

Chip Errata for the MPC7448

This document details all known silicon errata for the MPC7448. The MPC7448 is a microprocessor built on Power Architecture™ technology. The MPC7450 has the same functionality as the MPC7448 and any differences are detailed in the document. [Table 1](#) provides a revision history for this chip errata document.

Table 1. Document Revision History

Revision	Date	Substantive Change(s)
6	10/2008	Added Erratum 26.
5	10/2007	Added Erratum 25.
4	05/2007	Added Erratum 23 and Erratum 24.
3	09/2006	Added Erratum 22. Updated Projected Solution for Erratum 21.
2.1	03/2006	Clarified Erratum 21.
2	03/2006	Added Erratum 21.
1	02/2006	Added Erratum 18. Added Erratum 19. Added Erratum 20.
0	09/2005	Initial release.

Table 2 describes the devices to which the errata in this document apply and provides a cross-reference to match the revision code in the processor version register to the revision level marked on the part.

Table 2. Revision Level to Part Marking Cross-Reference

MPC7448 Revision	Part Marking	Processor Version Register
1.0	A	0x8004_0100
2.0	B	0x8004_0200
2.1	C	0x8004_0201
2.2	D	0x8004_0202

Table 3 summarizes all known errata and lists the corresponding silicon revision level to which it applies. A ‘Y’ entry indicates the erratum applies to a particular revision level, while a ‘N’ entry means it does not apply.

Table 3. MPC7448 Summary of Silicon Errata and Applicable Revision

No.	Name	Projected Impact Overview	Errata in Silicon Revision			
			1.0	2.0	2.1	2.2
1	Setting MSSCR0[18–24] will cause machine check exceptions	Software that sets MSSCR0[18–24] bits will cause the system to take spurious and sometimes frequent machine check exceptions.	These bits have been marked ‘Reserved for factory use only’ in the <i>MPC7450 RISC Microprocessor Family User’s Manual</i> .			
2	TAU reports incorrect temperatures	Programmed trip temperatures will not trigger output interrupts, even if temperatures exceed the expected setpoint by up to 55 degrees.	The TAU is not implemented as a feature and is not included in any MPC7450 Family documentation.			
3	L2 hardware flush may not flush every line from the L2 cache	Data corruption will occur in systems whose software misses in the iL1 during an L2 hardware flush routine.	The work around is documented in the <i>MPC7450 RISC Microprocessor Family User’s Manual</i> .			
4	L1_TSTCLK must be pulled low	Tying L1_TSTCLK high may cause data corruption in the L2 and may limit the frequency of operation.	The work around has been documented in the hardware specifications as the correct way to configure L1_TSTCLK and L2_TSTCLK.			
5	Earliest transfer of MPX/60x data requirement	Any system where a device may assert TA or TEA for a data tenure before or while the AACK for that transaction is driven.	The MPC7450 family implementation of the earliest transfer for MPX/60x data will remain as documented.			
6	Instructions following a dcba mapped T = 1 may not be executed	Any code that executes dcba instructions with T = 1 effective addresses may not see all instructions executed. Since Direct-Store Segment Address Translation was originally included in the architecture to support legacy POWER architecture I/O devices that used this interface, the impact to customers should be minimal.	Y	Y	Y	Y

Table 3. MPC7448 Summary of Silicon Errata and Applicable Revision (continued)

No.	Name	Projected Impact Overview	Errata in Silicon Revision			
			1.0	2.0	2.1	2.2
7	SRR0/SRR1/PC values incorrectly updated if instruction at breakpoint in COP debug mode causes an exception	Emulators that utilize the COP soft-stop feature may not work as intended when attempting to set a breakpoint at an instruction that causes an exception.	Y	Y	Y	Y
8	Processor may hang when mtmsr/isync transitions MSR[IR] from 1->0 and isync instruction resides in unmapped page	Any systems that disable instruction translation using mtmsr, and for which the required isync may reside in a different page whose page table entry is not available in the memory hierarchy may hang.	Y	Y	Y	Y
9	Scanning MSS_NRM chain via COP during softstop may cause unexpected interrupts upon resumption of normal operation	Emulators and debug tools accessing the MSS_NRM scan chain via COP during softstop.	Y	Y	Y	Y
10	tlb snoop during Doze state may cause processor hang	Systems performing tlb snoops during Doze state where the index of the tlb matches that of the instruction code that caused entry into Nap mode may hang.	Y	Y	Y	Y
11	Data corruption due to write-through aliasing in the MMU	Systems performing write-through aliasing of the same physical page may encounter data corruption.	Y	N	N	N
12	HID0[SPD]=1 does not prevent instruction fetches past unresolved branches when MSR[IR]=0	Systems executing code with instruction translation disabled (MSR[IR]=0) and HID0[SPD]=1 may see instruction fetches propagate to the external bus unexpectedly.	Y	Y	Y	Y
13	SPR read of L3CR returns undefined value	Any system expecting a read of the L3CR to return a result of zero due to the absence of the L3 cache may receive a non-zero value instead. This may cause some backwards compatibility issues with existing system code that expects the value to be zero if no L3 exists.	Y	Y	N	N
14	Store gathering/merging performance issue	A software algorithm that performs multiple back-to-back stores to the same cache line will see a negative performance impact compared to previous MPC744X/MPC745X processors.	Y	N	N	N
15	L2 latency performance issue	Performance analysis of revision 1.0 of the MPC7448 processor will encounter much higher L2 latencies compared to the projected L2 latency of this product.	Y	N	N	N

Table 3. MPC7448 Summary of Silicon Errata and Applicable Revision (continued)

No.	Name	Projected Impact Overview	Errata in Silicon Revision			
			1.0	2.0	2.1	2.2
16	Unexpected instruction fetch may occur when transitioning MSR[IR] 0->1	Systems executing code as described above may encounter unexpected machine checks or system hangs.	Y	Y	Y	Y
17	Problem accessing internal caches and arrays via COP	This problem occurs on any system that uses a COP emulator debugging tool to access the internal caches and arrays.	Y	Y	Y	Y
18	Accessing LSRL via COP during soft stop mode causes data corruption	This problem occurs on any system that uses a COP emulator to access the LSRL during soft-stop mode.	Y	Y	Y	Y
19	Processor I/O may lock up during power-up, reset and JTAG scan	Any system with an affected device may encounter this issue. Systems which adhere to the power sequencing requirements described in the MPC7448 RISC Microprocessor Hardware Specifications have minimal vulnerability to this issue.	Y	Y	N	N
20	Performance Monitor Out (PMON_OUT) not operational	Systems designed to use the PMON_OUT signal as an indication of an internal Performance Monitor event will not have this feature, originally intended as a debug aid.	Y	Y	Y	Y
21	Back-to-back snoops to L1 data cache may cause processor hang	Systems encountering this issue will typically fail with a hang condition in which the processor will enter an internal deadlock condition and cease to request the bus. Alternatively, it may enter an external deadlock condition in which it will infinitely retry all external bus snoops from other masters. In the internal deadlock condition, decrements and timebase exceptions will not be serviced.	Y	Y	Y	N
22	Voltage Derating No Longer Supported for MC7448xx1700LC devices	Operating MC7448xx1700LC at derated voltages in not supported on devices with date code 0613 and later. Customers using MC7448xx1700LC devices in the derated mode should migrate to the MC7448xx1267NC device.	—	—	Y	Y
23	MCP or SRESET signal assertion during transition to Nap may hang processor	Systems where MCP or SRESET can be asserted during entry into Nap mode are at risk. The risk is believed to be extremely small and has never been observed in a MPC744X system.	Y	Y	Y	Y
24	Store type operations during COP softstop debug mode may hang processor; Machine check error limitations	Emulators that utilize the COP softstop feature may not work as intended since the processor's violation of the system bus protocol may cause unexpected behavior on the part of the system controller.	Y	Y	Y	Y

Table 3. MPC7448 Summary of Silicon Errata and Applicable Revision (continued)

No.	Name	Projected Impact Overview	Errata in Silicon Revision			
			1.0	2.0	2.1	2.2
25	Unpaired stwcx. may hang processor	The processor will hang if the Load/Store Unit does not report the completion of the stwcx. to the Completion Unit. Paired lwarx/stwcx. instructions are not affected by this erratum.	Y	Y	Y	Y
26	Using 7x and 14x PLL multipliers may hang system when exiting HRESET state and nap, sleep, COP softstop modes	Systems using 60x bus mode and 7x multiplier with SYSCLK > 100 MHz or 14x multiplier with SYSCLK > 100 MHz are likely at risk of encountering this erratum. Systems using MPX bus mode and 7x multiplier with SYSCLK > 100 MHz or 14x multiplier with SYSCLK > 100 MHz and using MSSCR0[ABD] = 1 and MSSCR0[EIDIS] = 0 are at a low risk of encountering this erratum when exiting from nap, sleep and COP softstop modes.	Y	Y	Y	Y

Erratum No. 1: Setting MSSCR0[18–24] will cause machine check exceptions

Description:

The MSSCR0 register fields 18–24, if not all zeros, can cause the MPC7450 to take a machine check on internally triggered events without warning.

The MSSCR0 register fields 18–24 was originally intended for internal lab debug only. Setting one or more of these bits can cause the MPC7450 to take machine checks (or a checkstop based on MSR[ME]) due to unspecified internal events. These events, while useful for initial internal lab debug, have ceased to be of value and may cause undesired system behavior if set.

Projected Impact:

Software that sets MSSCR0[18–24] bits will cause the system to take spurious and sometimes frequent machine check exceptions.

Work-Around:

Do not set MSSCR0[18–24].

Projected Solution:

These bits have been marked “*Reserved for factory use only*” in the *MPC7450 RISC Microprocessor Family User’s Manual*.

Erratum No. 2: TAU reports incorrect temperatures

Description:

The thermal assist unit (TAU) on the MPC7450 and MPC7455 reports temperatures between 35 to 55 degrees lower than expected.

This erratum effects only customers using the TAU. If a trip temperature is programmed into the sensor's control registers, the output interrupt is never received, even if temperatures exceed the expected setpoint by up to 55 degrees (even after calibration). A control application will not be alerted of excessive temperatures and this could lead to damage of the part.

Projected Impact:

Programmed trip temperatures will not trigger output interrupts, even if temperatures exceed the expected setpoint by up to 55 degrees.

Work-Around:

None

Projected Solution:

None. The TAU is not implemented on the MPC7448.

Erratum No. 3: L2 hardware flush may not flush every line from the L2 cache

Description:

A valid line in the L2 may be ignored during an L2 hardware flush if instruction fetches are trying to allocate into the L2 during the flush.

The MPC7450 performs ‘front-end’ allocation in the L2 cache. If a request misses in the L2, the L2 allocates an entry at the time of the miss to make room for the subsequent reload by setting an ‘allocated’ bit in the L2 cache status for that line. This bit is cleared when the reloaded data is received.

The L2 hardware flush mechanism sequentially performs a tag read on every index, sector, and way in the L2 tag. As it encounters a valid entry, an operation is queued to the L2 to either simply invalidate the line or push the data from the cache if the data is modified.

The failing scenario is as follows: an instruction access to address ‘A’ from the L1 instruction cache (iL1) accesses and misses in the L2. The alternate sector for address ‘A’ is currently allocated in the L2 in way ‘N’ and awaiting a reload from the L3 or external bus. Meanwhile, the victim selection logic has chosen way ‘N’ to evict from the cache if an eviction is necessary. Since address ‘A’ alternate sector is in way ‘N,’ no eviction is necessary. The miss for ‘A’ queues up an internal allocate request to the L2 to allocate into way ‘N.’ During the cycle in which the instruction allocate request arbitrates into the L2, an L2 hardware flush to an unrelated index/sector/way ‘X/Y/Z’ is also arbitrating into the L2. Normally, the allocate request would win. As a result, an internal address mux that chooses the address with which to access the L2 is selected as the allocate address ‘A.’ However, an under-qualified internal retry condition exists for the allocate, where if the victim selection logic points to a way in which the alternate sector is in the allocated state, which it is, then the new allocate request gets retried. In this failing scenario, the L2 hardware flush request wins, since the allocate request gets retried. Meanwhile, the address mux continues to select the allocate address ‘A.’ As a result, the L2 hardware flush routine moves on to the next L2 tag entry without having accessed the current index/sector/way ‘X/Y/Z.’

Projected Impact:

Data corruption will occur in systems whose software misses in the iL1 during an L2 hardware flush routine.

Work-Around:

Set the IONLY and DONLY bits in the L2CR prior to the L2 hardware flush.

Projected Solution:

The work around has been documented in the *MPC7450 RISC Microprocessor Family User’s Manual* as the correct way to flush the L2 cache.

Erratum No. 4: L1_TSTCLK must be pulled low

Description:

Early revisions of the *MPC7450 RISC Microprocessor Hardware Specifications* incorrectly recommended pulling up L1_TSTCLK.

On all previous parts, L1_TSTCLK has been identified as a factory test pin and is recommended to be pulled high. This historical precedent was perpetuated in the *MPC7450 RISC Microprocessor Hardware Specifications*. However, on the MPC7450 Rev. 2.0, pulling this pin high prevents proper operation of the L2 cache and may limit the maximum frequency.

The *MPC7450 RISC Microprocessor Family User's Manual* does not address L1_TSTCLK or L2_TSTCLK.

Revision 1 and prior of the *MPC7450 RISC Microprocessor Hardware Specifications* notes these signals are test input signals for factory use only and must be pulled up to OV_{DD} for normal machine operation.

Projected Impact:

Tying L1_TSTCLK high may cause data corruption in the L2 and may limit the frequency of operation.

Work-Around:

Tie L1_TSTCLK low for proper device operation. It is recommended that L2_TSTCLK be tied to HRESET, but other configurations will not adversely affect performance.

Projected Solution:

Documented correctly in all the MPC7450 family hardware specifications.

Erratum No. 5: Earliest transfer of MPX/60x data requirement

Description:

The MPC7450 does not support the transfer of any data on MPX/60x bus before the processor's snoop response window, defined as the cycle after $\overline{\text{AACK}}$ is asserted.

The MPC7450 implementation of the earliest transfer of data during an MPX/60x bus transaction is more restrictive than previous processors including the MPC7400/MPC7410. This implementation creates a backwards compatibility issue with older system chipsets, including the Tundra Tsi106™ PowerPC host bridge or the Tundra Tsi107™

host bridge revisions prior to Rev. 1.4. In addition, any newly designed chipsets must adhere to this restriction.

In an MPC7450 system, the system chipset logic must ensure that the last (or only) assertion of $\overline{\text{TA}}$ for a data transfer does not occur sooner than the last cycle of the snoop response window (cycle after $\overline{\text{AACK}}$). Note that $\overline{\text{DBG}}$ can still be driven as early as $\overline{\text{TS}}$. Likewise, the system chipset logic must ensure that $\overline{\text{TEA}}$ is not asserted before the last cycle of the snoop response window.

The Tsi106 host bridge and the Tsi107 host bridge prior to Rev. 1.4 may transfer read and write data with the processor ending at or before the cycle of $\overline{\text{AACK}}$, which is one cycle before that permitted by the MPC7450. Systems that include either of these two bridge devices, or devices with the same behavior, are susceptible to processor hangs or data corruption as a result of this issue.

Projected Impact:

Any system where a device may assert $\overline{\text{TA}}$ or $\overline{\text{TEA}}$ for a data tenure before or while the $\overline{\text{AACK}}$ for that transaction is driven.

Work-Around:

Devices must not assert $\overline{\text{TA}}$ or $\overline{\text{TEA}}$ for a transaction before that transaction's snoop response window (cycle after $\overline{\text{AACK}}$), as documented in the *MPC7450 RISC Microprocessor Family User's Manual*.

Projected Solution:

The MPC7450 implementation of the earliest transfer for data is as documented in the *MPC7450 RISC Microprocessor Family User's Manual*.

Erratum No. 6: Instructions following a **dcba** mapped $T = 1$ may not be executed

Description:

A single instruction that is one, two, or three instructions following a **dcba** instruction with an address mapped using Direct-Store Segment Address Translation ($T = 1$) may not be executed. Direct-Store Segment Address Translation has been removed from the architecture and is not supported on the MPC750, MPC7400, or MPC7450 processors. However, the following cache operations, when mapped $T = 1$, should still no-op as defined in the original architecture: **dcba**, **dcbz**, **icbi**, **dcbst**, **dcbi**, **dcbf**, **dcbstst**, and **dcbt**.

On the MPC7450, the **dcba** instruction will correctly no-op when $T = 1$, but will incorrectly cause subsequent instructions to not be executed. Specifically, one of the instructions in a window of three instructions immediately following the **dcba** may not be executed. All three instructions may be executed correctly, but a maximum of one may not be executed. Whether or not this one instruction is executed is highly dependent upon internal timings.

Note that if branch folding is enabled ($HID0[FOLD] = 1$), and one or multiple branch instructions following the **dcba** are folded, then these branch instructions do not count towards determining the window of three instructions following the **dcba**.

Projected Impact:

Any code that executes **dcba** instructions with $T = 1$ effective addresses may not see all instructions executed. Since Direct-Store Segment Address Translation was originally included in the architecture to support legacy POWER architecture I/O devices that used this interface, the impact to customers should be minimal.

Work-Around:

A work around can be achieved by doing one of the following:

1. Do not map **dcba** instructions to $T = 1$ space.
2. Follow each **dcba** with three no-op instructions.
3. Follow each **dcba** instruction with an **isync** instruction.

Projected Solution:

None. This erratum will not be fixed in any subsequent revisions of the MPC7450 family.

Erratum No. 7: SRR0/SRR1/PC values incorrectly updated if instruction at breakpoint in COP debug mode causes an exception

Description:

During softstop debug mode, which is accessible through the COP, the processor corrupts the values of the SRR0/SRR1/PC if an instruction that matches IABR causes an exception of lower priority than a breakpoint exception.

If the instruction address breakpoint register (IABR) is set and enabled for an instruction address in COP softstop mode, the processor should halt operation and stop internal clocks before the instruction is executed. The PC should point to that instruction's address.

However, the processor may incorrectly update the PC if the instruction at that address causes an exception of lower priority than an IABR breakpoint. The SRR0 is incorrectly updated to the address of the instruction itself, and the SRR1 is modified.

For example, if the IABR points to an instruction that performs a data access to an address space that is mapped no-access in a DBAT, the PC is updated to the DSI exception handler address, and the SRR0 is updated to the address of the excepting instruction.

Other exception types that cause this failure are illegal instruction exceptions, traps, floating-point or AltiVec unavailable exceptions, privilege violations, and alignment exceptions.

Data translation that hits in the on-chip DTLB as an access violation will also show this problem. Translation that misses in the DTLB and requires a tablewalk will not show this problem because the tablewalk will be correctly terminated before any page table results return.

Instruction address breakpoints set through software during normal functional mode stop correctly before any PC/SRR0/SRR1 update occurs.

Projected Impact:

Emulators that utilize the COP soft-stop feature may not work as intended when attempting to set a breakpoint at an instruction that causes an exception.

Work-Around:

None.

Projected Solution:

Under review.

Erratum No. 8: Processor may hang when mtmsr/isync transitions MSR[IR] from 1->0 and isync instruction resides in unmapped page

Description:

If the **mtmsr** instruction is used to disable instruction translation, and the subsequent **isync** instruction resides on a different page than the **mtmsr** instruction, and the **isync** instruction's page causes a page fault exception, the processor will hang before taking the page fault exception. Once in the hang state, the processor will not recover and hard reset must be asserted.

An alternate failing scenario can exist if the **mtmsr** and **isync** reside on the same page but in different quadwords. If the mapping for that page exists in the iTLB, but not the page table, and a tlbie snoop occurs between the **mtmsr** and **isync** that invalidates the iTLB entry, then the processor will hang before taking the page fault exception.

If the **isync** instruction address is guaranteed to have a valid page table mapping resident in the memory hierarchy, then neither scenario can occur.

Projected Impact:

Any systems that disable instruction translation using **mtmsr**, and for which the required **isync** may reside in a different page whose page table entry is not available in the memory hierarchy may hang.

Any systems mapping the **mtmsr/isync** code with the IBATs will not fail due to this issue. Any systems not demand-paging their supervisor-level code will not fail due to this issue.

Work Arounuds:

Any of the following work-arounds will avoid the processor hang:

- **mtmsr/isync** instruction pairs should reside within the same quadword.
- disable instruction translation by initializing SRR0/SRR1 and executing **rfi**.
- map code which disables instruction address translation with the IBATs.

Projected Solution:

Under review.

Erratum No. 9: Scanning MSS_NRM chain via COP during softstop may cause unexpected interrupts upon resumption of normal operation

Description:

If the MSS_NRM scan chain is accessed via COP during softstop and MSR[EE] is set, then an unexpected decrementer (0x0900) or thermal management (0x1700) interrupt may occur when the processor resumes from softstop.

The following special purpose registers reside in the MSS_NRM scan chain:

1. HID1
2. L2CR
3. L3CR/L3PM/L3ITCR[0-3]/L3OH (L3ITCRs[1-3]/L3OH exist in MPC7457 only)
4. MSSCR0
5. MSSSR0
6. TBL/TBU
7. DEC
8. THRM1/THRM2/THRM3 (exist in MPC7451/MPC7445/MPC7455 only)

Accessing any of the above registers may trigger the unexpected interrupt.

The unexpected thermal management interrupt will only occur in the MPC7451 and MPC7455 processors.

The unexpected decrementer interrupt may occur in all processors of the MPC7450 family.

Projected Impact:

Emulators and debug tools accessing the MSS_NRM scan chain via COP during softstop.

Work Arounuds:

Use LSRL to access any elements in the MSS_NRM scan chain including the SPRs listed above.

Projected Solution:

Under review.

Erratum No. 10:tlbie snoop during Doze state may cause processor hang

Description:

If the instruction TLB entry for the code that caused entry into Nap mode is invalidated while in Doze state via a snooped tlbie, an instruction tablewalk will be immediately triggered for that instruction address. Taking the tablewalk is an incorrect action for the processor because no code is being executed during Doze state.

A processor hang can occur due to the unintentional tablewalk if the tablewalk results in an ISI exception, most likely due to a page fault. When the page fault is detected, the SRR0, SRR1, and MSR registers are updated as for a normal ISI exception except that the ISI handler code is not fetched because of the Doze state. Since the MSR[EE] External Interrupt Enable bit is cleared due to the ISI exception, neither an external interrupt or a decremter interrupt can wake the processor from Nap mode. A processor hang results.

If the unintentional instruction hardware tablewalk had completed without an exception, the MSR[EE] bit would not be cleared and the processor can be woken from Nap mode by an interrupt. However, system designers should use caution since the processor is only ever expected to provide snoop responses and/or push or intervention data during Doze state. Due to the unintentional tablewalk, up to four tablewalk read requests may occur to the external bus. The system would either have to service these read requests before re-entering Nap mode, or somehow ignore pending bus request assertions for these reads.

Projected Impact:

Systems performing tlbie snoops during Doze state where the index of the tlbie matches that of the instruction code that caused entry into Nap mode may hang.

Systems using the iBATs to map the Nap mode code are not affected.

Since a tlbie snoop will only likely occur in multiprocessor systems, most uniprocessor systems should not be affected.

Work ArounDs:

Any of the following work arounds are acceptable:

1. Do not perform tlbie snoops during Doze state
2. Disable instruction address translation before entering Nap mode.
3. Map the code that causes entry into Nap mode using the IBATs.
4. Ensure that the page table entry mapping for the Nap mode code remains valid during Nap mode, perhaps via an OS locking mechanism. Note that the system would still have to handle potential tablewalk read accesses during Doze state.

Projected Solution

Under review.

Erratum No. 11: Data corruption due to write-through aliasing in the MMU

Description:

If the memory management unit (MMU) on the MPC7450 processor is programmed such that the same physical block or page has storage access attributes mapped as both cacheable in one memory mapping and write-through in another, data corruption may result.

Accesses to the same storage location using two effective addresses for which the write-through mode (W-bit) differs meet the memory coherence requirements of a MPC744X processor if the accesses are performed by a single processor. Since the usage of the W-bit is mixed for the same physical address, a store addressed to a write-through page may find the addressed cache block modified in either the dL1 or L2 caches. In this case, the write-through store will update the location in both the cache block and main storage. The cache block remains in the modified state. If a block or page is mapped as write-through only, the cache line will never be modified.

In the failing scenario, address “A”, which is mapped both as cacheable and write-through resides as modified in the dL1 cache. A unrelated dL1 reload to the same set as address “A” occurs. The reload chooses address “A” for eviction due to the pseudo-LRU replacement algorithm. As a castout is being created of address “A”, a write-through store to address “A” erroneously bypasses the castout without updating the data. As a result, the castout with stale data will be written to memory after the write-through store.

Projected Impact:

Systems performing write-through aliasing of the same physical page may encounter data corruption.

Work Arounds:

Do not permit two effective addresses to map to the same physical address where one effective address is mapped as write-through and the other is mapped as cacheable. If write-through aliasing is unavoidable, the dL1 cache must be flushed of its contents by the system when switching from cacheable to write-through accesses.

Projected Solution:

Fixed in Rev 2.0.

Erratum No. 12: HID0[SPD]=1 does not prevent instruction fetches past unresolved branches when MSR[IR]=0

Description:

An out-of-order instruction fetch is defined as an instruction fetch made before it is known whether the instructions are required by the sequential execution model. When instruction translation is disabled (MSR[IR]=0), the accesses are guarded. In general, guarded storage is not accessed out-of-order. Three exceptions to this rule, as defined by the architecture, may cause out-of-order instruction fetches:

1. The instruction is in the instruction cache.
2. The instruction resides in the same physical page as an instruction that is required by the execution model.
3. The instruction resides in the next sequential physical page after the page of an instruction that is required by the execution model.

Therefore, guarded out-of-order instruction fetches may occur to a page for which there are no executable instructions as long as the previous page contained instructions required by the sequential execution model.

Typically, system software will contain a branch near the end of the second to last page of a memory region and leave the last page empty but valid. For example, a hypothetical system with one megabyte of memory will place no executable code in the last 4096 bytes of the one megabyte of memory space to avoid instruction fetches on the external bus interface beyond the one megabyte of valid physical memory.

The HID0[SPD], “Speculative data cache and instruction cache access disable”, is designed to prevent out-of-order instruction cache fetches beyond an unresolved branch and into a subsequent page from propagating to the external bus interface. By definition, setting HID0[SPD]=1 should permit a final branch instruction to exist in the very last word of a physical memory region.

However, the MPC7450 processor with HID0[SPD]=1 will incorrectly fetch past an unresolved branch as with HID0[SPD]=0, and perhaps create an external bus read operation to an invalid region of memory.

HID0[SPD] works as designed for load operations.

Projected Impact:

Systems executing code with instruction translation disabled (MSR[IR]=0) and HID0[SPD]=1 may see instruction fetches propagate to the external bus unexpectedly.

Work ArounDs:

System software should not place the last branch instruction at the end of a physical memory region in the last two cache lines of that memory region when MSR[IR]=0 and HID0[SPD]=1. If the branch is placed in the third to last cache line, accesses may still occur to the external bus for the final two cache lines, but no accesses will occur to the subsequent page.

The same restriction actually also holds when HID0[SPD]=0. Although architecturally the processor is permitted to access instructions out-of-order and into the next page past what is

required by the sequential execution model, the processor will not do so if the final branch is not in the last two cache lines of the last page required by the sequential execution model.

Projected Solution:

Under review.

Erratum No. 13: SPR read of L3CR returns undefined value

Description:

The L3 Control Register (L3CR) special purpose register does not return an expected result of zero when read. The value returned is undefined. The MPC7447A processor returned a zero result. A write of the L3CR on the MPC7448 processor has no effect.

No L3 cache exists on any of the MPC744X processors. The effects of reads and writes to the L3CR on these processors are documented in [Table 4](#).

Table 4. L3CR Read and Write Effects

Processor	L3CR Write Actions	L3CR Read Result
MPC7448	None	undefined
MPC7447A	None	zero
MPC7447	L3CR register updated	last value written
MPC7445	L3CR register updated	last value written
MPC7441	L3CR register updated	last value written

Although the L3CR registers of the MPC7441/MPC7445/MPC7447 processors can be read and written, with the read returning the last value written, the write had no other functional effect since the L3 cache does not exist.

Projected Impact:

Any system expecting a read of the L3CR to return a result of zero due to the absence of the L3 cache may receive a non-zero value instead. This may cause some backwards compatibility issues with existing system code that expects the value to be zero if no L3 exists.

Work Arounuds:

The L3CR should be treated as an unimplemented SPR that returns an undefined result when read.

Projected Solution:

Under review.

Erratum No. 14: Store gathering/merging performance issue

Description:

To increase external bandwidth to frame buffers and I/O devices, the MPC7448 performs store gathering of unguarded write-through stores or cache-inhibited stores. The same store gathering mechanism is used to merge cacheable write-back stores. This feature is enabled by setting `HID0[SQE]`.

The stores are gathered/merged while in the 5-entry committed store queue (CSQ). The basic rule is gathering/merging can occur if cache line addresses in CSQ_n and CSQ_{n+1} match, and CSQ_n is not potentially gathering/merging with CSQ_{n-1} . Gathering/merging never occurs between CSQ_0 and CSQ_1 . (For the complete set of requirements please refer to Section 3.1.2.3, “Store Gathering/Merging,” in the MPC7450UM)

However, on the MPC7448 processor, if CSQ_0 and CSQ_1 are to the same cache line, CSQ_2 is incorrectly signalled that CSQ_1 may potentially be gathering/merging with CSQ_0 , even though gathering/merging is never allowed with CSQ_0 . As a result, gathering/merging will be blocked between CSQ_2 and CSQ_1 . This may cause a ripple effect of blocked gathering/merging between CSQ_2/CSQ_3 and CSQ_3/CSQ_4 depending on the addresses of the stores.

This issue will not cause a functional fail.

Projected Impact:

A software algorithm that performs multiple back-to-back stores to the same cache line will see a negative performance impact compared to previous MPC744X/MPC745X processors.

Work ArounDs:

None.

Projected Solution:

Fixed in Rev 2.0.

Erratum No. 15:L2 latency performance issue

Description:

In revision 1.0 of the MPC7448 processor memory subsystem pipeline, the total latency for L1 data and instruction cache misses that hit in the L2 is greater than the documented projected latency.

The documented L2 latency with ECC disabled for data is 11 cycles and, for instructions, is 15 cycles. The documented L2 latency with ECC enabled for data is 12 cycles and, for instructions, is 16 cycles.

The actual L2 latency with ECC disabled for data is 14 cycles and, for instructions, is 18 cycles.

The actual L2 latency with ECC enabled for data is 15 cycles and, for instructions, is 19 cycles. An L2 latency as high as 21 cycles (data) has been observed for some applications with ECC enabled.

Projected Impact:

Performance analysis of revision 1.0 of the MPC7448 processor will encounter much higher L2 latencies compared to the projected L2 latency of this product.

Work Arounds:

None.

Projected Solution:

Fixed in Rev 2.0.

Erratum No. 16: Unexpected instruction fetch may occur when transitioning MSR[IR] 0->1

Description:

An `mtmsr/isync` pair followed by a `blr`, `bctr`, or branch absolute instruction, where the target effective address is not equal to the target physical address, may cause an unexpected instruction fetch on the MPX or 60x bus using the effective address.

The effect of the unexpected instruction fetch will be system dependent. If physical memory exists at the unexpected address, and read accesses are permitted, the processor will simply discard any returned instructions after the data tenure is complete, and no fail will occur. If a `TEA_` is asserted for the data tenure

the processor will take either an unexpected machine check exception or checkstop.

The unexpected instruction fetch issue is independent of translation method, and thus can occur for either iBATs or page tables.

Projected Impact:

Systems executing code as described above may encounter unexpected machine checks or system hangs.

Work Arounds:

The recommended work around is for any target of an unconditional branch in the sixteen instructions following an `mtmsr/isync` pair where instruction translation is being enabled to have a translation mapping of effective address = physical address.

If such a mapping is not possible, the issue can be avoided if the effective address target matches a valid region of physical memory in the system. As with the previous work around, the unexpected instruction fetch would still occur, and the instructions would be discarded by the processor.

A third work around is to only enable instruction translation by initializing `SRR0/SRR1` and executing `rfi`. A fourth work around that would prevent the unexpected fetch altogether would be to guarantee in software that there were no unconditional branches in the sixteen instructions following the `mtmsr/isync` pair.

Projected Solution:

Under review.

Erratum No. 17: Problem accessing internal caches and arrays via COP

Description:

COP emulator debugging tools cannot read the internal caches and arrays reliably at high speed. Additionally, emulator debugging tools cannot write to internal caches and arrays reliably at any speed.

Projected Impact:

This problem occurs on any system that uses a COP emulator debugging tool to access the internal caches and arrays.

Work ArounDs:

When reading the internal caches and arrays, the COP emulator can slow down the core frequency using the DFS (dynamic frequency switching) whenever it tries to read the internal caches and arrays. This process should be transparent to the end user if the tool vendor implements the work around.

When writing the internal caches and arrays, the COP emulator should attempt to write the data multiple times until the data is correctly written to the part. This process should be transparent to the end user if the tool vendor implements the work around.

Projected Solution:

Under review.

Erratum No. 18: Accessing LSRL via COP during soft stop mode causes data corruption

Description:

Accessing LSRL via COP emulators during soft stop mode can cause LSRL data corruption. LSRL corruption can occur if COP emulator tool accesses the LSRL during soft stop mode.

Emulator tools use soft-stop regularly for debugging purposes. The tool emulators use soft-stop in the following cases:

1. To stop the execution of a user program.
2. To single step user program.
3. To set up an instruction breakpoint in the user program.
4. To set up a data breakpoint in the user program.

All of the above actions cause the processor to go into a stop mode, assuming that the breakpoint in (3) or (4) is hit. If the COP emulator tool accesses the LSRL during soft stop, the system can hang after resuming.

Projected Impact:

This problem occurs on any system that uses a COP emulator to access the LSRL during soft-stop mode.

Work Arounds:

The COP emulator should turn off the warm-up clock during $\overline{\text{HRESET}}$ assertion. This process should be transparent to the end user if the tool vendor implements the work around.

Projected Solution:

Under review.

Erratum No. 19: Processor I/O may lock up during power-up, reset and JTAG scan

Description:

The I/O buffers may be erroneously disabled at power-up, during reset, or during JTAG scan, causing processor to lock up.

In the most common occurrence of this issue, control circuits for the I/O buffers may be placed in an incorrect state upon power up, causing the buffers to be disabled. As a result, the processor hangs and cannot recover until power is cycled. In rare cases, it is also possible to cause such a hang during JTAG scan operations. It may be possible for the part to lock up during a (non-POR) device reset, though this has never been observed within the nominal operating conditions described in the *MPC7448 RISC Microprocessor Hardware Specifications*.

The lock-up condition can only be encountered during power-up, reset, and JTAG scan operations, and will not be encountered during normal device operation.

Projected Impact:

Any system with an affected device may encounter this issue. Systems which adhere to the power sequencing requirements described in the *MPC7448 RISC Microprocessor Hardware Specifications* have minimal vulnerability to this issue.

Work Arounuds:

Implementing the following measures will minimize the chances of lock-up during power-up:

1. Adherence to the power sequencing requirements described in the *MPC7448 RISC Microprocessor Hardware Specifications*.
2. $\overline{\text{HRESET}}$ signal asserted while V_{DD} and OV_{DD} ramp up.
3. $\overline{\text{TRST}}$ signal asserted while V_{DD} and OV_{DD} ramp up.

No known work arounds exist for lock-up during JTAG scan or device reset, but the likelihood of encountering this issue in these cases is believed to be very rare.

Projected Solution:

Fixed in Rev 2.1.

Erratum No. 20: Performance Monitor Out (PMON_OUT) not operational

Overview:

The Performance Monitor Out output signal on the MPC7450 will not be asserted by the Performance Monitor unit as expected. PMON_OUT is defined to be asserted on the external interface when either a PMCn register overflow condition or a timebase event occurs. However, when either condition is detected, the processor incorrectly drops the event in most cases.

Projected Impact:

Systems designed to use the PMON_OUT signal as an indication of an internal Performance Monitor event will not have this feature, originally intended as a debug aid.

Work Arounnds:

No known general work around exists for this erratum.

The following two examples are the only known work arounds and are specific to 6:1 and 8:1 processor: bus ratios and the timebase unit.

In 6:1 processor:bus ratio, a time-base event with MMCR0[TBSEL]=00 (TBL[31]) can be used to force PMON_OUT to be asserted. PMON_OUT in this case would be asserted maximum once every eight system clocks.

In 8:1 processor:bus ratio, an overflow condition of event PMC1-4[3] with MMCR0[TBSEL]=00 (TBL[31]) can be used to force PMON_OUT to be asserted.

Projected Solution:

Under review.

Erratum No. 21: Back-to-back snoops to L1 data cache may cause processor hang

Overview:

Two sources of snoops can access the L1 data cache: external snoops from the 60x/MPX bus and internal snoops initiated by the processor. Due to an issue with the MPC7448 processor, an external snoop request followed by an internal snoop request (or vice-versa) in back-to-back processor clocks to the same modified dL1 cache line may cause the second of two snoops to receive an incorrect MESI state from the L1 data cache. A processor hang may result.

Internal snoop requests can be generated by load requests from the L2 hardware prefetch engine and instruction fetch requests, both of which snoop the dL1. These requests are initiated and performed internally and are not visible on the external 60x/MPX bus.

If the L2 hardware prefetch engine is enabled, a prefetch internal snoop can collide with an external snoop and a failure may result. Not enabling the L2 hardware prefetch engine eliminates this source of internal dL1 snoop requests and will prevent this failure mode from occurring.

The sequencer unit of the processor will speculatively fetch instructions past the currently executing instructions. Unless properly constrained via software, these instruction fetches are architecturally permitted to fetch into data regions. If this data is cached as modified in the dL1, then the instruction fetch snoop and the external snoop to the modified cache line can occur back-to-back and cause the processor to hang.

Projected Impact:

Any system in which L2 hardware prefetching is enabled may be impacted by this erratum. Additionally, systems in which all of the following conditions occur are susceptible to this erratum:

1. Address mapping in the instruction MMU (IMMU) is such that one or more IBATs or PTEs are mapped to physical address ranges in which data resides
2. Data in these physical address regions may exist in the modified state in the dL1
3. The system generates snoop activity to the above physical addresses ranges

Systems that have L2 hardware prefetching disabled and do not meet all three of the above criteria are not susceptible to this issue.

For systems that do meet all three criteria, two sources of potential failure exist due to out-of-order instruction fetching:

1. Sequential fetching ahead of the currently executing instruction stream.
2. Speculative execution of **bcctr** or **bclr** instructions.

If instructions and data are separated such that they do not reside within six cache lines of each other then source No. 1 is not a concern. If **bcctr** or **bclr** instructions exist in the instruction stream, source No. 2 exists regardless of the separation between instructions and data.

However, it must be noted that for the failure to occur, three specific events must coincide:

1. A **bcctr** or **bclr** instruction is speculatively executed which causes the instruction stream to begin fetching from addresses in a data region

2. The data at the fetched address must be modified in the dL1
3. The system must generate an external snoop to the same address in the same cycle as the instruction fetch request

Because failure requires all three events to occur with specific timing, and because in nearly all instances the LR and CTR will point to areas of memory containing instructions, the likelihood of encountering this issue as a result of a speculatively executed **bcctr** or **bclr** instruction is very small, but not zero.

Systems encountering this issue will typically fail with a hang condition in which the processor will enter an internal deadlock condition and cease to request the bus. Alternatively, it may enter an external deadlock condition in which it will infinitely retry all external bus snoops from other masters. In the internal deadlock condition, decremter and timebase exceptions will not be serviced.

Work ArounDs:

L2 hardware prefetching must be disabled ($MSSCR0[L2PFE] = 0$). (Note: this is the default setting.) This will prevent internal snoops caused by L2 prefetches.

To prevent the internal snoops due to instruction fetches from causing a failure, it must be guaranteed that instruction fetches, when snooping the dL1, do not encounter modified data in the dL1 for the address of the instruction being snooped if the system may generate external snoops to that same address. The following measures will guarantee this will not occur:

1. Data and instructions must reside in different physical pages of memory. Since hardware and software tablewalks do not occur speculatively, this prevents instructions from snooping the dL1 with an address shared by the data region.
2. Instruction block address translation registers (IBATs) must not overlap into regions in which data, mapped either by page tables or DBATs, is stored as modified. Mapping DBATs such that they overlap into instruction regions is acceptable as long as the data in the overlapping region is flushed from the dL1 (if modified) before instructions are fetched.
3. The work arounds listed in MPC7448 Errata No. 12 and No. 16 must be followed.

If measure No. 2 is unacceptable, then an alternative is to maintain a separation of two cache lines between instructions and data in these IBAT regions and operate with either $MSR[IR]=0$ or $HID0[SPD]=1$.

Projected Solution:

Fixed in Rev 2.2.

Erratum No. 22: Voltage Derating No Longer Supported for MC7448xx1700LC devices

Overview:

To reduce power consumption, MC7448xx1700LC devices previously supported voltage and frequency derating in which the core voltage (V_{DD}) could be reduced if the reduced maximum processor core frequency requirements were observed. This feature has been made redundant by new device offerings and is no longer supported.

For archival purposes, the supported derated core voltage, resulting maximum processor core frequency (f_{core}), and power consumption are provided in [Table 5](#). Only those parameters in [Table 5](#) were affected; all other parameter specifications were unaffected. Note that only MC7448xx1700LC devices previously supported this feature, and it was not supported for any other speed grades of the MC7448xxnnnnLC devices.

Table 5. Supported Voltage, Core Frequency, and Power Consumption Derating (MC7448xxnnnnLC)¹

Maximum Rated Core Frequency (Device Marking)	Date Code ²	Supported Derated Core Voltage (V_{DD})	Maximum Derated Core Frequency (f_{core})	Full-Power Mode Power Consumption		
				Typical	Thermal	Maximum
1700	0612 and prior	1.0 V \pm 50 mV	1250 MHz	8.4 W	10.3 W	12.0 W
	0613 and later			N/A		
1600	All			N/A		
1420	All			N/A		
1000	All			N/A		

¹ This feature is no longer supported.

² See Section 11.3, "Part Marking," in the *MPC7448 RISC Microprocessor Hardware Specifications* for information regarding date codes and part marking.

Projected Impact:

Operating MC7448xx1700LC at derated voltages is not supported on devices with date code 0613 and later. Customers using MC7448xx1700LC devices in the derated mode should migrate to the MC7448xx1267NC device.

See the *MPC7448 RISC Microprocessor Hardware Specifications* for information on date codes and device markings.

Work Arounuds:

Customers desiring the power savings provided by voltage and frequency derating are referred to the MC7448xxnnnnNx series of part numbers. See the *MPC7448 RISC Microprocessor Hardware Specifications* for more information.

Projected Solution:

None. This erratum is for advisory purposes only. Freescale will continue to support customers requiring low-power devices via the MC7448xxnnnnNx series.

Erratum No. 23: $\overline{\text{MCP}}$ or $\overline{\text{SRESET}}$ signal assertion during transition to Nap may hang processor

Overview:

If the machine check signal ($\overline{\text{MCP}}$) or soft reset signal ($\overline{\text{SRESET}}$) are asserted in a window after MSR[POW] has been set but before the processor has asserted the quiesce request signal ($\overline{\text{QREQ}}$), then the processor may encounter a hang condition.

The nap entry sequence in the MPC74XX User's Manual is as follows:

```
loop: sync
      mtmsr POW
      isync
      b loop
```

Legacy software entering nap using this entry sequence are not affected:

```
sync
mtmsr POW
isync
loop: b loop
```

The fail happens when an outstanding out-of-order instruction fetch that occurs before the mtmsr—but not having received data and the results of which are no longer needed for execution—extends the window between the setting of POW and the assertion of $\overline{\text{QREQ}}$ by the processor. If the Branch Target Instruction cache (BTIC) is enabled, and the Nap entry code is in the BTIC due to a previous execution of this code, then the instructions from the sequence can be loaded into the completion buffer the cycle after execution has halted. If the $\overline{\text{MCP}}$ or $\overline{\text{SRESET}}$ signals are asserted at this point, they will void the entry into Nap as architected. However, both events require the completion buffer to be empty for their exceptions to be processed. Completion is halted, though, so no exceptions are processed and the hang occurs. $\overline{\text{SMI}}$ and $\overline{\text{INT}}$ signal assertions do not require the completion buffer to be empty and therefore do not cause a hang.

Projected Impact:

Systems where $\overline{\text{MCP}}$ or $\overline{\text{SRESET}}$ can be asserted during entry into Nap mode are at risk. The risk is believed to be extremely small and has never been observed in a MPC744X system.

Work ArounDs:

Systems can implement any one of the following changes to work around this issue:

1. Use the legacy code entry sequence to enter Nap.
2. Disable the BTIC before entering Nap.
3. Invalidate the Nap entry code using an icbi instruction after taking the exception (a decremter exception for example) that awakens the processor from Nap state.

Projected Solution:

None. This erratum will not be fixed in any subsequent revisions of the MPC7450 family.

Erratum No. 24: Store type operations during COP softstop debug mode may hang processor; Machine check error limitations

Overview:

During softstop debug mode, the processor may incorrectly disable internal clocks before a store type operation has accessed the 60x/MPX bus. Softstop debug mode is accessible via the common on-chip processor (COP) and is used by emulator tools for debugging. The store type operations affected are:

CI store	eieio	tlbie	dcbf w/ data	dcbi	ecowx
WT store	tlbsync	dcbf	castout	icbi	

The store type operation would be retained in the bus store queue while the clocks were frozen. The retained store may cause the processor to violate the bus protocol either before entering or after resuming from softstop. The resulting protocol violation may hang the system and require a hard reset to recover.

Possible protocol violations include but are not limited to the following:

1. A multi-cycle assertion of \overline{TS} as softstop is entered.
2. A \overline{TS} assertion after resuming from softstop that may not meet proper setup time.
3. A \overline{TS} assertion after resuming from softstop that is not preceded by a qualified \overline{BG} assertion.
4. A missed \overline{ACK} assertion.

Softstop debug mode via the COP is affected. Using the IABR/DABR and taking a trace or performance monitor interrupt during functional mode works as expected. The QREQ/QACK nap/sleep protocol also works as expected.

The COP softstop operations affected are those triggered by:

1. A direct COP softstop request.
2. An IABR or DABR match event.
3. An MSR[SE] or MSE[BE] event.
4. A performance monitor event.

The issue also affects functional operation mode. Normally, when a machine check exception occurs, any store type operations in the pipeline of the processor are required to complete to memory before the machine check exception is taken. Due to the erratum, the machine check exception may be taken while a solitary store type operation is present in the bus store queue. The only known impact of this behavior occurs if the solitary store type operation encounters a parity error or TEA error on the 60x/MPX bus. If this condition occurs, the processor checkstops due to taking a machine check exception while in the machine check exception handler.

Projected Impact:

Emulators that utilize the COP softstop feature may not work as intended since the processor's violation of the system bus protocol may cause unexpected behavior on the part of the system controller.

Work Arounds:

Customers may be able to find CPU:SYSCLK multiplier ratios that do not result in the processor hanging the system when this erratum is encountered; the address and address transfer attributes may have a modified output valid timing but may be sufficient to meet the receiving device's input setup times. If this erratum is encountered, debugging software at another CPU:SYSCLK ratio is possible. The store type operations will not complete until resuming from softstop state or single-stepping beyond the store type operation. Enabling address bus parking with the processor will reduce the chance of incurring this erratum.

Projected Solution:

Under review.

Erratum No. 25: Unpaired stwcx. may hang processor

Overview:

In general, lwarx and stwcx. instructions should be paired, with the same effective address used for both. The only exception is that an unpaired stwcx. instruction to any (scratch) effective address can be used to clear any reservation held by the processor.

When a stwcx. is unpaired, the e600 core may encounter an unexpected hang condition if each of the following is true:

1. Initial condition

```
RESERVE bit = 1 (due to previously executed lwarx)
Reservation = address A
Instruction executed = stwcx. to address B, resident in dL1 in Modified or
Exclusive state
dL1 modified entry = address C
```

2. An external snoop to address A of a type shown in [Table 6](#) occurs while the stwcx. is being processed by the Load/Store Unit.

Table 6. Snooped Store Types that Cancel a Reservation

Command	TT
Write-with-flush	0x02
Write-with-kill	0x06
Kill block	0x0c
Read-with-intent-to-modify	0x0e
Read claim	0x0f
Read-with-intent-to-modify-atomic (stwcx.)	0x1e

3. An external snoop to address C follows the snoop to address A while the stwcx. is being processed by the Load/Store Unit.

Normally, the snoop to address A would clear the RESERVE bit, and the snoop to address C would initiate a snoop push of the modified line from the dL1. The stwcx. may succeed or fail depending on when the snoop to A cleared the RESERVE bit, but the completion of the stwcx. should be reported regardless.

A one cycle window exists wherein the above sequence will cause the Load/Store Unit to not report the completion of the stwcx. to the Completion Unit. As a result, the processor will hang. The hang can only be cleared by asserting hard reset.

Projected Impact:

The processor will hang if the Load/Store Unit does not report the completion of the stwcx. to the Completion Unit. Paired **lwarx/stwcx.** instructions are not affected by this erratum.

Most operating systems include an unpaired **stwcx.** at the end of exception handler code and context switch code to clear the RESERVE bit before returning to normal execution. Note that stwcx. is a user level instruction.

Non-SMP environments are less susceptible to this erratum due to the requirement of an external snoop to address A which holds the reservation from a previous `lwarx` instruction. Most operating systems do not allow a snoop to be initiated by an external peripheral to an address that the core wants to reserve in a non-SMP environment. If the non-SMP environment's operating system does not allow such snoops, then the environment will not be affected by this erratum.

This erratum effects the core:bus ratios shown in [Table 7](#).

Table 7. Core:Bus Ratios Affected

Part	2:1	5:2	3:1	7:2	4:1	9:2	5:1	11:2	6:1	13:2	7:1	15:2	8:1	17:2	9:1
MPC7448	yes	yes ¹	yes	yes ¹	yes	yes ¹	yes	yes	yes	yes	yes	yes	yes	yes	no

¹ This ratio is reachable only during Dynamic Frequency Switching (DFS).

Work Arounds:

Any individual one of the following steps can be taken to work around this issue:

Option 1: Place a `lwarx` instruction to the same scratch address as the `stwcx.` immediately before the `stwcx.`, or

Option 2: Place a `dcbf` instruction to the same scratch address as the `stwcx.` immediately before the `stwcx.`, or

Option 3: Do not permit an external snoop to the address of the reservation address.

Interrupts must be disabled (`MSR[EE] = 0`) during the instruction sequences for the first two options. In most operating systems, interrupts are already disabled when an unpaired `stwcx.` is executed.

If the work arounds are not possible, then the number of core:bus ratios affected in some products may be reduced (as shown in [Table 8](#)) by placing the L2 cache in L2 data only mode (`L2CR[L2DO] = 1`).

Table 8. Core:Bus Ratios Affected if L2CR[L2DO] = 1

Part	2:1	5:2	3:1	7:2	4:1	9:2	5:1	11:2	6:1	13:2	7:1	15:2	8:1	17:2	9:1
MPC7448	yes	yes ¹	yes	yes ¹	yes	yes ¹	no	no	no	no	no	no	no	no	no

¹ This ratio is reachable only during Dynamic Frequency Switching (DFS).

Projected Solution:

Under review.

Erratum No. 26: Using 7x and 14x PLL multipliers may hang system when exiting $\overline{\text{HRESET}}$ state and nap, sleep, COP softstop modes

Overview:

The processor's I/O cells are turned on upon exiting $\overline{\text{HRESET}}$ state and when exiting nap, sleep and COP softstop modes. The processor is supposed to wait for one SYSCLK cycle before internally reading the I/O cells; however, the I/O cells are read prematurely for the 7x and 14x multipliers (PLL_CFG[0:5] = 0b001000 and 0b110010, respectively) resulting in incorrect data being latched into the internal registers. Certain combinations of this incorrect data can result in the device hanging in 60x bus mode or corrupting data in MPX bus mode systems.

Projected Impact:

Systems using 60x bus mode and 7x multiplier with SYSCLK > 100 MHz or 14x multiplier with SYSCLK > 100 MHz are likely at risk of encountering this erratum.

Systems using MPX bus mode and 7x multiplier with SYSCLK > 100 MHz or 14x multiplier with SYSCLK > 100 MHz and using MSSCR0[ABD] = 1 and MSSCR0[EIDIS] = 0 are at a low risk of encountering this erratum when exiting from nap, sleep and COP softstop modes.

Work ArounDs:

Options for 60x bus mode systems are as follows:

- Use MPX bus mode (see MPX bus mode work around details). —OR—
- Use a multiplier other than 7x or 14x. —OR—
- Use 7x or 14x and limit SYSCLK speed to 100 MHz. —OR—
- If the system uses an FPGA based system controller, add a one clock cycle $\overline{\text{AACK}}$ assertion after receiving $\overline{\text{BR}}$ but before granting $\overline{\text{BG}}$ at exit from reset state and do not use low power modes or COP softstop mode.

Options for MPX bus mode systems are as follows:

- Use a multiplier other than 7x or 14x. —OR—
- Use 7x or 14x and limit SYSCLK speed to 100 MHz. —OR—
- Use MPX bus mode with MSSCR0[ABD] = 0. —OR—
- Use MPX bus mode with MSSCR0[EIDIS] = 1. —OR—
- Use MPX bus mode and flush caches before entering low power modes or COP softstop mode.

Projected Solution:

Under review.

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