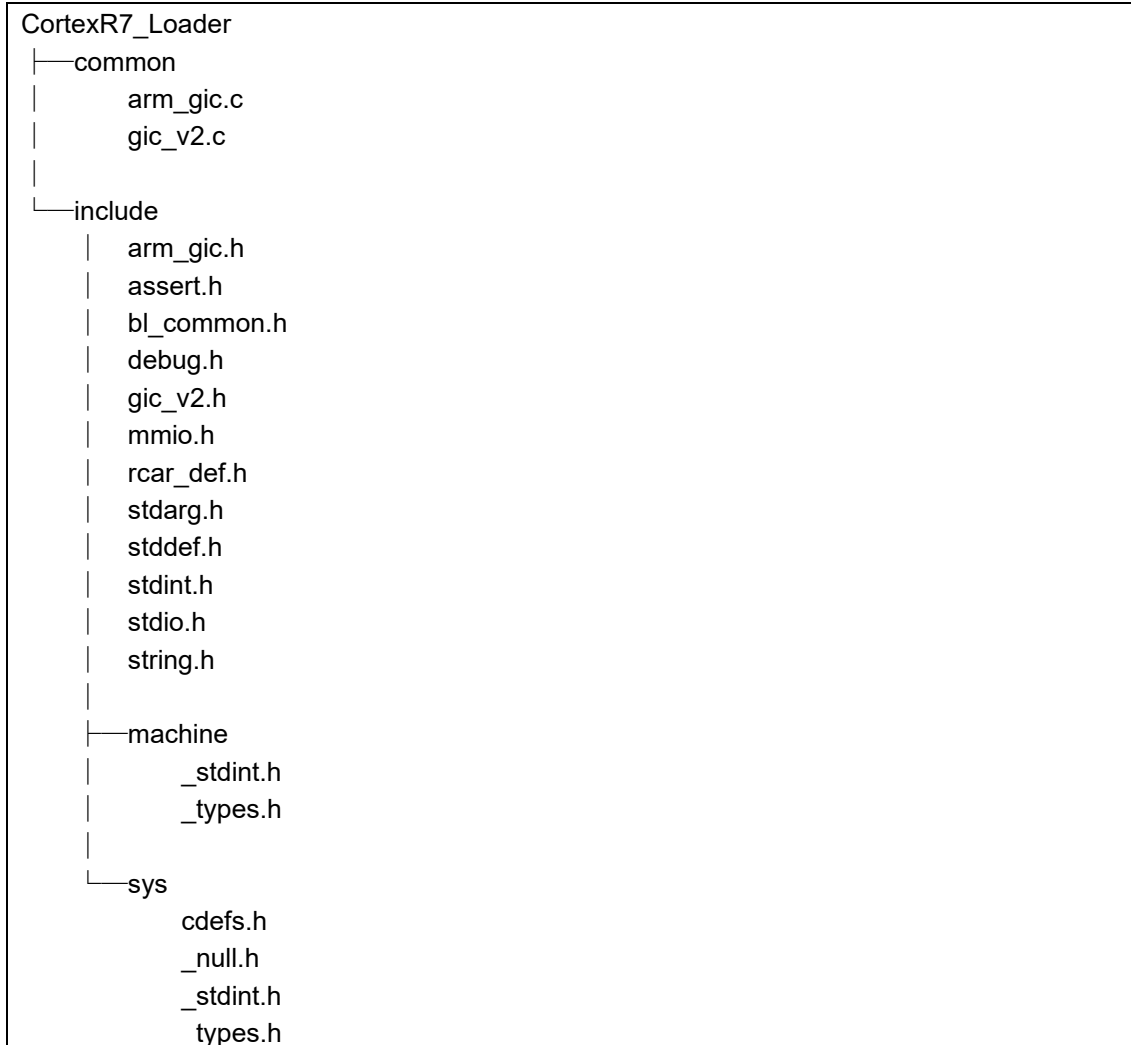
- SoC
 - R-Car H3
 - R-Car M3
 - R-Car M3N
 - R-Car E3
- Board
 - System Evaluation Board "Salvator-X"
 - System Evaluation Board "Salvator-XS"
 - System Evaluation Board "Ebisu"
 - System Evaluation Board "Ebisu-4D"

5. Restrictions

There are no restrictions in Loader.

6. Notice

The following shows the files that are licensed as BSD.



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REVISION HISTORY	Initial Program Loader for CR7 Release Note: Software
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Rev.	Date	Description	
		Page	Summary
1.0.0	May 31, 2017	—	New creation.
1.0.1	Jul. 7, 2017	4	3.Change History 3.2 Add history of Rev.1.0.1.
1.0.2	Nov.24,2017	4	3.Change History 3.3 Add history of Rev.1.0.2.
1.0.3	Mar.9,2018	1	1.1Objectives Added the M3N.
		3	2.Component 2.3.5 Added information of the M3N.
		5	3.Change History 3.4 Added the Rev.1.0.3.
		6	4. Confirming the execution software components Added the M3N.
1.0.4	Oct. 31, 2018	1	1.1 Objectives Added R-Car E3.
		3	2.3.3 R-Car H3 Ver.2.0 / Ver.3.0 2.3.4 R-Car M3 Ver.1.0 / Ver.1.1 / Ver.1.2 2.3.6 R-Car E3 Ver.1.0 Added H3 Ver.3.0 / M3 Ver.1.2 / E3 Ver.1.0.
		5 - 6	3.5 Rev.1.0.4 Added Rev.1.0.4.
		7	4. Confirming the execution software components Added R-Car E3 and Ebisu.
1.0.5	Dec. 21, 2018	2	2.3 Initial Clock setting Removed H3 Ver.1.0/Ver.1.1.
		3	2.3 Initial Clock setting Removed M3 Ver.1.0.
		7	3.6 Rev.1.0.5 Added Rev.1.0.5.
		8	4. Confirming the execution software components Added Ebisu-4D.
1.0.6	Mar. 29, 2019	7-8	3.7 Rev.1.0.6 Added Rev.1.0.6
1.0.7	Jun. 28, 2019	2	2.3.2 R-Car M3 Ver.1.1 / Ver.1.2 / Ver.1.3 / Ver.3.0 Added M3 Ver.1.3 / Ver.3.0.
		3	2.3.4 R-Car E3 Ver.1.0 / Ver.1.1 Added E3 Ver.1.1.
		4-7	3.1 IPL Version.1.0.7 3.2 IPL Version.1.0.8 3.3 IPL Version.1.0.9 3.4 IPL Version.1.0.10 3.5 IPL Version.1.0.11 3.6 IPL Version.1.0.12 3.7 IPL Version.2.0.0 Renamed section name from document version to IPL version.
		8	3.8 IPL Version.2.0.1 Added IPL Version.2.0.1.
1.0.8	Jul. 5, 2019	8	3.9 IPL Version.2.0.2 Added IPL Version.2.0.2.
1.0.9	Sep. 19, 2019	9	3.10 IPL Version.2.0.3 Added IPL Version.2.0.3.
1.0.10	Dec. 16, 2019	9	3.11 IPL Version.2.0.4 Added IPL Version.2.0.4.
1.0.11	Jan. 21, 2020	9	3.12 IPL Version.2.0.5 Added IPL Version.2.0.5.

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Rev.	Date	Description	
		Page	Summary
1.0.12	Feb. 7, 2020	9	3.13 IPL Version.2.0.6 Added IPL Version.2.0.6.
		12	6.Notice Added the list of files that are licensed as BSD.
1.0.13	Jan. 15, 2021	9	3.14 IPL Version.2.0.7 Added IPL Version.2.0.7.
1.0.14	Jan 21, 2022	10	3.15 IPL Version.2.0.8 Changed the IPL Version parameter settings.
1.0.15	Apr 25, 2022	10	3.16 IPL Version 2.0.9 Removed hardware restrictions from the user's manual

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