User's Manual

RENESAS

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Linux Interface Specification Device Driver SCIF/HSCIF

User's Manual: Software

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

Renesas Electronics
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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/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/D3/V3U/V3H User's Manual.
  — To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N/E3/D3/V3U/V3H
  → See the R-Car H3/M3/M3N/E3/D3/V3U/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 ... ××××, 0b××××, or ××××B
  Decimal ... ××××
  Hexadecimal ... 0x×××× or ××××H
  Data type: Double word ... 64 bits
  Word … 32 bits
  Half word ... 16 bits
  Byte ... 8 bits

Table of Contents

1. Overview

1.1 Overview

This manual explains the driver module that controls the SCIF and HSCIF on R-Car H3/M3/M3N/E3/D3/V3U/V3H.

1.2 Function

This module controls the Serial Communication Interface with FIFO (SCIF) on R-Car H3/M3/M3N/E3/D3/V3U/V3H. This module supports the following functions.

- Data transmission and reception for RS232C
- Control of communication settings
  - Baud rate 9600, 19200, 38400, 57600, 115200[bps]
  - Parity bit (none/ODD/EVEN)
  - Stop bit (1bit or 2bit)
  - Data transfer bit length (7bit or 8bit)

  Each setting can be changed from the standard ioctl for tty.
- DMA Transfer
  - Support: SCIF0, SCIF1, SCIF3, SCIF4, SCIF5
  - Not support: Serial console (SCIF2 on R-Car H3/M3/M3N/E3/D3; SCIF0/HSCIF0 on V3U/V3H)
- Hardware Flow Control
  - Support: SCIF0, SCIF1, SCIF3, SCIF4
  - Not support: SCIF2, SCIF5

This module controls the High Speed Serial Communication Interface with FIFO (HSCIF) on R-Car H3/M3/M3N/E3/D3/V3U/V3H. This module supports the following functions.

- Data transmission and reception for RS232C
- Control of communication settings
  - Baud rate 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, and 1000000 ～ 3000000(Max)[bps]
  - Parity bit (none/ODD/EVEN)
  - Stop bit (1bit or 2bit)
  - Data transfer bit length (7bit or 8bit)

  Each setting can be changed from the standard ioctl for tty.
- DMA Transfer
- Hardware Flow Control

1.3 Connected Port

This module support SCIF/HSCIF ports on R-Car H3-Sip/M3-Sip/M3N-Sip/E3/D3/V3U/V3H System Evaluation Board as following.

Table 1-1. SCIF Connector (R-Car H3/M3/M3N)

Channel	Connector	Support status	Remark
SCIF0	-	No	-
SCIF1	CN26	Yes	This port is exclusive to HSCIF1 for specification of the R-Car H3-Sip/M3-Sip/M3N-Sip System Evaluation Board.
SCIF2	CN25	Yes	DMA Not support.
SCIF3	-	No	-
SCIF4	-	No	-
SCIF5	-	No	-

Table 1-2. SCIF Connector (R-Car E3/D3)

Channel	Connector	Support status	Remark
SCIF0	-	No	-
SCIF1	-	No	-
SCIF2	CN25	Yes	DMA Not supported.
SCIF3	-	No	-
SCIF4	-	No	-
SCIF5	-	No	-

Table 1-3. SCIF Connector (R-Car V3U)

Channel	Connector	Support status	Remark
SCIF0	CN10	Yes	DMA Not supported. This port is exclusive to HSCIF0 for specification of the R-Car V3U System Evaluation Board.
SCIF1	-	No	-
SCIF3	-	No	-
SCIF4	-	No	-

Note: In R-Car V3U System Evaluation Board, SCIF2 and SCIF5 channel are not supported.

Table 1-4. SCIF Connector (R-Car V3H)

Channel	Connector	Support status	Remark
SCIF0	CN11	Yes	DMA Not support. This port is exclusive to HSCIF0 for specification of the R-Car V3H System Evaluation Board.
SCIF1	-	No	-
SCIF3	-	No	-
SCIF4	-	No	-

Note: In R-Car V3H System Evaluation Board, SCIF2 and SCIF5 channel are not supported.

Table 1-5. HSCIF Connector (R-Car H3/M3/M3N)

Channel	Connector	Support status	Remark
HSCIF0	-	No	-
HSCIF1	CN26	Yes	This port is exclusive to SCIF1 for specification of the R-Car H3-Sip/M3-Sip/M3N-Sip System Evaluation Board.
HSCIF2	-	No	-
HSCIF3	-	No	-
HSCIF4	-	No	-

Table 1-6. HSCIF Connector (R-Car D3)

Channel	Connector	Support status	Remark
HSCIF0	-	No	-
HSCIF3	-	No	-

Note: In R-Car D3 System Evaluation Board, HSCIF1, HSCIF2 and HSCIF4 channel are not supported.

Table 1-7. HSCIF Connector (R-Car E3)

Channel	Connector	Support status	Remark
HSCIF0	-	No	-
HSCIF1	-	No	-
HSCIF2	CN6	No	EXIO Connector A
HSCIF3	-	No	-
HSCIF4	-	No	-

Table 1-8. HSCIF Connector (R-Car V3U)

Channel	Connector	Support status	Remark
HSCIF0	CN10	Yes	DMA Not supported. This port is exclusive to SCIF0 for specification of the R-Car V3U System Evaluation Board.
HSCIF1	-	No	-
HSCIF2	-	No	-
HSCIF3	-	No	-

Note: In R-Car V3U System Evaluation Board, HSCIF4 channel is not supported.

Table 1-9. HSCIF Connector (R-Car V3H)

Channel	Connector	Support status	Remark
HSCIF0	CN11	Yes	DMA Not supported. This port is exclusive to SCIF0 for specification of the R-Car V3H System Evaluation Board.
HSCIF1	-	No	-
HSCIF2	-	No	-
HSCIF3	-	No	-

Note: In R-Car V3H System Evaluation Board, HSCIF4 channel is not supported.

1.4 Reference

1.4.1 Standard

There is no reference document on standards.

1.4.2 Related Documents

The following table shows the document related to this module.

Table 1-10. 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, 2019
-	Renesas Electronics	R-CarD3 System Evaluation Board Hardware Manual RTP0RC77995SEB0010S	Rev.1.20	Jul. 25, 2017

1.5 Restrictions

Kernel messages interfere with serial communication.
If it is necessary to correctly handle both serial communication and kernel messages on the same serial port, you need to enable hardware flow control on the serial port.

1.6 Notice

- This driver isn't evaluated with the baud rate of 1Mbps and more.

2. Terminology

The following table shows the terminology related to this module.

Table 2-1. Terminology

Terms	Explanation
SCIF	Serial Communication Interface with FIFO
HSCIF	High Speed Serial Communication Interface with FIFO

3. Operating Environment

3.1 Hardware Environment

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

Table 3-1. Hardware Environment (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

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-CarV3U System Evaluation Board Falcon	-	Renesas Electronics
R-CarV3H System Evaluation Board Condor-I	-	Renesas Electronics
R-CarD3 System Evaluation Board Draak	-	Renesas Electronics

3.2 Module Configuration

The following figure shows the configuration of this module.

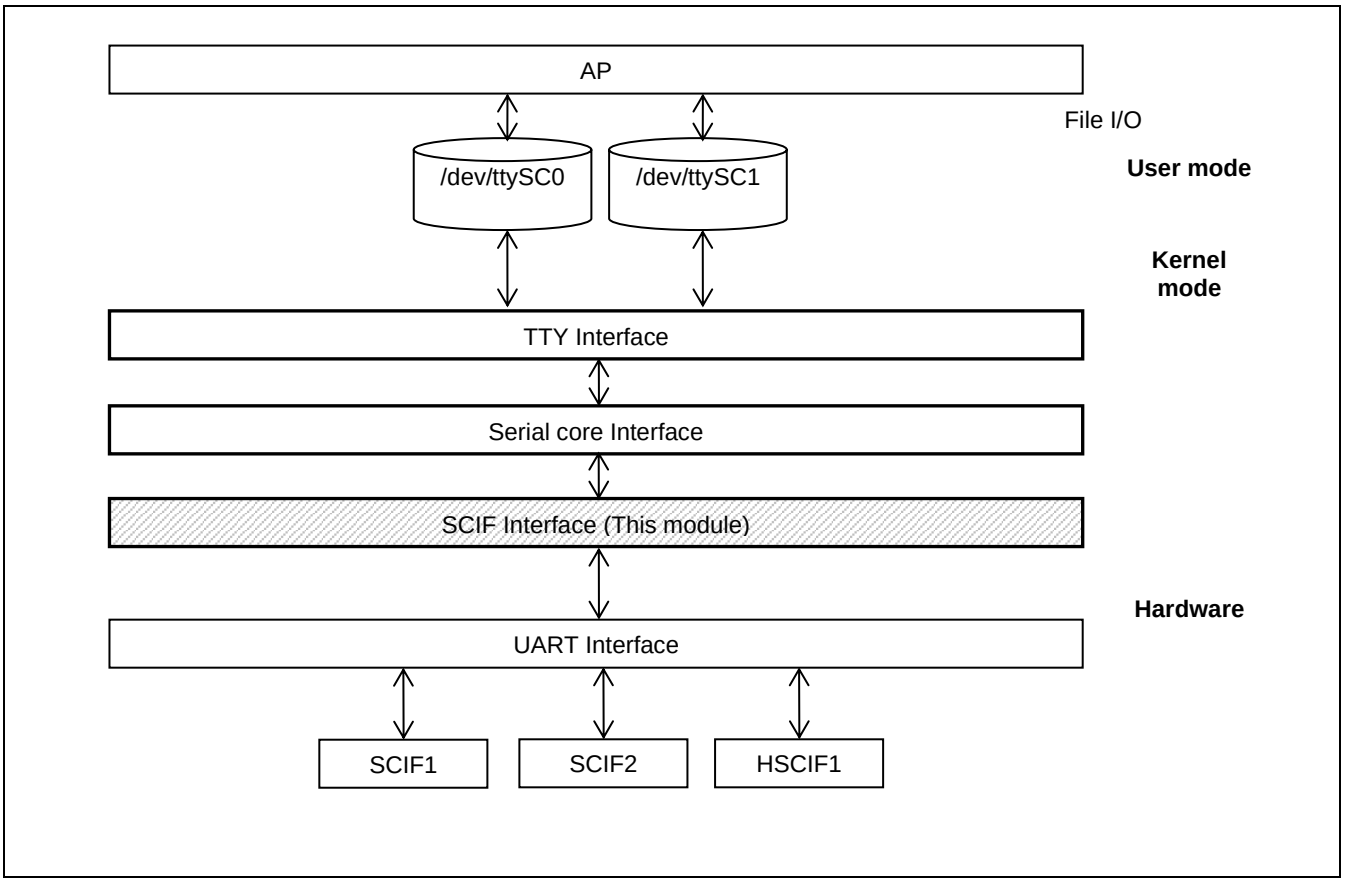

Figure 3-1. Module Configuration (R-Car H3/M3/M3N)

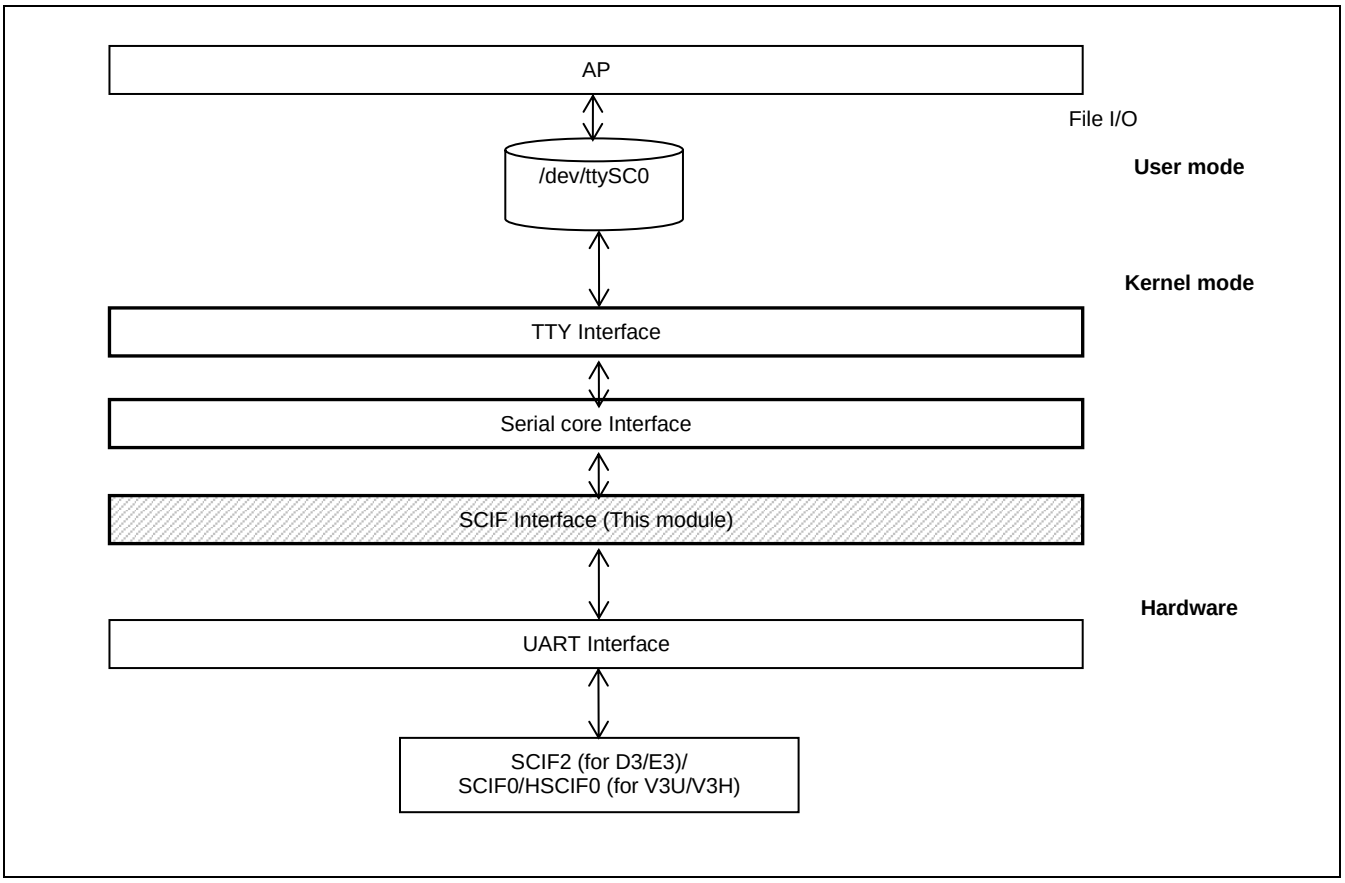

Figure 3-2. Module Configuration (R-Car E3/D3/V3U/V3H)

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.

4.1 Device Node

Device node of this module is shown below.

Table 4-1. Device Node (R-Car H3/M3/M3N)

Channel	Device node	Major number	Minor number
SCIF1	/dev/ttySC1	204	9
SCIF2	/dev/ttySC0	204	8
HSCIF1	/dev/ttySC1	204	9

Table 4-2. Device Node (R-Car E3/D3)

Channel	Device node	Major number	Minor number
SCIF2	/dev/ttySC0	204	8

Table 4-3. Device Node (R-Car V3U/V3H)

Channel	Device node	Major number	Minor number
SCIF0	/dev/ttySC0	204	8
HSCIF0	/dev/ttySC0	204	8

4.2 Clock source setting

4.2.1 Select clock source

The following clock source can be used.

Table 4-4. Clock Source

Clock source	Description
fck	Functional Clock Source
brg_int	Optional Baud rate generator Internal Clock Source
scif_clk	Optional Baud rate generator External Clock Source

4.2.2 External clock setting

Please change the following file for use the External clock.
R-Car E3/D3 does not support definition of external clock.

The editing file:
- For R-Car H3/M3/M3N: arch/arm64/boot/dts/renesas/salvator-common.dtsi
- For R-Car V3U: arch/arm64/boot/dts/renesas/r8a779a0-falcon.dts
- For R-Car V3H: arch/arm64/boot/dts/renesas/r8a77980-condor.dts

The editing contents are shown in Figure 4-1.

```
&scif_clk {
        clock-frequency = <14745600>;
        status = "okay";
};
```

Figure 4-1. External Clock define

<14745600>: is the frequency of the source clock.
- R-Car H3/M3/M3N/V3H: 14.7456 MHz.
- R-Car V3U: 24MHz.

If you do not want to use the external clock, delete all of the contents shown in Figure **4-1**.

5. Integration

5.1 Directory Configuration

The directory configuration is shown below.

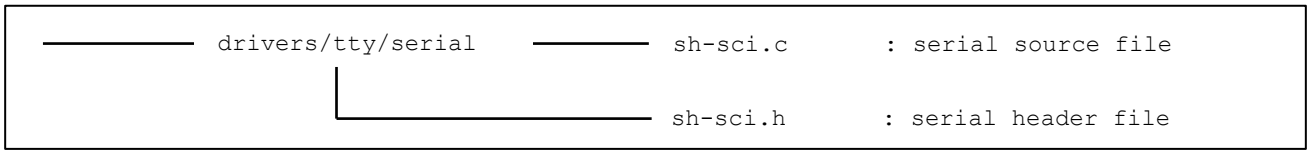

Figure 5-1. Directory Configuration (R-Car H3/M3/M3N/E3/D3/V3U/V3H)

5.2 Integration Procedure

5.2.1 Enable HSCIF

The following description explains how to enable HSCIF1 channel on H3/M3/M3N and HSCIF0 channel on V3U/V3H. RCar-E3/D3 does not support HSCIF.

Since HSCIF and SCIF are shared by PFC, they can be used exclusively.

The following description indicates a difference from the default setting. (“-”: Delete a description (default setting), “+”: Setting after the modification).

The editing file:

- For R-Car H3/M3/M3N: arch/arm64/boot/dts/renesas/salvator-common.dtsi
- For R-Car V3U: arch/arm64/boot/dts/renesas/r8a779a0-falcon.dts
- For R-Car V3H: arch/arm64/boot/dts/renesas/r8a77980-condor.dts

The editing contents are shown in Figure 5-2 and Figure 5-3.

```
 / {
        aliases {
             serial0 = &scif2;
-            serial1 = &scif1;
+            serial1 = &hscif1;
             ethernet0 = &avb;
        };
        …
   };
&scif1 {
        pinctrl-0 = <&scif1_pins>;
        pinctrl-names = "default";
        /* Please use exclusively to the hscif1 node */
-       status = "okay";
+       /* status = "okay"; */
  };
&hscif1 {
        pinctrl-0 = <&hscif1_pins>;
        pinctrl-names = "default";
        /* Please use exclusively to the scif1 node */
-       /* status = "okay"; */
+       status = "okay";
  };
```

Figure 5-2. Enable HSCIF1 (R-Car H3/M3/M3N)

```
 / {
       aliases {
-           serial0 = &scif0;
+           serial0 = &hscif0;
            ethernet0 = &avb0;
       };
       …
   };
&scif0 {
       pinctrl-0 = <&scif0_pins>;
       pinctrl-names = "default";
       /* Please use exclusively to the hscif0 node */
-      status = "okay";
+      /* status = "okay"; */
  };
&hscif0 {
       pinctrl-0 = <&hscif0_pins>;
       pinctrl-names = "default";
       /* Please use exclusively to the scif0 node */
-      /* status = "okay"; */
+      status = "okay";
  };
```

Figure 5-3. Enable HSCIF0 (R-Car V3U/V3H)

5.2.2 Enable hardware flow control

The following description explain how to enable hardware flow control function on H3/M3/M3N/E3/V3U. For D3, HW flow control is not supported because connected channel (SCIF2) does not have the pins related to this function. For V3H, HW flow control is not supported due to the Condor board design.

Add "uart-has-rtscts" property to use the hardware flow control function. The following description indicates a difference from the default setting. (“+”: Setting after the modification)

The editing files:

- For R-Car H3/M3/M3N: arch/arm64/boot/dts/renesas/salvator-common.dtsi
- For R-Car E3: arch/arm64/boot/dts/renesas/r8a77990-ebisu.dts (R-Car E3 Ver.1.1 or later)
  arch/arm64/boot/dts/renesas/r8a77990-es10-ebisu.dts (R-Car E3 Ver.1.0)
- For R-Car V3U: arch/arm64/boot/dts/renesas/r8a779a0-falcon.dts

The editing contents are shown in Figure 5-4 and Figure 5-5.

```
&scif1 {  *1
       pinctrl-0 = <&scif1_pins>;  *1
       pinctrl-names = "default";
+      uart-has-rtscts;
       ...
  };
```

*1: Replace with the channel number of the scif to be used.

Figure 5-4. Enable Hardware Flow Control for HSCIFx (R-Car H3/M3/M3N/E3/V3U)

5.2.3 Kernel configuration settings

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

```
General setup    --->
      [ ] Embedded system *1

Device Drivers    --->
      Character devices    --->
            Serial drivers    --->
                  <*> SuperH SCI(F) serial port support
                  (11)    Maximum number of SCI(F) serial ports *2
                  [*]     Support for console on SuperH SCI(F) *2
                  [*]     Support for early console on SuperH SCI(F) *2
                  [*]     DMA support *2 *3
```

Figure 5-6. Kernel configuration(R-Car H3/M3/M3N/D3/E3/V3U/V3H)

Notes: *1 Please set if you want to enable option selection.
*2 This menu is option. To use it, enable the configuration of *1.
*3 The default is DMA transfer mode. When this configuration is disabled, selects the PIO transfer mode.

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 SCIF/HSCIF User's Manual: Software

Rev.	Date	Description	
		Page	Summary
0.1	Sep. 25, 2015	—	New creation.
0.2	Nov. 20, 2015	All	Add HSCIF support.
		3	1.5 Restrictions DMA was supported.
		8	5.2 Integration Procedure Add Figure 5-4 Kernel configuration(R-Car H3)
0.3	Mar. 18, 2016	1	1.2 Function Add the unsupported port name of the hardware control.
		7	Figure 5-2 Change the comment of the status property
		8	Figure 5-3 Add Hardware Flow Control supported.
		8	Figure 5-4 Update the Kernel configuration menu.
0.4	Apr. 15, 2016	All	Add R-Car M3 support.
		3	Table 1.4 Related document (R-Car H3/M3) Update related documents.
		7	5.2 Integration Procedure Add R-Car M3 Device tree file(r8a7796.dtsi).
0.5	Aug. 5, 2016	1	1.2 Function Add Support/Not support device for DMA transfer.
		2	Table 1.1 SCIF Connector(R-Car H3/M3) Add DMA support to the remark of SCIF2. Add that SCIF1 or HSCIF1 is used exclusively.
		3	Table 1.4 Related documents(R-Car H3/M3) - H3 Document Update. - Add M3 Document.
		6	Add "4.1 Device Node"
		6, 7	Add "4.2 Clock source setting"
		7, 8	Add "4.3 IPMMU Setting"
0.6	Dec. 16, 2016	6, 7, 9,10	4.2.2 External clock Setting 4.3 IPMMU Setting 5.2 Integration Procedure Chang R-Car H3 device tree file name(r8a7795.dtsi, r8a7795-salvator-x.dts)
		9	5.2 Integration Procedure Eliminate the explanation of board dependence.
		9	5.2 Integration Procedure The property name enabling the hardware flow control function is set to the upstream notation.Change "ctsrts" to "uart-has-rtscts".
		9	Figure 5.2 Figure 5.2 was divided according to the module. HSCIFx is added as figure 5.3.
		11	5.2 Integration Procedure There is description in 10 pages already. It was eliminated for redundancy. Delete "Check this item.", "The changes are … the kernel.".
		All	Add "HSCIF" to the document title.

Rev.	Date	Description	
		Page	Summary
0.7	Mar. 15, 2017	1, 2	1.3 Connected device Table 1-1 SCIF Connector (R-Car H3/M3) Table 1-2 HSCIF Connector (R-Car H3/M3) Fix “R-Car H3/M3 System” to “R-Car H3-Sip/M3-Sip System”.
		2	Table 1-4 Related documents (R-Car H3/M3) - Add User’s Manual: Hardware Rev.0.53. - Add Salvator-XS Hardware Manual Rev.2.00.
		3	Table 1.4 Related documents(R-Car H3/M3) Add User’s Manual: Hardware Rev0.53.
		3	1.5 Restrictions 1.6 Notice - Add "1.6 Notice" - Moved the description of "1.5 Restrictions" to "1.6 Notice"
		5	Table 3-1 Hardware Environment (R-Car H3/M3) Add Evaluation Board Salvator-XS.
		7, 9	4.2.2 External clock Setting 5.2 Integration Procedure Add Device tree file(r8a7795-salvator-x.dts/r8a7795-salvator-xs.dts).
		8	4.3 IPMMU Setting Add Device tree file(r8a7795.dtsi).
		8, 9	4.3 IPMMU Setting Figure 4-2 and Figure 4-3. 5.2 Integration Procedure Figure 5-2 and Figure 5-3. Change Figure and description.
0.8	Jun. 14, 2017	3	Update User’s Manual: Hardware Rev0.53 to Rev0.54.
		7, 8, 9	4.2.2 External clock Setting 4.3 IPMMU Setting 5.2 Integration Procedure Change of version notation.
1.00	Aug. 8, 2017	All	Update document format.
1.01	Oct. 24, 2017	All	Add R-Car M3N support.
		7, 9	4.2.2 External clock Setting 5.2 Integration Procedure Add Device tree file(r8a7796-salvator-xs.dts).
1.50	Jan. 29, 2018	3	Table 1-4 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.
		7, 10	4.2.2 External clock Setting 5.2 Integration Procedure Change the device tree file name.
		8	Delete 4.3 IPMMU Setting
		8, 9	5.2 Integration Procedure - Add "5.2.1 Enable hscif1" - Update "5.2.2 Enable hardware flow control" - Update "5.2.3 Kernel configuration settings"
1.51	Mar. 28, 2018	All	Add R-Car E3 support.
		1, 2	1.2 Corrected spelling ’None’
1.52	Jun. 27, 2018	9	5.2.1 Enable hscif1 - Update “Figure 5-2 enable HSCIF1”.
1.53	Oct. 22, 2018	3	Table 1-4 Related documents (R-Car H3/M3/M3N/E3) - Delete User’s Manual: Hardware Rev.0.80. - Add User’s Manual: Hardware Rev.1.00 1.5 Restrictions - Add “Kernel messages interfere”
1.54	Oct. 29, 2018	11	5.2.3 Kernel configuration settings - Update Figure 5-6

Rev.	Date	Description	
		Page	Summary
2.00	Dec. 25, 2018	3	Table 1-5 Related documents (R-Car H3/M3/M3N/E3) - Updated board manual.
		5	Table 3.1 Hardware Environment (R-Car H3/M3/M3N/E3) - Updated board name.
		-	Update AddressList.
2.01	Apr. 17, 2019	3	Table 1-5 Related documents (R-Car H3/M3/M3N/E3) - Updated User's Manual: Hardware revision number.
		10	5.2.2 Enable hardware flow control - Add device tree file name of R-Car E3 Ver.1.0
		-	Update AddressList
2.50	Apr. 24, 2020	All	Add R-Car V3U support.
2.51	Dec. 1, 2020	4	Update Related documents for R-Car V3U.
		9	4.2.2 External clock setting - Update editing file name of R-Car V3U.
		All	Add HSCIF0 support for R-Car V3U.
2.52	Jan. 29, 2021	All	Add R-Car V3H v2.0 support.
2.53	Apr. 21, 2021	-	Add Kernel v5.10 support.
		-	Add R-Car D3 support.
3.00	Dec. 10, 2021	-	Add Kernel v5.10.41 support.

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User's Manual: Software

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Linux Interface Specification
Device Driver SCIF/HSCIF

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