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RENESAS TECHNICAL UPDATE

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Product Category	MPU/MCU		Document No.	TN-RA*-A0121A/E	Rev.	1.00
Title	Improve the description of LIOTRM/MIOTRM/HIOTRM register and on-chip oscillators characteristics		Information Category	Technical Notification		
Applicable Product	RA0E1 Group	Lot No. All	Reference Document	RA0E1 Group User's Manual: Hardware Rev.1.00 (R01UH1040EJ0100)		

Improve the description of LIOTRM/MIOTRM/HIOTRM register and on-chip oscillators characteristics in the User's Manual.

[Before correction of 8.2.20 LIOTRM : Low-speed On-chip Oscillator Trimming Register]

8.2.20 LIOTRM : Low-speed On-chip Oscillator Trimming Register

Base address: SYSC = 0x4001_E000

Offset address: 0x805

Bit position:	7	6	5	4	3	2	1	0
Bit field:	LIOTRM[7:0]							
Value after reset:	1	0	0	0	0	0	0	0

Bit	Symbol	Function	R/W
7:0	LIOTRM[7:0]	LOCO User Trimming 0x00: Minimum speed 0x01: ⋮ 0x80 Initial value ⋮ 0xFE: 0xFF: Maximum speed	R/W

Note: Set the PRCR.PRC0 bit to 1 (write enabled) before rewriting this register.

The LIOTRM register is added to the original LOCO trimming data.

MCU operation is not guaranteed when LIOTRM is set to a value that causes the LOCO frequency to be outside of the specification range. When LIOTRM is modified, the frequency stabilization time corresponds to the frequency stabilization time at the start of MCU operation. When the ratio of the LOCO frequency and the other oscillation frequency is an integer value, changing the LIOTRM value is prohibited.

[After correction of 8.2.20 LIOTRM : Low-speed On-chip Oscillator Trimming Register]

8.2.20 LIOTRM : Low-speed On-chip Oscillator Trimming Register

Base address: SYSC = 0x4001_E000

Offset address: 0x805

Bit position:	7	6	5	4	3	2	1	0
Bit field:	LIOTRM[7:0]							
Value after reset:	1	0	0	0	0	0	0	0

Bit	Symbol	Function	R/W
7:0	LIOTRM[7:0]	LOCO User Trimming 0x00: Minimum speed 0x01: ⋮ 0x80 Initial value ⋮ 0xFE: 0xFF: Maximum speed	R/W

Note: Set the PRCR.PRC0 bit to 1 (write enabled) before rewriting this register.

The frequency of the low-speed on-chip oscillator can be trimmed by configuring the LIOTRM register. When the LIOTRM register is configured, the frequency stabilization time corresponds to the frequency stabilization time at the start of MCU operation. For details on the resolution of frequency trimming and the stabilization time of the low-speed on-chip oscillator clock, refer to Table 31.6.

The frequency of the low-speed oscillator can be verified by using a timer (such as a Timer Array Unit or a 32-bit interval timer) with a high-accuracy external clock input, or by other methods.

Note: The oscillator's frequency may vary due to changes in temperature and power supply voltage after trimming. In such cases, regular trimming is essential, especially when high frequency accuracy is required.

[Before correction of 8.2.21 MIOTRM: Middle-speed On-chip Oscillator Trimming Register]

8.2.21 MIOTRM : Middle-speed On-chip Oscillator Trimming Register

Base address: SYSC = 0x4001_E000

Offset address: 0x804

Bit position:	7	6	5	4	3	2	1	0
Bit field:	MIOTRM[7:0]							
Value after reset:	1	0	0	1	0	0	0	0

Bit	Symbol	Function	R/W
7:0	MIOTRM[7:0]	MOCO User Trimming 0x00: Minimum speed 0x01: ⋮ 0x90: Initial value ⋮ 0xFE: 0xFF: +111	R/W

Note: Set the PRCR.PRC0 bit to 1 (write enabled) before rewriting this register.

The MIOTRM register is added to the original MOCO trimming data.

MCU operation is not guaranteed when MIOTRM is set to a value that causes the MOCO frequency to be outside of the specification range. When MIOTRM is modified, the frequency stabilization wait time corresponds to the frequency stabilization wait time at the start of the MCU operation. When the ratio of the MOCO frequency and the other oscillation frequency is an integer value, changing the MIOTRM value is prohibited.

[After correction of 8.2.21 MIOTRM: Middle-speed On-chip Oscillator Trimming Register]

8.2.21 MIOTRM : Middle-speed On-chip Oscillator Trimming Register

Base address: SYSC = 0x4001_E000

Offset address: 0x804

Bit position:	7	6	5	4	3	2	1	0
Bit field:	MIOTRM[7:0]							
Value after reset:	1	0	0	1	0	0	0	0

Bit	Symbol	Function	R/W
7:0	MIOTRM[7:0]	MOCO User Trimming 0x00: Minimum speed 0x01: ⋮ 0x90: Initial value ⋮ 0xFE: 0xFF: Maximum speed	R/W

Note: Set the PRCR.PRC0 bit to 1 (write enabled) before rewriting this register.

The frequency of the middle-speed on-chip oscillator can be trimmed by configuring the MIOTRM register. When the MIOTRM register is configured, the frequency stabilization time corresponds to the frequency stabilization time at the start of MCU operation. For details on the resolution of frequency trimming and the stabilization time of the middle-speed on-chip oscillator clock, refer to Table 31.6.

The frequency of the middle-speed oscillator can be verified by using a timer (such as a Timer Array Unit or a 32-bit interval timer) with a high-accuracy external clock input, or by other methods.

Note: The oscillator's frequency may vary due to changes in temperature and power supply voltage after trimming. In such cases, regular trimming is essential, especially when high frequency accuracy is required.

[Before correction of 8.2.22 HIOTRM : High-speed On-chip Oscillator Trimming Register]

8.2.22 HIOTRM : High-speed On-chip Oscillator Trimming Register

Base address: FLCN = 0x407E_C000

Offset address: 0x200

Bit position:	7	6	5	4	3	2	1	0
Bit field:	—	—	HIOTR [5:0]					
Value after reset:	0	0	x	x	x	x	x	x

Bit	Symbol	Function	R/W
5:0	HIOTRM[5:0]	HOCO User Trimming 0x00: Minimum speed ⋮ 0x3f: Maximum speed	R/W
7:6	—	These bits are read as 0. The write value should be 0.	R/W

Note: The value of this register is that adjusted at shipment following a reset.

The HIOTRM register is added to the original HOCO trimming data.

MCU operation is not guaranteed when HIOTRM is set to a value that causes the HOCO frequency to be outside of the specification range. When HIOTRM is modified, the frequency stabilization wait time corresponds to the frequency stabilization wait time at the start of the MCU operation.

[After correction of 8.2.22 HIOTRM : High-speed On-chip Oscillator Trimming Register]

8.2.22 HIOTRM : High-speed On-chip Oscillator Trimming Register

Base address: FLCN = 0x407E_C000

Offset address: 0x200

Bit position:	7	6	5	4	3	2	1	0
Bit field:	—	—	HIOTR [5:0]					
Value after reset:	0	0	x	x	x	x	x	x

Bit	Symbol	Function	R/W
5:0	HIOTRM[5:0]	HOCO User Trimming 0x00: Minimum speed ⋮ 0x3f: Maximum speed	R/W
7:6	—	These bits are read as 0. The write value should be 0.	R/W

Note: After a reset, the HIOTRM register is initialized with the trimming value set at the time of shipment.

The frequency of the high-speed on-chip oscillator can be trimmed by configuring the HIOTRM register. When the HIOTRM register is configured, the frequency stabilization time corresponds to the frequency stabilization time at the start of MCU operation. For details on the resolution of frequency trimming and the stabilization time of the high-speed on-chip oscillator clock, refer to Table 31.6.

The frequency of the high-speed oscillator can be verified by using a timer (such as a Timer Array Unit or a 32-bit interval timer) with a high-accuracy external clock input, or by other methods.

Note: The oscillator's frequency may vary due to changes in temperature and power supply voltage after trimming. In such cases, regular trimming is essential, especially when high frequency accuracy is required.

[Before correction of 31.2.3 On-chip Oscillators Characteristics]

31.2.3 On-chip Oscillators Characteristics

Table 31.6 On-chip oscillators characteristics (1 of 2)

Conditions: VCC = 1.6 to 5.5 V, VSS = 0 V, Ta = -40 to +105°C

Parameter		Symbol	Min	Typ	Max	Unit	Test conditions
High-speed on-chip oscillator clock frequency		f_{HOCO}	1	—	32	MHz	—
High-speed on-chip oscillator clock frequency accuracy	OSCSF.HOCOSF = 1	—	-1.0	—	+1.0	%	Ta = -40 to +105°C, 1.6 V ≤ VCC ≤ 5.5 V
	OSCSF.HOCOSF = 0*3	—	-15	—	0	%	—
High-speed on-chip oscillator clock correction resolution		—	—	0.05	—	%	—
Middle-speed on-chip oscillator clock frequency*1		f_{MOCO}	1	—	4	MHz	—
Middle-speed on-chip oscillator clock frequency accuracy		—	-12	—	12	%	—
Middle-speed on-chip oscillator clock correction resolution		—	—	0.15	—	%	—
Middle-speed on-chip oscillator frequency temperature coefficient		—	—	—	±0.17*2	%/°C	—
Low-speed on-chip oscillator clock frequency*1		f_{LOCO}	—	32.768	—	kHz	—
Low-speed on-chip oscillator clock frequency accuracy		—	-15	—	15	%	—
Low-speed on-chip oscillator clock correction resolution		—	—	0.3	—	%	—

Table 31.6 On-chip oscillators characteristics (2 of 2)

Conditions: VCC = 1.6 to 5.5 V, VSS = 0 V, Ta = -40 to +105°C

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Low-speed on-chip oscillator frequency temperature coefficient	—	—	—	±0.21*2	%/°C	—

Note 1. The listed values only indicate the characteristics of the oscillators. Refer to AC Characteristics for instruction execution time.
Note 2. Guaranteed by characterization results.
Note 3. The listed condition applies when OFS1.HOCOFRQ1[2:0] = 010b.

[After correction of 31.2.3 On-chip Oscillators Characteristics]

31.2.3 On-chip Oscillators Characteristics

Table 31.6 On-chip oscillators characteristics (1 of 2)

Conditions: VCC = 1.6 to 5.5 V, VSS = 0 V, Ta = -40 to +105°C

Parameter		Symbol	Min	Typ	Max	Unit	Test conditions
High-speed on-chip oscillator clock frequency		f_{HOCO}	1	—	32	MHz	—
High-speed on-chip oscillator clock frequency accuracy	OSCSF.HOCOSF = 1	—	-1.0	—	+1.0	%	Ta = -40 to +105°C, 1.6 V ≤ VCC ≤ 5.5 V
	OSCSF.HOCOSF = 0*3	—	-15	—	0	%	—
High-speed on-chip oscillator clock frequency trimming resolution		—	—	0.05	—	%	—
High-speed on-chip oscillator clock oscillation stabilization time *4		t_{HOCO}	—	—	4.4	µs	—
Middle-speed on-chip oscillator clock frequency*1		f_{MOCO}	1	—	4	MHz	—
Middle-speed on-chip oscillator clock frequency accuracy		—	-12	—	12	%	—
Middle-speed on-chip oscillator clock frequency trimming resolution		—	—	0.15	—	%	—
Middle-speed on-chip oscillator clock oscillation stabilization time		t_{MOCO}	—	—	1	µs	—
Middle-speed on-chip oscillator frequency temperature coefficient		—	—	—	±0.17*2	%/°C	—
Low-speed on-chip oscillator clock frequency*1		f_{LOCO}	—	32.768	—	kHz	—
Low-speed on-chip oscillator clock frequency accuracy		—	-15	—	15	%	—
Low-speed on-chip oscillator clock frequency trimming resolution		—	—	0.3	—	%	—

Table 31.6 On-chip oscillators characteristics (2 of 2)

Conditions: VCC = 1.6 to 5.5 V, VSS = 0 V, Ta = -40 to +105°C

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions
Low-speed on-chip oscillator clock oscillation stabilization time	t_{LOCO}	—	—	100	µs	—
Low-speed on-chip oscillator frequency temperature coefficient	—	—	—	±0.21*2	%/°C	—

Note 1. The listed values only indicate the characteristics of the oscillators. Refer to AC Characteristics for instruction execution time.
Note 2. These values are the results of characteristic evaluation and are not checked for shipment.
Note 3. The listed condition applies when OFS1.HOCOFRQ1[2:0] = 010b.
Note 4. Check OSCSF.HOCOSF to confirm whether stabilization time has elapsed.