

CONFIDENTIAL

Linux Interface Specification Device Driver MSIOF

User's Manual: Software

R-Car H3/M3/M3N/E3/D3/V3U/V3H Series

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (<http://www.renesas.com>).

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

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

www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.

CONFIDENTIAL

Trademark

- Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.
- Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.
- Other company names and product names mentioned herein are registered trademarks or trademarks of their respective owners.
- Registered trademark and trademark symbols (® and ™) are omitted in this document

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/V3U/V3H processor.

- **[Purpose]**

This manual is intended to give users an understanding of the functions of the R-Car H3/M3/M3N/E3/D3/V3U/V3H 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/V3U/V3H

→ See the R-Car H3/M3/M3N/E3/D3V3U/V3H User's Manual.

— To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N/E3/D3V3U/V3H

→ See the R-Car H3/M3/M3N/E3/D3V3U/V3H 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 ... 0xxxxx or xxxxH

Data type: Double word ... 64 bit

Word ... 32 bits

Half word ... 16 bits

Byte ... 8 bits

CONFIDENTIAL

Table of Contents

| | |
|-------------------------------------|----|
| 1. Overview | 1 |
| 1.1 Overview | 1 |
| 1.2 Function | 1 |
| 1.3 Connected device | 2 |
| 1.4 Reference | 3 |
| 1.4.1 Standard | 3 |
| 1.4.2 Related documents | 3 |
| 1.5 Restriction | 4 |
| 1.6 Notice | 4 |
| 2. Operating Environment | 5 |
| 2.1 Hardware Environment | 5 |
| 2.2 Module Configuration | 5 |
| 2.3 State Transition Diagram | 5 |
| 3. External Interface | 6 |
| 4. Integration | 7 |
| 4.1 Directory Configuration | 7 |
| 4.2 Integration Procedure | 8 |
| 4.2.1 Device tree setting | 8 |
| 4.2.1.1 Pin Function setting | 9 |
| 4.2.1.2 Clock setting | 12 |
| 4.2.1.3 Channel Node setting | 13 |
| 4.2.1.4 sub node setting | 14 |
| 4.2.2 Add userspace interface | 15 |
| 4.2.3 Kernel configuration | 15 |
| 4.3 Option Setting | 16 |
| 4.3.1 Module Parameters | 16 |
| 4.3.2 Kernel Parameters | 16 |

1. Overview

1.1 Overview

This manual explains the driver module (this module) that controls the MSIOF Interfaces on R-Car H3/M3/M3N/E3/D3/V3U/V3H.

1.2 Function

This module transmits/receives data to/from a device connected to MSIOF on the R-Car H3/M3/M3N/E3/D3/V3U/V3H. The following table lists the function of this module.

Table 1.1 Driver Function

| Function | Support status (R-Car H3/M3/M3N/E3/D3/V3H) | Support status (R-Car V3U) |
|--------------------------|--|----------------------------|
| Number of channels | 4 | 6 |
| Channel | Ch0 ~ Ch3 | Ch0 ~ Ch5 |
| Master Mode | Support | |
| Slave Mode | Support | |
| DMA function | Support | |
| MSIOF Chip select signal | Hardware control | |
| Settable word size | 8, 16, 32 bits | |
| Settable transfer size | Set multiple of the word size by byte unit. | |
| Module Clock | R-Car H3/M3/M3N/E3/D3/V3U/V3H: 12.5MHz (initial value) - 133.33MHz | |
| Max transfer frequency | For R-Car H3/M3/M3N/E3/D3/V3U/V3H: MSIOF_SCK clock cycle time (when master TX or slave RX): "Module Clock" / 4 MSIOF_SCK clock cycle time (when master RX or slave TX): "Module Clock" / 8 Please designate the set value which considered an electrical characteristic as the transfer rate designated by application. (refer to R-Car Series, "3rd Generation Additional Document for User's Manual: Hardware") | |

When you would like to use DMA transfer, please set the transfer size to the value calculated by the following Equation1. Other sizes will transfer 256m by DMA and transfer the remainder by PIO.

DMA transfer size = $16 + 4n + 256m$. . . (Equation1)

n: 0, 1, 2, ~ 60

m: 0, 1, 2, ...

Ex)

In case of 510 bytes, 256 bytes will be transferred by DMA and 254 bytes will be transferred by PIO.

In case of 568 bytes, 256 bytes and 256 bytes and 56 bytes will be transferred by 3 times DMA.

In case of 266 bytes, 256 bytes will be transferred by DMA and 10 bytes will be transferred by PIO.

1.3 Connected device

This chapter describes the connected device to MSIOF. Please refer to the following tables for each device.

Table 1.2 MSIOF Connected device (R-Car H3/M3/M3N)

| MSIOF Channel | Connected device | Support Status | Note |
|---------------|------------------|----------------|------|
| Ch0 | None | No | — |
| Ch1 | None | No | — |
| Ch2 | None | No | — |
| Ch3 | None | No | — |

Table 1.3 MSIOF Connected device (R-Car E3)

| MSIOF Channel | Connected device | Support Status | Note |
|---------------|-------------------------------|----------------|------|
| Ch0 | LVDS Control Connector – CN41 | No | — |
| Ch1 | None | No | — |
| Ch2 | None | No | — |
| Ch3 | None | No | — |

Table 1.4 MSIOF Connected device (R-Car D3)

| MSIOF Channel | Connected device | Support Status | Note |
|---------------|-------------------------------|----------------|------|
| Ch0 | None | No | — |
| Ch1 | None | No | — |
| Ch2 | LVDS Control Connector – CN41 | No | — |
| Ch3 | None | No | — |

Table 1.5 MSIOF Connected device (R-Car V3U)

| MSIOF Channel | Connected device | Support Status | Note |
|---------------|------------------|----------------|------|
| Ch0 | None | No | — |
| Ch1 | None | No | — |
| Ch2 | None | No | — |
| Ch3 | None | No | — |
| Ch4 | None | No | — |
| Ch5 | None | No | — |

Table 1.6 MSIOF Connected device (R-Car V3H)

| MSIOF Channel | Connected device | Support Status | Note |
|---------------|---------------------------------------|----------------|------|
| Ch0 | CN17 - Multiplexed with JTAG2 signals | No | — |
| Ch1 | None | No | — |
| Ch2 | None | No | — |
| Ch3 | None | No | — |

Note : The MSIOF0, and other functions (e.g. DU_DRGB[1:0] functions) are multiplexed on the same pins as the JTAG2 functions due to the specifications of the R-CarV3H's pin function controller. Accordingly, when the JTAG2 functions are in use, the MSIOF0 and other functions are not available. Due to the specifications of the R-CarV3H's JTAG2 interface, the power-supply voltage to the VDDQ_DU pins must be 1.8 V when that interface is to be used. If you will be using the Condor-I board with an expansion board that requires a 3.3 V power supply voltage, the JTAG2 connector (CN26) will not be usable because of the difference in the power-supply voltage.

1.4 Reference

1.4.1 Standard

There are no reference documents on standards.

1.4.2 Related documents

The following table shows the document related to this module.

Table 1.7 Related documents (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

| Number | Issue | Title | Edition | Data |
|--------|---------------------|--|----------|---------------|
| - | 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-Car V3U Series User's Manual | Rev.0.5 | Jul. 31, 2020 |
| - | Renesas Electronics | R-CarV3U System Evaluation Board Falcon Hardware Manual | Rev.0.01 | Sep. 11, 2020 |
| - | Renesas Electronics | R-Car V3H_2 Additional Document for User's Manual: Hardware | Rev.0.50 | Jul. 31, 2020 |
| - | Renesas Electronics | R-CarV3H System Evaluation Board Condor-I Hardware Manual | Rev.0.02 | Nov. 11, 2020 |
| - | Renesas Electronics | R-CarD3 System Evaluation Board Hardware Manual RTP0RC77995SEB0010S | Rev.1.20 | Jul. 25, 2017 |

1.5 Restriction

There is no restriction in this module.

1.6 Notice

When once of transmission exceeds 256 byte, it's possible to transfer with 2 group. (But present driver is not supported.)

When being used in 256 byte x 2group, a SS signal is asserted by the 512 byte unit.

When an asserting period of a SS signal requires more than 512 bytes, control by GPIO is needed.

The DTDL of SITMDR1/SIRMDR1 is set the fixed value (2 clock cycle delay) in case of R-Car H3 Ver.3.0 by the H/W specification.

2. Operating Environment

2.1 Hardware Environment

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

Table 2.1 Hardware specification (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

| Name | Version | Manufacture |
|--|---------|---------------------|
| 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-CarV3U System Evaluation Board Falcon | - | Renesas Electronics |
| R-CarV3H System Evaluation Board Condor-I | - | Renesas Electronics |
| R-CarD3 System Evaluation Board Draak | - | Renesas Electronics |

2.2 Module Configuration

The following figure shows the configuration of this module.

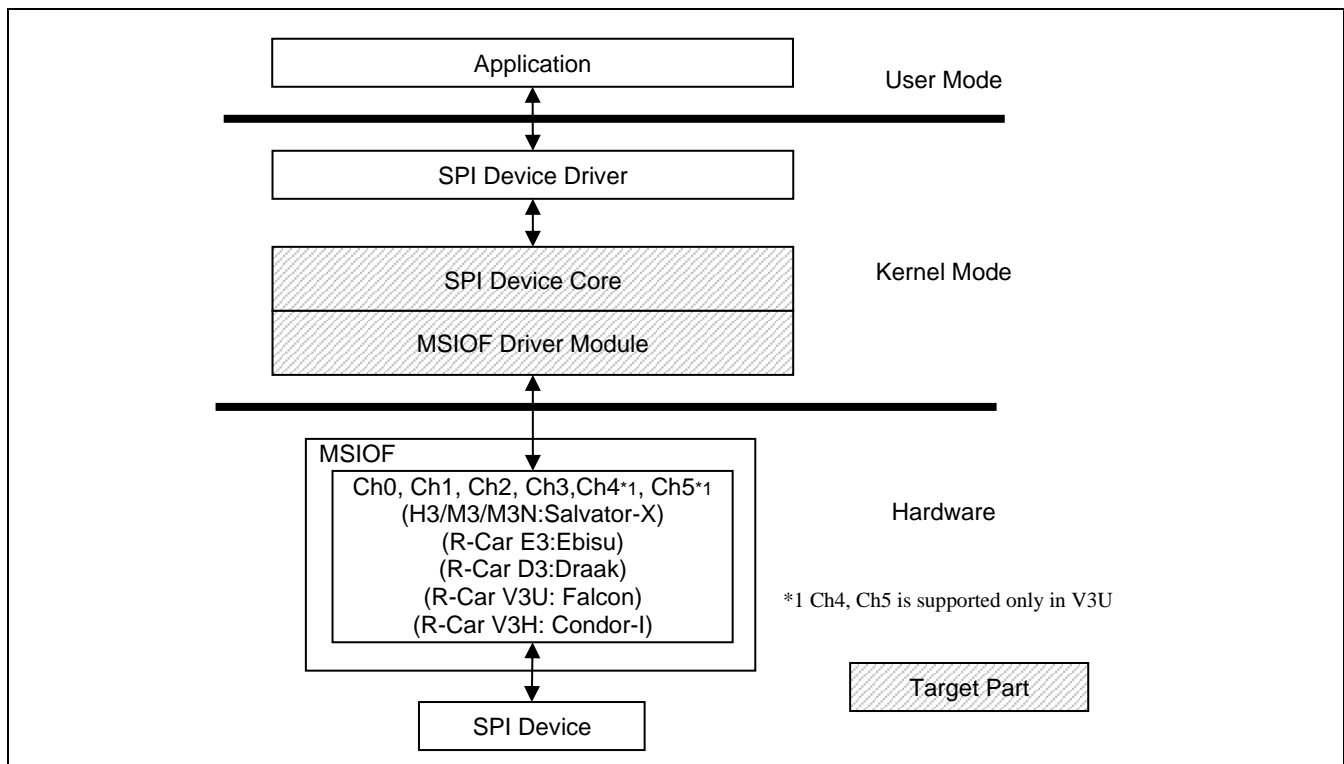


Figure 2.1 Module configuration (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

2.3 State Transition Diagram

There is no state transition diagram for this module.

3. External Interface

Detailed explanation is skipped because the external interface of this module is based on Linux.

4. Integration

4.1 Directory Configuration

The directory configuration is shown below.

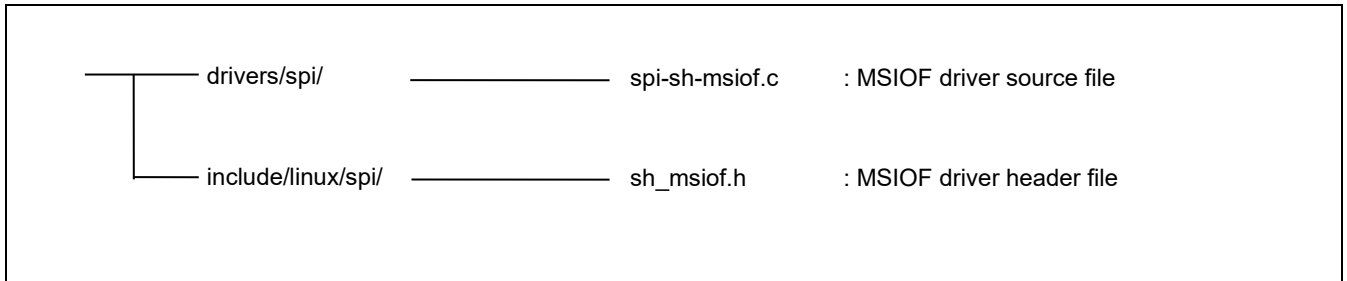


Figure 4-1 Directory Configuration (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

4.2 Integration Procedure

Add the setting of the channel to be used.

Add "Pin Function", "Clock setting", "Channel Node setting", "sub node setting" to the device tree and add the compatible value of the sub node to spidev.c.

4.2.1 Device tree setting

Typical editing examples are shown below. The device tree file name varies depending on the board to be used. Please refer to the user's manual of Kernel Core for the device tree file name.

- Example for R-Car H3 Ver.3.0 or later(In case of Salvator-XS board)
File path: arch/arm64/boot/dts/renesas/r8a77951-salvator-xs-4x2g.dts
- Example for R-Car E3(In case of Ebisu board)
File path: arch/arm64/boot/dts/renesas/r8a77990-ebisu.dts
- Example for R-Car D3 (In case of Draak board)
File path: arch/arm64/boot/dts/renesas/r8a77995-draak.dts
- Example for R-Car V3U (In case of Falcon board)
File path: arch/arm64/boot/dts/renesas/r8a779a0-falcon.dts
- Example for R-Car V3H (In case of Condor-I board)
File path: arch/arm64/boot/dts/renesas/r8a77980-condor.dts

Edit the device tree as follows.

- 4.2.1.1 Pin Function setting
- 4.2.1.2 Clock setting
- 4.2.1.3 Channel Node setting
- 4.2.1.4 sub node setting

4.2.1.1 Pin Function setting

The editing contents are shown in Figure 4-2 (Example for r8a77951-salvator-xs-4x2g.dts).

```
&pfc {
    msiof0_pins: spi0 {
        groups = "msiof0_clk", "msiof0_sync",
                "msiof0_rxd", "msiof0_txd";
        function = "msiof0";
    };

    msiof1_pins: spi1 {
        groups = "msiof1_clk_c", "msiof1_sync_c",
                "msiof1_rxd_c", "msiof1_txd_c";
        function = "msiof1";
    };

    msiof2_pins: spi2 {
        groups = "msiof2_clk_b", "msiof2_sync_b",
                "msiof2_rxd_b", "msiof2_txd_b";
        function = "msiof2";
    };

    msiof3_pins: spi3 {
        groups = "msiof3_clk_d", "msiof3_sync_d",
                "msiof3_rxd_d", "msiof3_txd_d";
        function = "msiof3";
    };
};
```

Figure 4-2 Pin Function setting (Example for r8a77951-salvator-xs-4x2g.dts)

The editing contents are shown in Figure 4-3 (Example for r8a77990-ebisu.dts).

```
&pfc {
    msiof0_pins: spi0 {
        groups = "msiof0_clk", "msiof0_sync",
                "msiof0_rxd", "msiof0_txd";
        function = "msiof0";
    };
};
```

Figure 4-3 Pin Function setting (Example for r8a77990-ebisu.dts)

The editing contents are shown in Figure 4-4 (Example for r8a77995-draak.dts).

```
&pfc {  
    msiof0_pins: spi0 {  
        groups = "msiof0_clk", "msiof0_sync",  
                "msiof0_rxd", "msiof0_txd";  
        function = "msiof0";  
    };  
  
    msiof2_pins: spi2 {  
        groups = "msiof2_clk", "msiof2_sync_b",  
                "msiof2_rxd", "msiof2_txd";  
        function = "msiof2";  
    };  
};
```

Figure 4-4 Pin Function setting (Example for r8a77995-draak.dts)

The editing contents are shown in Figure 4-5 (Example for r8a779a0-falcon.dts).

```
&pfc {  
    msiof0_pins: spi0 {  
        groups = "msiof0_clk", "msiof0_sync",  
                "msiof0_rxd", "msiof0_txd";  
        function = "msiof0";  
        power-source = <1800>;  
    };  
  
    msiof1_pins: spi1 {  
        groups = "msiof1_clk", "msiof1_sync",  
                "msiof1_rxd", "msiof1_txd";  
        function = "msiof1";  
        power-source = <1800>;  
    };  
  
    msiof2_pins: spi2 {  
        groups = "msiof2_clk", "msiof2_sync",  
                "msiof2_rxd", "msiof2_txd";  
        function = "msiof2";  
        power-source = <1800>;  
    };  
};
```

Figure 4-5 Pin Function setting (Example for r8a779a0-falcon.dts)

The editing contents shown in Figure 4-6 (Example for r8a77980-condor.dts)

```
&pfc {  
    msiof0_pins: spi0 {  
        groups = "msiof0_clk", "msiof0_sync",  
                "msiof0_rxd", "msiof0_txd";  
        function = "msiof0";  
    };  
    msiof1_pins: spi1 {  
        groups = "msiof1_clk", "msiof1_sync",  
                "msiof1_rxd", "msiof1_txd";  
        function = "msiof1";  
    };  
    msiof2_pins: spi2 {  
        groups = "msiof2_clk", "msiof2_sync",  
                "msiof2_rxd", "msiof2_txd";  
        function = "msiof2";  
    };  
    msiof3_pins: spi3 {  
        groups = "msiof3_clk", "msiof3_sync",  
                "msiof3_rxd", "msiof3_txd";  
        function = "msiof3";  
    };  
};
```

Figure 4-6 Pin Function setting (Example for r8a77980-condor.dts)

4.2.1.2 Clock setting

Define the original clock for generating the bus speed.

```
/* module clock */
&msiof_ref_clk {
    clock-frequency = <133333333>; *1
};

*1 Please set a value based on electrical characteristics.
```

Figure 4-7 Clock setting

4.2.1.3 Channel Node setting

Enable status property.

```

&msiof0 {
    pinctrl-0 = <&msiof0_pins>;
    pinctrl-names = "default";
    /* Please use exclusively to the rcar_sound node */
    /* status = "okay"; */

    /* Add a subnode. */
};

&msiof1 {
    pinctrl-0 = <&msiof1_pins>;
    pinctrl-names = "default";
    /* In case of using this node, please enable this property */
    /* status = "okay"; */

    /* Add a subnode. */
};

&msiof2 {
    pinctrl-0 = <&msiof2_pins>;
    pinctrl-names = "default";
    /* In case of using this node, please enable this property */
    /* status = "okay"; */

    /* Add a subnode. */
};

&msiof3 {
    pinctrl-0 = <&msiof3_pins>;
    pinctrl-names = "default";
    /* In case of using this node, please enable this property */
    /* status = "okay"; */

    /* Add a subnode. */
};

```

Figure 4-8 Channel Node setting

4.2.1.4 sub node setting

Add a subnode to the channel node in Figure 4-8. Subnode is partially defined in master mode and slave mode.

Use the slave device name of the connection destination as the compatible value. The following form is ideal.

Maker name, slave device name

The editing contents sample for master mode are shown in Figure 4-9.

```
/* Add a subnode. */
slavedev {
    compatible = "maker,slavedev";
    reg = <0>;
    spi-max-frequency = <16666666>;
    spi-cpha;
    spi-cpol;
};
```

Figure 4-9 Subnode definition for master mode

The subnode name in slave mode is "slave".

The editing contents sample for slave mode are shown in Figure 4-10.

```
spi-slave;

/* Add a subnode. */
slave {
    compatible = "maker,slavedev";
    spi-cpha;
    spi-cpol;
};
```

Figure 4-10 Subnode definition for slave mode

4.2.2 Add userspace interface

Add the compatible value of the subnode to the next file.

file : drivers/spi/spidev.c

```
static const struct of_device_id spidev_dt_ids[] = {
    ...
    { .compatible = "maker,slavedev" },    <-- Add this line.
    {} ,
};
```

Figure 4-11 User space interface

4.2.3 Kernel configuration

To enable the function of this module, make the following setting with Kernel Configuration. The changes affect after re-building the kernel.

```
Device Drivers  --->
  [*] SPI support  -->
    --- SPI support
      <*> SuperH MSIOF SPI Controller
          ...
          *** SPI Protocol Masters ***
      <*> User mode SPI device driver support
          ...
      [ ] SPI slave protocol handlers *1
```

Figure 4-12 Kernel configuration (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

Notes: *1: Please set if you want to enable SPI Slave mode.

4.3 Option Setting

4.3.1 Module Parameters

There are no module parameters.

4.3.2 Kernel Parameters

There are no module parameters.

CONFIDENTIAL

| | |
|------------------|--|
| REVISION HISTORY | Linux Interface Specification Device Driver MSIOF User's Manual: Software |
|------------------|--|

| Rev. | Date | Description | |
|------|---------------|-------------|--|
| | | Page | Summary |
| 0.1 | Sep. 25, 2015 | — | New creation. |
| 0.2 | Nov. 20, 2015 | 2 | 1.5 Restrictions DMA was supported. |
| | | 7 | Figure 4.3 Kernel configuration (R-Car H3) Remove the DMA item. |
| | | 7 | Notes: Remove. |
| 0.3 | Mar. 18, 2016 | 1 | 1.2 Function Usage of DMA. |
| | | 1 | Table 1.1 Driver Function Add transfer size. |
| 0.4 | Apr. 15, 2016 | All | Add R-Car M3 support. |
| | | 2 | Table 1.5 Related document (R-Car H3/M3) Update related documents. |
| | | 6 | 4.2 Integration Procedure Add R-Car M3 Device tree file(r8a7796.dtsi). |
| 0.5 | Aug. 5, 2016 | 1 | Table 1.1 Add "Module Clock", "The biggest transfer clock" |
| | | 2 | Table 1.3-2 Related Documents - H3 Document Update. - Add M3 Document. |
| | | 5, 6 | Add "3.1 IPMMU Setting" |
| 0.6 | Dec. 16, 2016 | 5, 7 | 3.1 IPMMU Setting 4.2 Integration Procedure Change R-Car H3 Device tree file name (r8a7795.dtsi, r8a7795-salvator-x.dts) |
| | | 1 | 1.3 Connected device Fix "R-Car H3/M3 System" to "R-Car H3-Sip/M3-Sip System" |
| 0.7 | Mar. 15, 2017 | 2 | Table 1.5 Related document (R-Car H3/M3) - Add User's Manual: Hardware Rev.0.53. - Add Salvator-XS Hardware Manual Rev.2.00. |
| | | 3 | Table 2.1 Hardware specification Add Evaluation Board Salvator-XS. |
| | | 5, 6 | 3.1 IPMMU Setting - Add R-Car H3 WS2.0 Device tree file(r8a7795.dtsi). - Add hardware revision to the description of device tree file name (r8a7795-es1.dtsi, r8a7795-es1.dtsi). - Change the Figure and description for Figure 3.1 and Figure 3.2 |
| | | 8 | 4.2 Integration Procedure - Add R-Car H3 WS2.0 Device tree file(r8a7795-salvator-x.dts). - Add Salvatore-XS Device tree file(r8a7795-salvator-xs.dts). - Add hardware revision to the description of device tree file name (r8a7795-salvator-x.dts, r8a7795-salvator-xs.dts , r8a7795-es1-salvator-x.dts). - Change the Figure 4.2 |
| | | 1 | Table 1.1 Driver Function Add the biggest transfer clock for R-Car H3 WS2.0. |
| 0.8 | Apr. 14, 2017 | 6 | 3.1 IPMMU Setting Add DMA channel to use for each channel. |
| | | 1, 5, 8 | 1.2 Function 3.1 IPMMU Setting 4.2 Integration Procedure Change of version notation. |
| 0.9 | Jun. 14, 217 | 2 | Update User's Manual: Hardware Rev0.53 to Rev0.54. |
| 1.00 | Aug. 8, 2017 | All | Update document format. |

CONFIDENTIAL

| Rev. | Date | Description | |
|-------|---------------|-------------|--|
| | | Page | Summary |
| 1.0.1 | Oct. 24, 2-17 | All | Add R-Car M3N support. |
| | | 8 | 4.2 Integration Procedure Add Salvatore-XS Device tree file(r8a7796-salvator-xs.dts). |
| 1.50 | Jan. 29, 2018 | 2 | Table 1.5 Related documents (R-Car H3/M3/M3N) - Delete User's Manual: Hardware Rev.0.51. - Delete User's Manual: Hardware Rev.0.55. - Add User's Manual: Hardware Rev.0.80. |
| | | 6 | Delete 3.1 IPMMU Setting |
| | | 7 | Add 4.2.1 Device tree setting |
| | | 10 | Add 4.2.2 Add userspace interface |
| | | 11 | Update 4.2.3 Kernel configuration |
| | | | |
| 1.51 | Mar. 28, 2018 | All | Add R-Car E3 support. |
| | | 1,2 | Table 1.1 Driver Function - Update "Module Clock ", "Max transfer frequency" 1.4 Related documents - Add "R-Car Series, 3rd Generation Additional Document for User's Manual: Hardware " |
| | | 8 | 4.2.1 Device tree setting - Update "aliases " |
| | | 9 | Figure 4 4 Clock setting - Update "clock-frequency" |
| 1.52 | Jun. 27, 2018 | 8 | 1.6 Notice - Add notice for R-Car H3 Ver.3.0. |
| | | 8 | 4.2.1 Device tree setting - Update the target file. |
| 1.53 | Oct. 22, 2018 | 2 | 1.4 Related documents - Delete User's Manual: Hardware Rev.0.80. - Delete "R-Car Series, 3rd Generation Additional Document for User's Manual: Hardware " - Add User's Manual: Hardware Rev.1.00. |
| 2.00 | Dec. 25, 2018 | 2 | Table 1.5 Related documents (R-Car H3/M3/M3N/E3) - Updated board manual. |
| | | 4 | Table 2.1 Hardware specification (R-Car H3/M3/M3N/E3) - Updated board name. |
| | | - | Update AddressList. |
| 2.01 | Mar. 11, 2019 | 8, 11,12 | Fix typo. |
| 2.50 | Apr. 24, 2020 | All | Add R-Car V3U support |
| | | All | Update for based on kernel v5.4 |
| 2.51 | Dec. 1, 2020 | 2 | Table 1.4 Update connected device |
| | | 3 | Table 1.5 Related documents (R-Car H3/M3/M3N/E3/V3U) Fix Edition and Data of H/W manual for V3U/Falcon |
| | | 10 | Figure 4-4 Pin Add pin setting for V3U falcon |
| 2.52 | Jan. 29, 2021 | - | Add R-Car V3H v2.0 support. |
| 2.53 | Apr. 21, 2021 | - | - Add R-Car D3 support. - Add Kernel v5.10 support |
| 2.54 | Aug. 16, 2021 | 10 | Figure 4-4 Update Pin function setting for D3 Draak |
| 3.00 | Dec. 10, 2021 | - | Add Kernel v5.10.41 support |
| 3.1.0 | Dec. 25, 2023 | - | Add Kernel v5.19.194 support for H3, M3, M3N, E3 |

Linux Interface Specification Device Driver MSIOF
User's Manual: Software

Publication Date: Rev.0.1 Sep. 25, 2015
Rev.3.1.0 Dec. 25, 2023

Published by: Renesas Electronics Corporation



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

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



ルネサスエレクトロニクス株式会社

■営業お問合せ窓口

<http://www.renesas.com>

※営業お問合せ窓口の住所は変更になることがあります。最新情報につきましては、弊社ホームページをご覧ください。

ルネサス エレクトロニクス株式会社 〒135-0061 東京都江東区豊洲3-2-24（豊洲フォレシア）

■技術的なお問合せおよび資料のご請求は下記へどうぞ。
総合お問合せ窓口：<https://www.renesas.com/contact/>

Linux Interface Specification Device Driver MSIOF



Renesas Electronics Corporation