

**CONFIDENTIAL**

# Linux Interface Specification Device Driver Thermal Sensor

User's Manual: Software

R-Car H3/M3/M3N/E3/D3/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](http://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/](http://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/V3H processor.

- **[Purpose]**

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

→ See the R-Car H3/M3/M3N/E3/D3/V3H User's Manual.

— To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N/E3/D3/V3H

→ See the R-Car H3/M3/M3N/E3/D3/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 bits

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 Related Document.....	1
1.4 Restriction .....	2
1.5 Notice.....	2
2. Terminology.....	3
3. Operating Environment.....	4
3.1 Hardware Environment .....	4
3.2 Software Configuration.....	5
4. External Interface.....	7
4.1 Sysfs Interface.....	7
4.2 Change Thermal Threshold.....	7
4.3 Setting for Interrupt or Polling Mode.....	8
5. Integration .....	9
5.1 Directory Configuration .....	9
5.2 Integration Procedure.....	9
5.3 Option Setting .....	9
5.3.1 Module Parameters.....	9
5.3.2 Kernel Parameters .....	9

# 1. Overview

## 1.1 Overview

This manual explains the driver module (this module) that controls the Thermal Sensor Module on R-Car H3/M3/M3N/E3/D3/V3H.

## 1.2 Function

This module controls Thermal Sensor Controller on R-Car H3/M3/M3N/E3/D3/V3H. It supports the following functions:

- (1) Get current temperature of SoC by accessing sysfs. The accuracy is about  $\pm 2^{\circ}\text{C}$  if driver uses hardware chip characteristic parameters to calculate temperature. Otherwise, the accuracy is about  $\pm 8\text{-}10^{\circ}\text{C}$ .
- (2) Halt the system when SoC temperature exceeds predefined threshold. About how to change the threshold, please refer to section 4.2.

## 1.3 Related Document

The following table shows the documents related to this module.

**Table 1-1 Related document (R-Car H3/M3/M3N/E3/D3/V3H)**

Number	Issue	Title	Edition	Date
-	Renesas Electronics	R-Car Series, 3 <sup>rd</sup> Generation User's Manual: Hardware	Rev.2.20	Jul. 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 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

## **1.4 Restriction**

None

## **1.5 Notice**

None.

## 2. Terminology

The following table shows terminology related to this module.

**Table 2-1 Terminology**

Terms	Explanation
THS	<b>T</b> hermal <b>S</b> ensor.
TSC	<b>T</b> hermal <b>S</b> ensor <b>C</b> ontroller.
Thermal zone	Represents a region managed by thermal framework.



## 3. Operating Environment

### 3.1 Hardware Environment

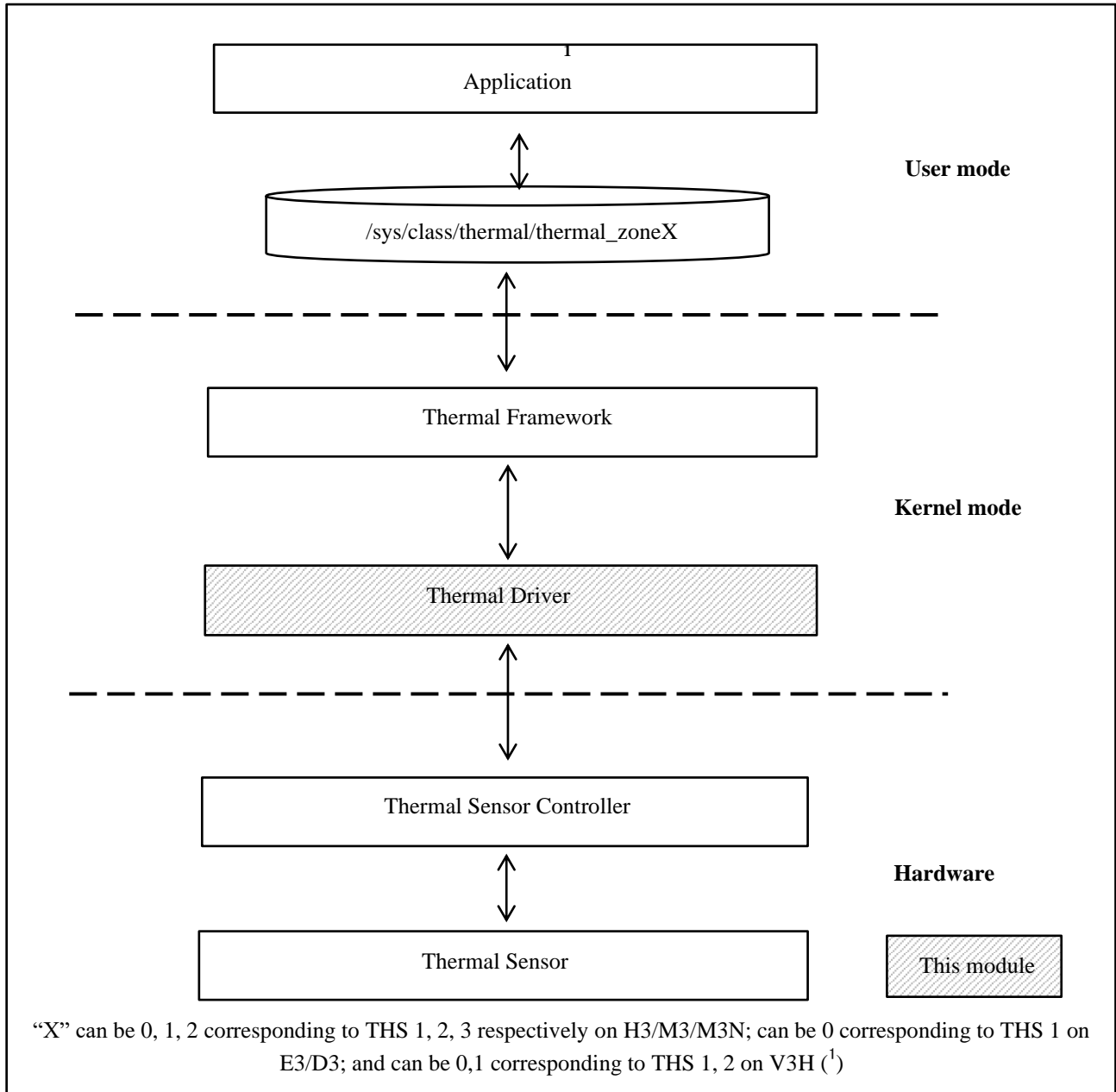
The following table lists the hardware needed to use this module.

**Table 3-1 Hardware Specification (R-Car H3/M3/M3N/E3/D3/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 R-CarE3 System Evaluation Board Ebisu-4D	-	Renesas Electronics
R-CarV3H System Evaluation Board Condor-I	-	Renesas Electronics
R-CarD3 System Evaluation Board Draak	-	Renesas Electronics

### 3.2 Software Configuration

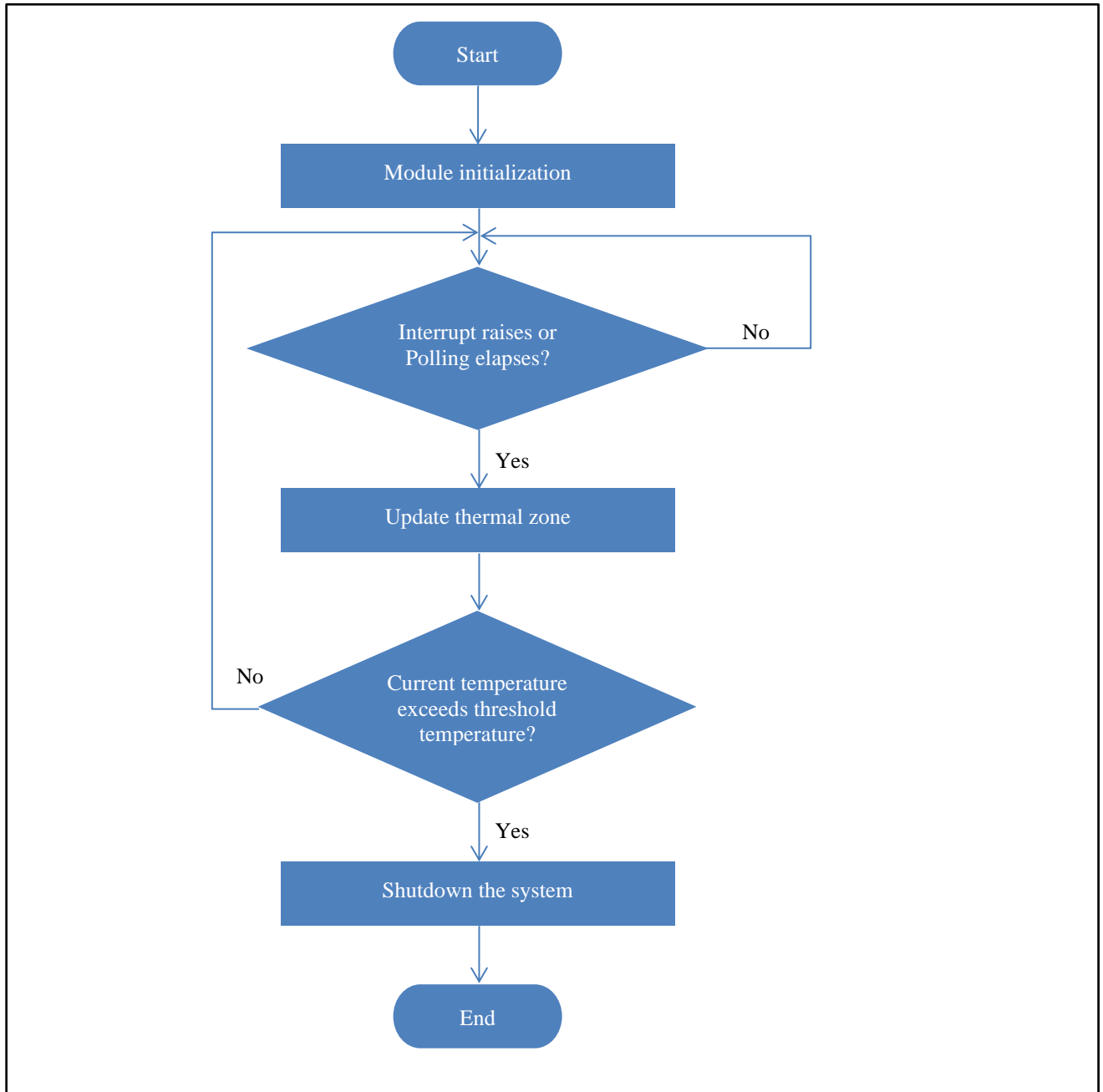
The following figure shows the configuration of this module.



**Figure 3-1 Module Configuration**

<sup>1</sup> - On R-Car H3/M3/M3N, thermal module supports three channels (THS1/2/3) and three thermal zones. On R-Car E3/D3, thermal module supports only one channel (THS1) and one thermal zone. And on R-Car V3H, thermal module supports two channels (THS1,2) and two thermal zones.

The following figure shows the software flowchart of this module.



**Figure 3-2 Thermal Sensor Software Flowchart**

## 4. External Interface

### 4.1 Sysfs Interface

Thermal driver does not provide directly external interface for user application. Instead, with thermal user interface, application can get current temperature of this SoC and trip point information as described in the table below.

**Table 4-1 System information of thermal sensor driver**

Thermal Zone Interfaces	Notes
/sys/class/thermal/thermal_zoneX/temp	Current temperature of this SoC (millicelsius)
/sys/class/thermal/thermal_zoneX/trip_point_Y_type	Trip point type
/sys/class/thermal/thermal_zoneX/trip_point_Y_temp	Trip point temperature

Note:

- Thermal zones are registered by this thermal device driver to thermal framework.
- There are three thermal zones corresponding to three thermal channels. Thermal\_zone0, thermal\_zone1, thermal\_zone2 will correspond to THS1, THS2, and THS3 respectively. <sup>(1)</sup>
- There are some other nodes under thermal\_zone, but they are not mentioned here.
- X, Y: depends on how many zone, trip point is defined.

### 4.2 Change Thermal Threshold

Thermal framework will halt the system when SoC temperature exceeds predefined threshold. Please modify device tree to define desired threshold temperature of corresponding thermal zone. Otherwise, it will be set to default value of 120000 (millicelsius).

It is able to apply different setting to each of three supported thermal zones <sup>(1)</sup>. Below figure is an example of thermal zone 0 of R-Car H3.

```
thermal-zones {
    sensor_thermal1: sensor-thermal1 {
        polling-delay-passive = <250>;
        polling-delay = <0>;
        /* sensor ID */
        thermal-sensors = <&tsc 0>;
        sustainable-power = <6313>;

        trips {
            sensor1_crit: sensor1-crit {
                temperature = <120000>; <-- Change this value
                hysteresis = <2000>;
                type = "critical";
            };
        };
    };
};
```

**Figure 4-1 Device tree source file**

### 4.3 Setting for Interrupt or Polling Mode

This setting is available on R-Car H3/M3/M3N/V3H which supports two modes - polling and interrupt. On R-Car E3/D3, only one interrupt mode is supported so please skip this section.

By default, the driver will use interrupt mechanism to update temperature of thermal zone. Please modify device tree to use polling if desire.

It is able to apply different selection to each of three supported thermal zones (<sup>1</sup>). Below figure is an example of thermal zone 0 of R-Car H3.

```
thermal-zones {
    sensor_thermal1: sensor-thermal1 {
        polling-delay-passive = <250>;
        polling-delay = <0>;          <-- Change this value to any number bigger
        /* sensor ID */               than 0 to use polling mode
        thermal-sensors = <&tsc 0>;
        sustainable-power = <6313>;

        trips {
            sensor1_crit: sensor1-crit {
                temperature = <120000>;
                hysteresis = <2000>;
                type = "critical";
            };
        };
    };
};
```

**Figure 4-2 Configuration Example for Polling Support**

(\*) Polling-delay is the maximum number of milliseconds to wait between polls when checking whether trip points have been crossed.

## 5. Integration

### 5.1 Directory Configuration

The Thermal driver software directory configuration is shown below.

```

arch/arm64/boot/dts/renesas/
├── r8a7795.dtsi
├── r8a77965.dtsi
├── r8a7796.dtsi
├── r8a77990.dtsi
├── r8a77980.dtsi
drivers/thermal/
├── rcar_gen3_thermal.c :R-Car H3/M3/M3N/V3H thermal driver source code.
└── rcar_thermal.c      :R-Car E3/D3 thermal driver source code.
```

**Figure 5-1 Directory Configuration**

### 5.2 Integration Procedure

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

```

Device Drivers --->
  --- Generic Thermal sysfs driver
    [ ] Thermal state transition statistics
    (0) Emergency poweroff delay in milli-seconds
    [*] Expose thermal sensors as hwmon device
    [*] APIs to parse thermal data out of device tree
    [ ] Enable writable trip points
        Default Thermal governor (step_wise) --->
          [ ] Fair-share thermal governor
          *- Step_wise thermal governor
          [ ] Bang Bang thermal governor
          [ ] User_space thermal governor
          [*] Power allocator thermal governor
          [*] Generic cpu cooling support
          [ ] Generic clock cooling support
          [ ] Generic device cooling support
          [*] Thermal emulation mode support
        < > Generic Thermal MMIO driver
        < > Hisilicon thermal driver
        < > Temperature sensor driver for Freescale i.MX SoCs
        < > Temperature sensor driver for Maxim MAX77620 PMIC
        < > QorIQ Thermal Monitoring Unit
        < > Rockchip thermal driver
        <*> Renesas R-Car thermal driver
        <*> Renesas R-Car Gen3 thermal driver
        < > Marvell EBU Armada SoCs thermal management
        < > Temperature sensor driver for mediatek SoCs
    ...
```

**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.

# CONFIDENTIAL

REVISION HISTORY	Linux Interface Specification Device Driver Thermal Sensor User's Manual: Software
------------------	---

Rev.	Date	Description	
		Page	Summary
0.1	Nov. 20, 2015	—	New creation.
0.2	Mar. 18, 2016	1	- Add restriction for interrupt mode. - Add temperature range to function description.
		6	- Change Thermal threshold. - Clarify the description for changing thermal threshold.
		7	- Default mode for Thermal sensor driver is changed from Polling to Interrupt. - Clarify the description for Interrupt/Polling mode switching.
		8	- New directory structure of Thermal sensor driver for R-Car H3. - Update Figure 5-2 Kernel Configuration.
0.3	Apr. 15, 2016	All	- Add R-Car M3 support. - Improve paragraph description.
		8	- Add new device tree source file for R-Car M3.
0.4	Aug. 12, 2016	1	- Remove restriction for interrupt mode. - Update R-Car Series, 3rd Generation User's Manual: Hardware to Rev 0.52.
		6	- Add "sustainable-power" property in sample thermal configuration.
		7	- Add "sustainable-power" property in sample thermal configuration in device tree.
		8	- Update Figure 5-2 Kernel Configuration.
0.5	Dec. 16, 2016	3	- Table 3-1: Add hardware specification for M3.
		8	- Figure 5-1: Add r8a7795-es1.dtsi: H3 ES1.x device file
		8	- Figure 5-2: Update kernel configuration.
0.6	Mar. 15, 2017	1	- Table 1-1. Add R-Car Series, 3rd Generation LSI hardware manual Rev0.53 and R-CarH3-SiP/M3-SiP System Evaluation Board Salvator-XS Hardware Manual Rev2.00.
		3	- Table 3-1. Add R-CarH3-SiP/M3-SiP System Evaluation Board Salvator-XS
		8	- Figure 5-1: Use 'WS' instead of 'ES' in file name description.
0.7	Jun. 14, 2017	1	- Table 1-1: Change HWM version from "Rev.0.53 Dec.31,2016" to "Rev.0.54 Apr.14, 2017."
		8	- Figure 5-1: Change H3 WS1.1 to H3 Ver.1.1 and H3 WS2.0 to H3 Ver.2.0.
1.00	Aug. 8, 2017	All	-Update document format
1.01	Oct. 24, 2017	All	- Add support for M3N (change M3 to M3/M3N.)
		8	- Figure 5-1: Add file directory for M3N.
1.50	Jan. 29, 2018	All	Notice: use version 2017
		All	Address list: use version 2018
		1	Table 1-1: Remove reference "R-Car Series, 3rd Generation User's Manual: Hardware - Rev.0.51".
		6-7	- Figure 4-1, Figure 4-2: Change: "thermal-sensors = <tsc1>;" -> to "thermal-sensors = <tsc 0>;"
1.51	Mar. 28, 2018	All	- Add support for R-Car E3 in description.
		1	- Table 1-1: Add "R-CarE3 System Evaluation Board Ebisu Hardware Manual RTP0RC77990SEB0010S"
		3	- Table 3-1: Add "R-CarE3 System Evaluation Board Ebisu"
		4	- Add footnote 1: "- On R-Car H3/M3/M3N, thermal module supports three channels (THS1/2/3) and three thermal zones. And on R-Car E3, thermal module supports only one channel (THS1) and one thermal zone." - Figure 3-1: Revise " "X" can be 0, 1, 2 corresponding to THS 1, 2, 3 respectively on H3/M3/M3N; and can be 0 corresponding to THS 1 on E3. (1)"
		6-7	- Add reference to footnote 1 in description of Chapter 4.1, 4.2, 4.3.
		8	- Figure 5-1: Add support for r8a77990 and update the format of description.
1.52	Jun. 27, 2018		- Change Gen3 to R-Car Series, 3rd Generation
1.53	Sep. 26, 2018	1	Table 1-1: Change version of R-Car Series, 3rd Generation User's Manual: Hardware from Rev.0.80 : Oct. 31, 2017 to Rev.1.00 : Apr. 30, 2018

# CONFIDENTIAL

2.00	Dec. 25, 2018	-	- Update AddressList
		1	<ul style="list-style-type: none"> <li>- Table 1-3: Change Salvator-XS board information as: <ul style="list-style-type: none"> <li>• R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS Hardware Manual</li> <li>• Rev.2.04</li> <li>• Jul. 17, 2018</li> </ul> </li> <li>• R-CarH3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7795SIPB0011S <ul style="list-style-type: none"> <li>• Rev.1.09</li> <li>• May. 11, 2017</li> </ul> </li> <li>R-CarM3-SiP System Evaluation Board Salvator-X Hardware Manual RTP0RC7796SIPB0011S <ul style="list-style-type: none"> <li>• Rev.0.04</li> <li>• Oct. 3, 2016</li> </ul> </li> <li>R-CarE3 System Evaluation Board Ebisu Hardware Manual RTP0RC77990SEB0010S <ul style="list-style-type: none"> <li>• Rev.0.03</li> <li>• Apr. 11, 2018</li> </ul> </li> </ul>
		3	<ul style="list-style-type: none"> <li>- Table 3-1: <ul style="list-style-type: none"> <li>+ Change Salvator-XS board name as “R-CarH3-SiP/M3-SiP/M3N-SiP System Evaluation Board Salvator-XS”</li> <li>+ Append Ebisu-4D board to Ebisu board type as below: <ul style="list-style-type: none"> <li>R-CarE3 System Evaluation Board Ebisu</li> <li>R-CarE3 System Evaluation Board Ebisu-4D</li> </ul> </li> </ul> </li> </ul>
2.01	Apr. 17, 2019	2	- Update Related documents
		-	- Update Address List
2.02	Jun. 24, 2020	1	Update Related documents <ul style="list-style-type: none"> <li>+ Change revision of R-Car Series, 3rd Generation HWM from ‘Rev.1.50’ to ‘Rev.2.00’</li> </ul>
		-	Update Address List
		7	4.3 Setting for Interrupt or Polling Mode <ul style="list-style-type: none"> <li>+ This setting is available for H3/M3/M3N only</li> </ul>
		8	5. Integration <ul style="list-style-type: none"> <li>+ Add SW directory for R-Car E3 source code</li> <li>+ Update kernel configuration for R-Car thermal driver support</li> </ul>
2.03	Jan. 29, 2021	All	- Add R-Car V3H v2.0 support.
2.50	Apr. 21, 2021	-	- Add R-Car D3 support.
		-	- Add Kernel v5.10 support.
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



# CONFIDENTIAL

---

Linux Interface Specification Device Driver Thermal Sensor  
User's Manual: Software

Publication Date: Rev.0.1 Nov. 20, 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 Thermal Sensor



Renesas Electronics Corporation