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RENESAS TECHNICAL UPDATE

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Product Category	MPU/MCU		Document No.	TN-RZ*-A0117A/E	Rev.	1.00
Title	RZ/G2E Additional Descriptions, Notification of thermal sensor temperature offset “16. Thermal Sensor (THS)”.		Information Category	Technical Notification		
Applicable Product	RZ/G Series, 2nd Generation RZ/G2E	Lot No. All lots	Reference Document	RZ/G Series, 2nd Generation User's Manual: Hardware Rev.1.11 (R01UH0808EJ0111)		

This technical update describes Additional Descriptions of RZ/G Series, 2nd Generation product.

[Summary]

Additional Descriptions for thermal sensor temperature offset. “16. Thermal Sensor (THS)”.

[Priority level]

Importance: “Normal”

Urgency: “Normal”

[Products]

RZ/G2E

[Section number and title]

Section 16. Thermal Sensor (THS)

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(By using two pages view of PDF readers this enables previously and prospectively view on odd and even pages.)

[Correction]

1. Section 16, Page 16-1, 16.1.1 Features (1) The analog of thermal sensor measurements temperature offset of Tj, notification added.

Current (from):

16. Thermal Sensor (THS)

16.1 Overview

This LSI provides a thermal sensor module that measures the temperature (Tj) inside the LSI. The thermal sensor module also includes a chip internal voltage monitoring module that measures the supply voltage (VDD) inside the LSI.

16.1.1 Features

(1) The analog voltage of thermal sensor for RZ/G2E measures temperature Tj with an accuracy of ±5°C over the range from -40°C to 115°C.The digital value of thermal sensor for RZ/G2E measures temperature Tj with an accuracy of ±7.75°C over the range from -40°C to 90°C and of ±7.5°C over the range from 90°C to 115°C.
(2) Provides reference to temperature Tj as measured from outside the chip with the use of external LSI pins (VTHREF and VTHSENSE) for RZ/G2E.
(3) This module can generate interrupts when the detected temperature Tj within the LSI rises above or falls below several specified temperatures.

16.1.2 Block Diagram

A block diagram of the thermal sensor module for each product is shown in Figure 16.1 (for RZ/G2E). The thermal sensor module consists of the thermal sensors (THS), which are analog circuits for measuring temperature and voltage, respectively, and the thermal sensor controller (TSC), which control the analog circuits.

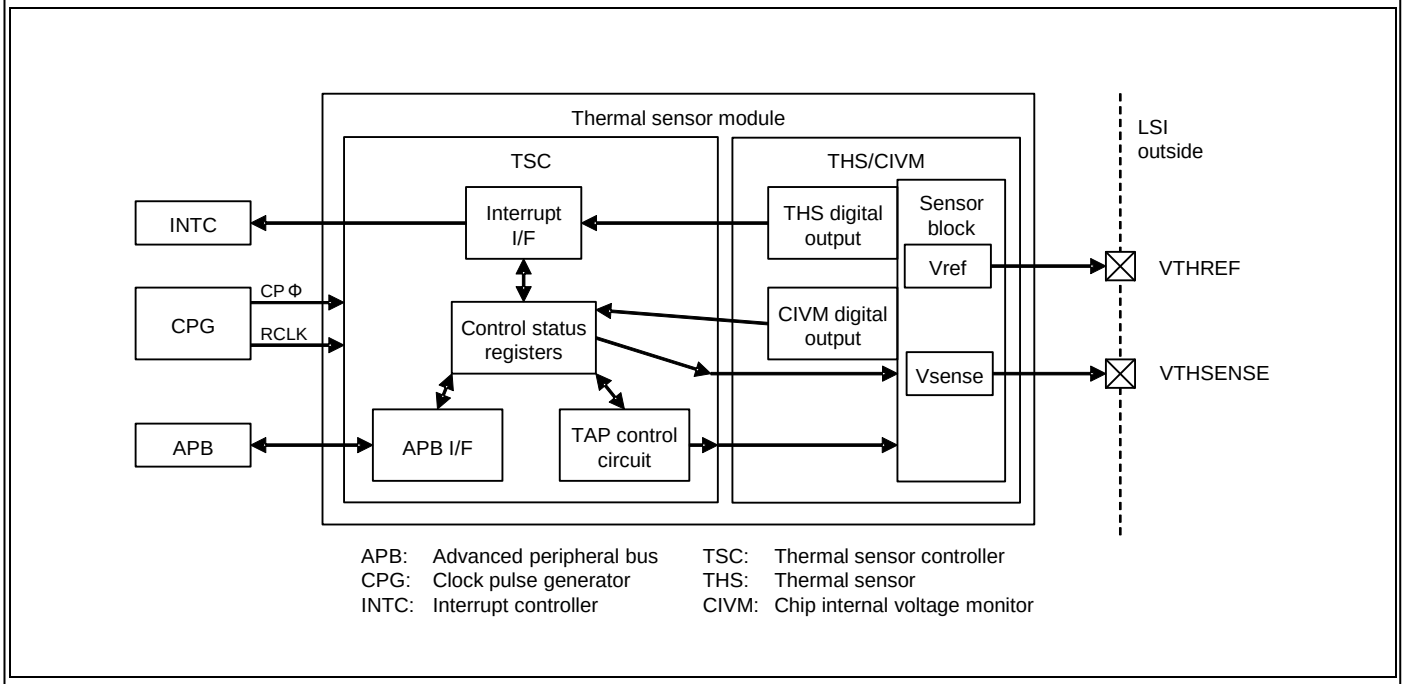

Figure 16.1 Block Diagram of Thermal Sensor Module

The TSC module outputs two kinds of signal to the THS module, that is, signals from control registers and from the TAP control circuit. The signals from control registers are used to control the analog circuits.

The TAP control circuit automatically adjusts the measurement range required in measuring the temperature and voltage, and outputs the results to the THS module.

The THS module outputs two kinds of signal to the TSC module, that is, digital signals from the THS module, which indicate the digital values representing the temperature and voltage, respectively. These values read from the corresponding registers can be used to generate interrupts due to comparison with the specified temperatures or voltages as well as to detect the temperature and voltage within the LSI.

Correction (to):

16. Thermal Sensor (THS)

16.1 Overview

This LSI provides a thermal sensor module that measures the temperature (Tj) inside the LSI. The thermal sensor module also includes a chip internal voltage monitoring module that measures the supply voltage (VDD) inside the LSI.

16.1.1 Features

(1) The analog voltage of thermal sensor for RZ/G2E measures temperature Tj with an accuracy of ±5°C over the range from -40°C to 115°C.The digital value of thermal sensor for RZ/G2E measures temperature Tj with an accuracy of ±7.75°C over the range from -40°C to 90°C and of ±7.5°C over the range from 90°C to 115°C.
Tj needs to consider the offset temperature. Refer to 16.3.10.
(2) Provides reference to temperature Tj as measured from outside the chip with the use of external LSI pins (VTHREF and VTHSENSE) for RZ/G2E.
(3) This module can generate interrupts when the detected temperature Tj within the LSI rises above or falls below several specified temperatures.

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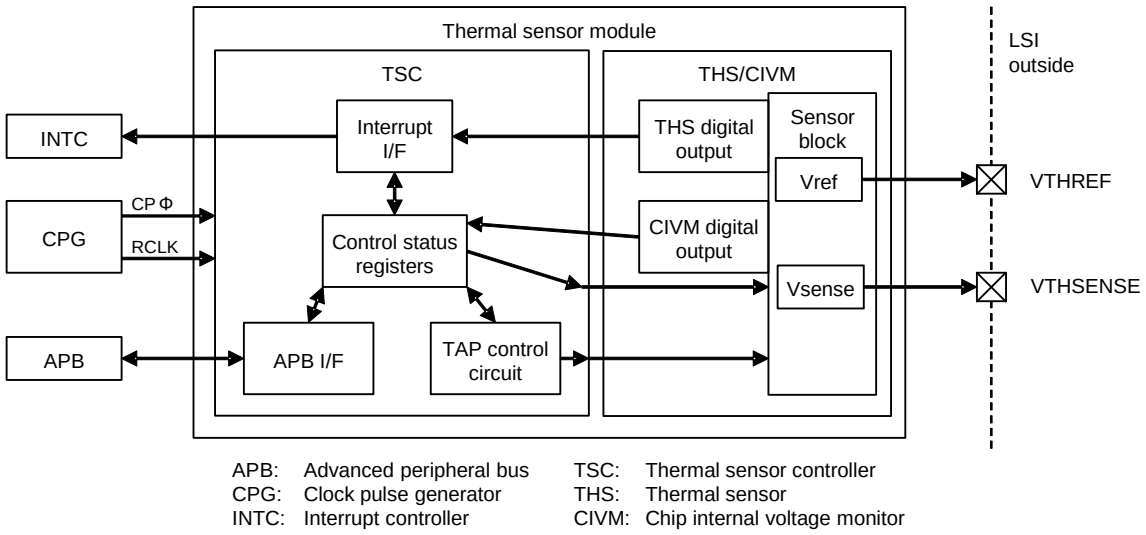
A block diagram of the thermal sensor module for each product is shown in Figure 16.1 (for RZ/G2E). The thermal sensor module consists of the thermal sensors (THS), which are analog circuits for measuring temperature and voltage, respectively, and the thermal sensor controller (TSC), which control the analog circuits.



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The THS module outputs two kinds of signal to the TSC module, that is, digital signals from the THS module, which indicate the digital values representing the temperature and voltage, respectively. These values read from the corresponding registers can be used to generate interrupts due to comparison with the specified temperatures or voltages as well as to detect the temperature and voltage within the LSI.

[Description]

Delete accuracy of THS/CIVM from RZ/G Series, 2nd Generation User's Manual: Hardware.

[Reason for Correction]

Specification or limitation of Tj accuracy note is needed to clarify the specification.

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(By using two pages view of PDF readers this enables previously and prospectively view on odd and even pages.)

[Correction]

2. Section 16, Page 16-9, 16.2.6 THS Status Register (THSSR), CTEMP[5:0] notification, added.

Current (from):

16.2.6 THS Status Register (THSSR)

Bit:	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Initial value:	0	0	0	0	—	—	—	—	—	—	—	—	0	—	—	—
R/W:	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Bit:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	—	—	—	—	—	—	—	—	—	—	CTEMP[5:0]					
Initial value:	0	0	0	0	0	0	0	0	0	0	—	—	—	—	—	—
R/W:	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Bit	Bit Name	Initial Value	R/W	Description
31 to 28	—	All 0	R	These bits are fixed to 0.
27 to 24	—	—	R	These bits are indefinite.
23 to 20	—	—	R	These bits are indefinite.
19	—	0	R	This bit is fixed to 0.
18 to 16	—	—	R	These bits are indefinite.
15 to 6	—	All 0	R	These bits are fixed to 0.
5 to 0	CTEMP[5:0]	—	R	Indicates the current temperature. Convert the value of the bits to actual temperature (°C) by the following formula. When CTEMP[5:0] is less than 24, T = CTEMP[5:0] × 5.5 – 72. When CTEMP[5:0] is equal to or greater than 24, T = CTEMP[5:0] × 5 – 60.

Correction (to):

16.2.6 THS Status Register (THSSR)

Bit:	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Initial value:	0	0	0	0	—	—	—	—	—	—	—	—	0	—	—	—
R/W:	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Bit:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	—	—	—	—	—	—	—	—	—	—	CTEMP[5:0]					
Initial value:	0	0	0	0	0	0	0	0	0	0	—	—	—	—	—	—
R/W:	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Bit	Bit Name	Initial Value	R/W	Description
31 to 28	—	All 0	R	These bits are fixed to 0.
27 to 24	—	—	R	These bits are indefinite.
23 to 20	—	—	R	These bits are indefinite.
19	—	0	R	This bit is fixed to 0.
18 to 16	—	—	R	These bits are indefinite.
15 to 6	—	All 0	R	These bits are fixed to 0.
5 to 0	CTEMP[5:0]	—	R	Indicates the current temperature. Convert the value of the bits to actual temperature (°C) by the following formula. When CTEMP[5:0] is less than 24, T = CTEMP[5:0] × 5.5 – 72. When CTEMP[5:0] is equal to or greater than 24, T = CTEMP[5:0] × 5 – 60.

Note: * Tj needs to consider the offset temperature. Refer to 16.3.10.

[Description]

Additional description.

[Reason for Correction]

Specification or limitation of Tj accuracy note is needed to clarify the specification.

[Correction]

3. Section 16, Page 16-20, 16.3.10 Thermal Sensor Offset, new section added.

Current (from):

— (None)

Correction (to):

16.3.10 Thermal Sensor offset

The Tjs calculated by using CTEMP [5:0] of thermal sensor has the following temperature gap.

- Tjs tends to be higher than Tj at CTEMP [5:0] = 0d35.
- Tjs tends to be lower than Tj at CTEMP [5:0] = 0d06.

Intermediate offset temperature will be calculated by using straight line approximation. The formula is below.

Tj = 5.0065 × CTEMP [5:0] – 67.4405

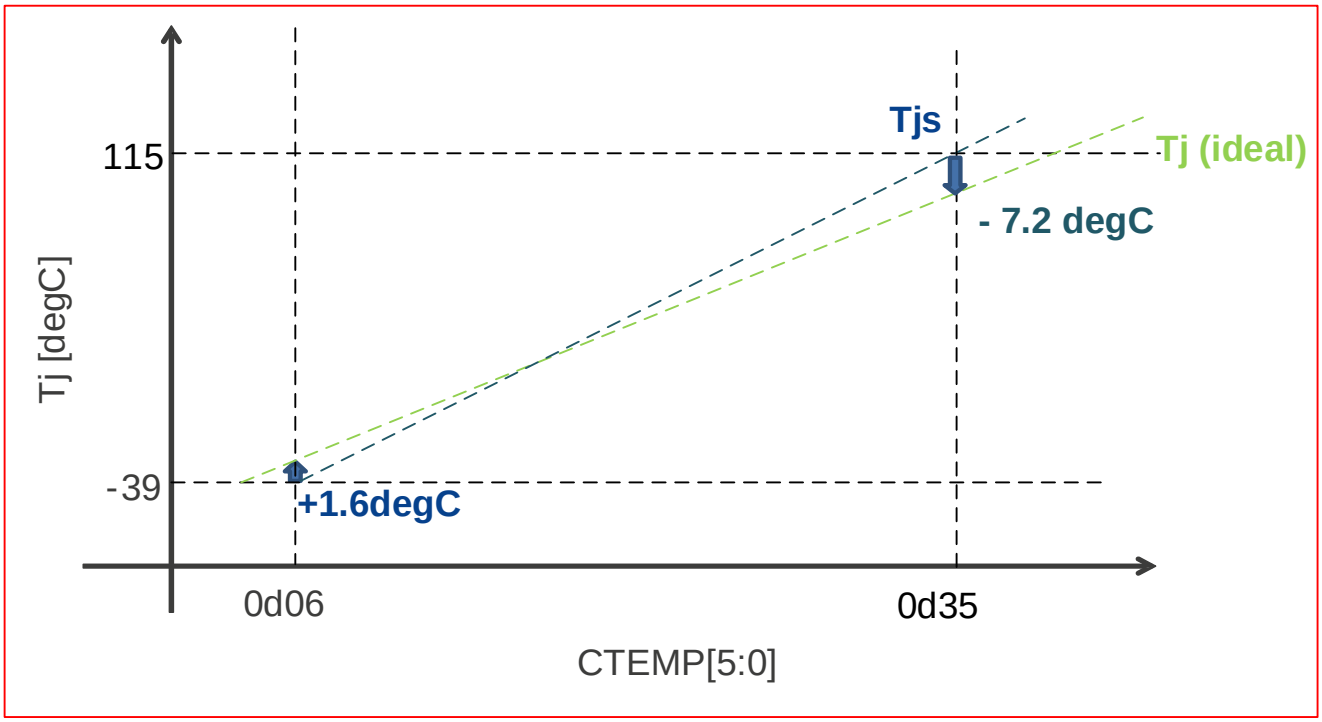

Figure 16.7 Thermal Sensor offset

[Description]

Additional section

[Reason for Correction]

Specification or limitation of Tj accuracy explanation is needed to clarify the specification.

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