User's Manual

CONFIDENTIAL

Linux Interface Specification Device Driver MFISLock

User's Manual: Software

R-Car H3/M3/M3N/E3/D3 Series

Renesas Electronics
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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
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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/D3 processor.

- **[Purpose]**
  This manual is intended to give users an understanding of the functions of the R-Car H3/M3/M3N/E3/D3 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/D3
  → See the R-Car H3/M3/M3N/E3/D3 User's Manual.
  — To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N/E3/D3
  → See the R-Car H3/M3/M3N/E3/D3 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 ... ××××, 0b××××, or ××××B
  Decimal ... ××××
  Hexadecimal ... 0x×××× or ××××H
  Data type: Double word … 64 bit
  Word … 32 bits
  Half word ... 16 bits
  Byte ... 8 bits

Table of Contents

1. Overview

1.1 Overview

This manual explains the MFISLock driver module that controls MFIS on R-Car H3/M3/M3N/E3/D3.

1.2 Function

This module controls MFIS on R-Car H3/M3/M3N/E3/D3 and provides Mutex function between heterogeneous processors. This function is implemented using MFIS lock registers.

1.3 Reference

1.3.1 Standard

There is no reference document on standards.

1.3.2 Related Documents

The following table shows the document related to this module.

Table 1.1 Related documents (R-Car H3/M3/M3N/E3/D3)

Number	Issue	Title	Edition	Date
-	Renesas Electronics	R-Car Series, 3rd Generation User's Manual: Hardware	Rev.2.20	Jun. 30, 2020
-	Renesas Electronics	R-CarH3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7795SIPB0011S	Rev.1.09	May. 11, 2017
-	Renesas Electronics	R-CarM3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7796SIPB0011S	Rev.0.04	Oct. 3, 2016
-	Renesas Electronics	R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS Hardware Manual	Rev.2.04	Jul. 17, 2018
-	Renesas Electronics	R-CarE3 System Evaluation Board Ebisu Hardware Manual RTP0RC77990SEB0010S	Rev.0.03	Apr. 11, 2018
-	Renesas Electronics	R-CarE3 System Evaluation Board Ebisu-4D (E3 board 4xDRAM) Hardware Manual	Rev.1.01	Jul. 19, 2018
-	Renesas Electronics	R-CarD3 System Evaluation Board Hardware Manual RTP0RC77995SEB0010S	Rev.1.20	Jul. 25, 2017

Table 1.2 Related Linux kernel Documentaion (R-Car H3/M3/M3N/E3/D3)

File	Title	Linux version
Documentation/hwspinlock.txt	Hardware Spinlock Framework	v4.14

1.4 Restrictions

There are no restrictions.

1.5 Notice

There are no notice.

2. Terminology

The following table shows the terminology related to this module.

Table 2.1 Terminology

Terms	Explanation
MFIS	Multifunctional Interface of R-Car SoC
hwspinlock	Hardware Spinlock Framework in Linux kernel
PFC	Pin Function Controller of R-Car SoC
CPG	Clock Pulse Generator of R-Car SoC

3. Operating Environment

3.1 Hardware Environment

The following table lists the hardware needed to use this module.

Table 3.1 Hardware environment (R-Car H3 / M3 / M3N / E3 /D3)

Name	Version	Manufacturer
R-CarH3-SiP System Evaluation Board Salvator-X	-	Renesas Electronics
R-CarM3-SiP System Evaluation Board Salvator-X	-	Renesas Electronics
R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS	-	Renesas Electronics
R-CarE3 System Evaluation Board Ebisu	-	Renesas Electronics
R-CarE3 System Evaluation Board Ebisu-4D	-	Renesas Electronics
R-CarD3 System Evaluation Board	-	Renesas Electronics

3.2 Module Configuration

The following figure shows the configuration of this module.

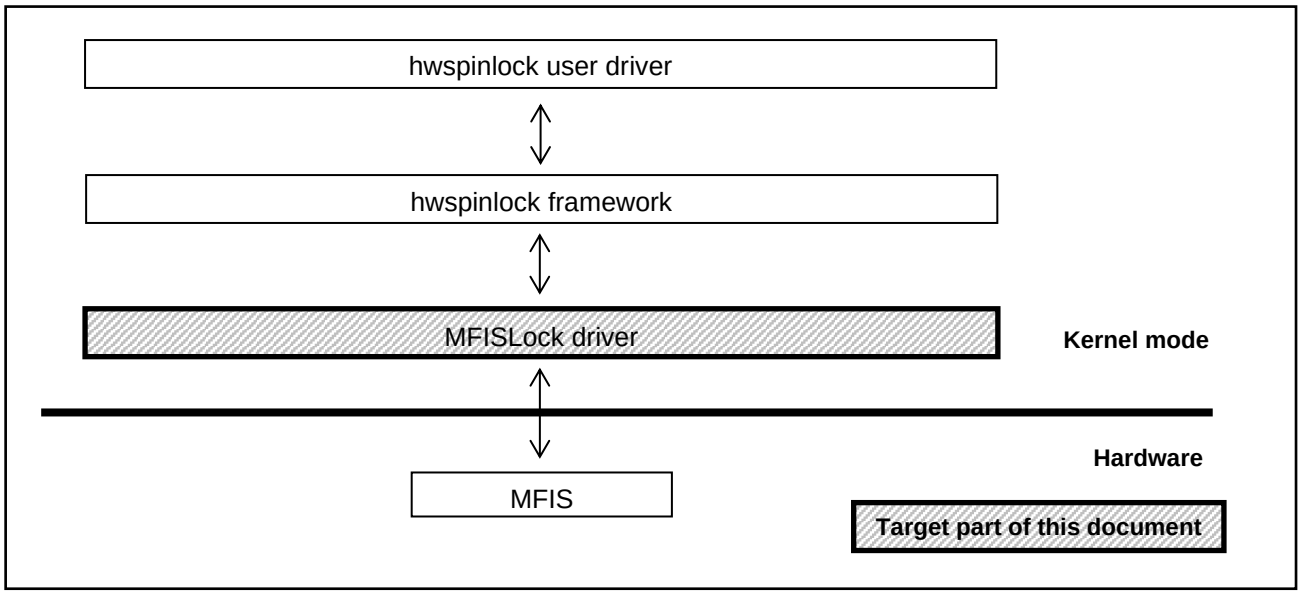

Figure 3.1 Module Configuration (R-Car H3 / M3 / M3N / E3 /D3)

3.3 State Transition Diagram

There is no state transition diagram for this module.

4. External Interface

Detailed explanation is skipped because the external interface of this module is based on Linux hwspinlock framework. Please refer to Linux kernel Documentation.

The external functions supported by this module are shown below.

Table 4.1 List of external interface supported function for MFISLock driver

Number	Support interface name	summary
1	hwspin_lock_request_specific	reserve hwspinlock with specific id
2	hwspin_lock_free	free hwspinlock
3	hwspin_trylock	attempt to lock hwspinlock
4	hwspin_unlock	unlock hwspinlock

The number of available hwspinlock is equal to the number of MFIS Lock registers, and is shown below.

Table 4.2 The number of available hwspinlock (R-Car H3/M3/M3N/E3/D3)

SoC	SoC Ver	The number of available hwspinlock
R-Car H3	Ver.1.1	8
	Ver.2.0 or later	64 *1
R-Car M3	Ver.1.1, Ver.1.2, Ver.1.3	8
	Ver.3.0 or later	64
R-Car M3N	Ver.1.1 or later	64 *1
R-Car E3	Ver.1.0 or later	64
R-Car D3	Ver.1.1	64

Note *1: Supported from BSP v3.5.9.

The hwspinlock ID is equal to the index of MFIS Lock register. Examples are shown below.

Table 4.3 Relation between channel of MFIS Lock register and IDs

MFIS Lock register channel	hwspinlock ID
MFISLCKR0	0
MFISLCKR1	1
MFISLCKR2	2
:	:
MFISLCKR62	62
MFISLCKR63	63

5. Integration

5.1 Directory Configuration

The directory configuration is shown below

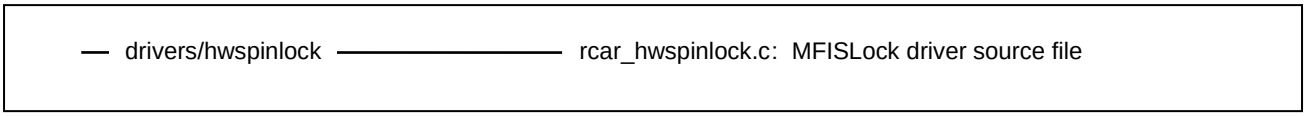

Figure 5.1 Directory Configuration (R-Car H3/M3/M3N/E3/D3)

5.2 Integration Procedure

To enable the function of this module, make the following setting with Kernel Configuration.

```
Device Drivers  --->
        Hardware Spinlock drivers  --->
          [*] R-Car Hardware Spinlock functionality
```

Figure 5.2 Kernel configuration

5.3 Option Setting

5.3.1 Module Parameters

There are no module parameters.

5.3.2 Kernel Parameters

There are no kernel parameters

REVISION HISTORY		Linux Interface Specification Device Driver MFISLock User's Manual: Software	
Rev.	**Date**	**Description**	
		Page	**Summary**
0.1	Dec. 16, 2016	-	New creation.
0.2	Mar. 15, 2017	1	Added R-Car Series, 3rd Generation User's Manual: Hardware Rev0.53 to Related Documents.
		1	Added R-CarH3-SiP/M3-SiP System Evaluation Board Salvator-XS Hardware Manual to Related Documents.
		1	Supported to control Mutex for HW access of PFC or CPG while booting up Linux kernel.
		3	Added R-CarH3-SiP/M3-SiP System Evaluation Board Salvator-XS.
		-	Updated Address List
0.3	Jun. 14, 2017	1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.0.54.
1.00	Aug. 8, 2017	All	Update document format.
1.01	Oct. 24, 2017	All	Supported R-Car M3N.
		1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.0.55.
		4	Supported the increase of hwspinlock from 8 to 64 on R-Car H3 Ver.2.0 and M3N.
1.50	Jan. 29, 2018	1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.0.80.
		1	Updated Linux version of the hwspinlock document to v4.14.
		-	Updated Address List.
1.51	Mar. 28, 2018	All	Supported R-Car E3.
		3	Added R-CarE3 System Evaluation Board Ebisu.
1.52	Jun. 27, 2018	4	Added R-Car M3 Ver.1.2 in Table 4.2.
1.53	Oct. 29, 2018	1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.1.00.
2.00	Dec. 25, 2018	1	Table 1.1 Updated R-CarH3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7795SIPB0011S to Rev.1.09.
		1	Table 1.1 Updated R-CarM3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7796SIPB0011S to Rev.0.04.
		1	Table 1.1 Updated R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS Hardware Manual to Rev.2.04.
		1	Table 1.1 Updated R-CarE3 System Evaluation Board Ebisu Hardware Manual RTP0RC77990SEB0010S to Rev.0.03.
		1	Table 1.1 Added R-CarE3 System Evaluation Board Ebisu-4D (E3 board 4xDRAM) Hardware Manual.
		4	Table 3.1 Updated the Name of R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS.
		4	Table 3.1 Added R-CarE3 System Evaluation Board Ebisu-4D.
		-	Updated Address List.
2.01	Apr. 17, 2019	1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.1.50.
		5	Added R-Car M3 Ver.1.3, Ver.3.0 or later and R-Car E3 Ver.1.0 later in Table 4.2.
		-	Updated Address List.
2.50	Apr. 21, 2021	1	Updated R-Car Series, 3rd Generation User's Manual: Hardware to Rev.2.20.
		1	Added R-CarD3 System Evaluation Board Hardware Manual to Related Documents.
		5	Added R-CarD3 System Evaluation Board in Table 3.1.
		6	Added R-Car D3 Ver.1.1 in Table 4.2.
		All	Supported R-Car D3.

3.00	Dec. 10, 2021	-	Add Kernel v5.10.41 support

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Renesas Electronics Corporation
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc. Milpitas Campus
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics America Inc. San Jose Campus
6024 Silver Creek Valley Road, San Jose, CA 95138, USA
Tel: +1-408-284-8200, Fax: +1-408-284-2775

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai 200333, China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, #06-02 Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia
Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

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