

RENESAS TECHNICAL UPDATE

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Product Category	MPU/MCU		Document No.	TN-SH7-A779A/E	Rev.	1.00
Title	Limitation on use of SH-4A CPU speculative execution when returning from subroutine (only PVR[23:16]=H'20 version CPU)		Information Category	Technical Notification		
Applicable Product	SH7780 and SH7763 Groups	Lot No.	Reference Document	SH7780 Hardware Manual (REJ09B0158-0100) SH7763 Hardware Manual (REJ09B0256-0200) SH-4A Software Manual (REJ09B0003-0150)		
		All lots				

For the early version of the SH-4A CPU, when using the condition of CPUOPM.RABD=0 may cause an erroneous operation or system hang-up even if using the workaround in manual description in special codes.

[Summary]

The SH7780 and SH7763 out of the on-chip SH-4A CPU (SH7780 Series) core products can be shortened the execution cycle for the returning from subroutine when clearing CPUOPM.RABD (bit 5) to 0 then the CPU issuing instruction fetch speculatively, as described in each product hardware manual and the software manual appendix A, "CPU Operation Mode Register".

But, this speculative instruction fetch may issue the access to the address that should not be accessed from the program. For this problem, there is a workaround described in Appendix C, "Speculative Execution for Subroutine Return" both each product hardware manuals and the SH-4A software manual as follows.

Usage Condition: When the speculative execution for subroutine return is enabled, the RTS instruction should be used to return to the address set in PR by the JSR, BSR or BSRF instructions. It can prevent the access to unexpected address and avoid the problem.

However, the unexpected access of an instruction prefetching to the prohibited address may still occur even if keeping above "Usage Condition" during speculative execution for subroutine return in special codes.

[Problem]

Following problem may occur when returning from subroutine (same side effect of the instruction prefetching).

1. It is possible that an external bus access caused by an instruction prefetch may result in misoperation of an external device, such as a FIFO, connected to the area concerned.
2. If there is no device to reply to an external bus request caused by an instruction prefetch, hang-up will occur.

[Workaround]

There is no suitable workaround about each product. Use the RABD bit without changing from the initial value 1 (1: Instruction fetch for subroutine return is not issued speculatively). By using RABD=1, the speculative instruction prefetching does not occur during subroutine return.

[Applicable Products]

Following SH7780 series product that are used the SH-4A CPU, and the CPUOPM.RABD function is opened:

- (1) SH7780 Group
- (2) SH7763 Group

[Note]

*: Processor Version Register (PVR)

SH-4A CPU products have the version register that indicates processor core version. This register is named at the processor version register (PVR) and that is 32-bit read only register. For the PVR of the above (1) and (2) group products, refer to the hardware manual, "Appendix I".

PVR Register Configuration

Register Name	Abbrev.	R/W	Initial Value	P4 Address	Area 7 Address	Access Size
Processor Version Register	PVR	R	H'1020 xxxx	H'FF000030	H'1F000030	32

Bit:	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	version information															
Initial Value	0	0	0	1	0	0	0	0	0	0	1	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
	version information								-	-	-	-	-	-	-	-
Initial Value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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 24	Version Information	H'10	R	Version Information The read value is always H'10 for the SH-4A core product.
23 to 16	Version Information	H'20	R	Version Information The applicable product of this problem is equal to H'20. Note that, H'30 or after this product does not correspond to this problem.
15 to 8	Version Information	H'xx	R	Version Information The value is different in each product. For details, refer to the hardware manual of each product.
7 to 0	—	Undefined	R	This value is undefined. It should be masked by software when used.

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